The Economist

Google's health ambitions

Modelling insurrection risk

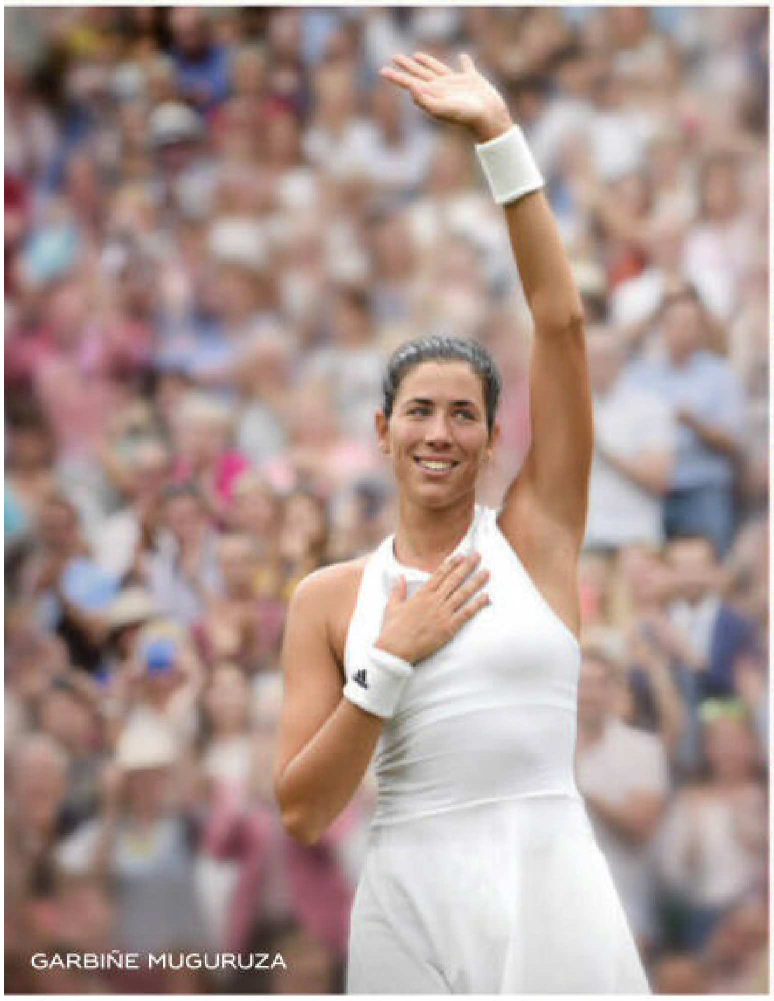
The ECB's next headache

British startups: why no titans?

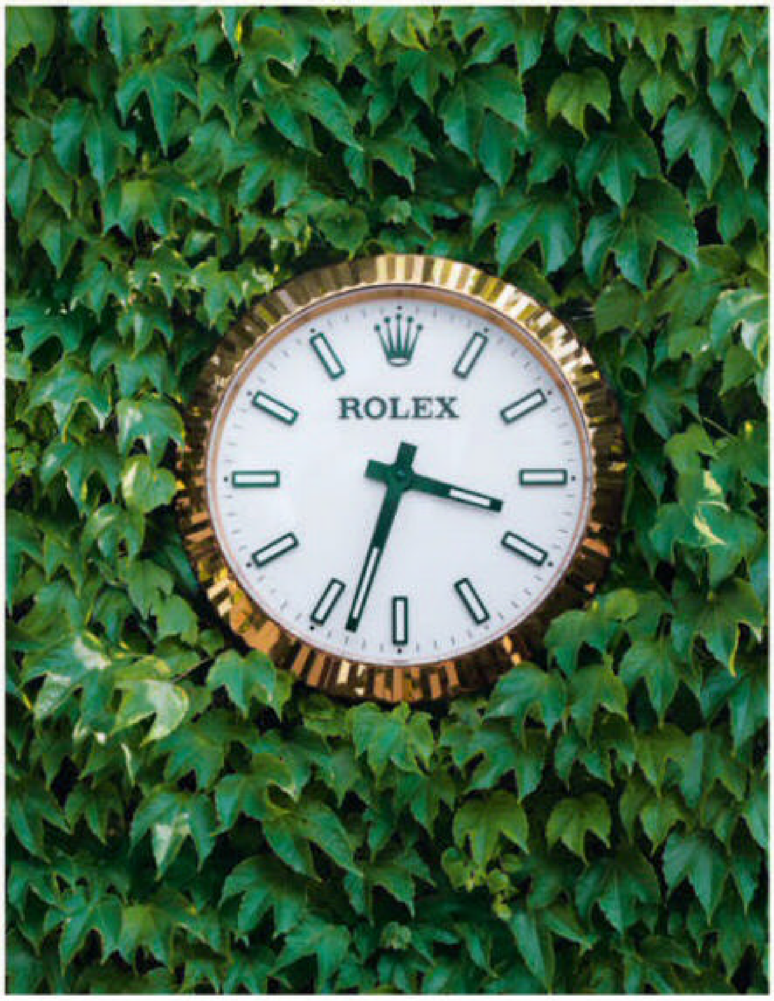
JUNE 25TH–JULY 1ST 2022

THE RIGHT WAY TO FIX THE ENERGY CRISIS

ROGER FEDERER



GARBIÑE MUGURUZA



BJÖRN BORG

Contents

On the cover

How to fix the world's energy emergency without wrecking the climate: leader, *page 11*. Electrifying is a great start: Technology Quarterly, *after page 46*. Energy security gives climate-friendly nuclear-power plants a new appeal. To meet it they have to become easier to build, *page 20*. Finland completes the first underground warren for storing spent nuclear fuel, *page 77*

Google's health ambitions Alphabet wants to shake up a seemingly undisruptable multi-trillion-dollar industry, *page 63*

Modelling insurrection risk A wave of unrest is coming in emerging markets. Here's how to avert some of it: leader, *page 12*, and analysis, *page 59*

The ECB's next headache How fighting inflation could imperil the single currency: leader, *page 14*. Is the once-mighty doom loop between banks and sovereigns still to be feared? *Page 70.*

British startups: why no titans? As new firms get bigger, the capital they need dries up: leader, *page 16*, and analysis, *page 23*

*→ The digital element of your subscription means that you can search our archive, read all of our daily journalism and listen to audio versions of our stories. Visit **economist.com***

The world this week

8 A summary of political and business news

Leaders

11 **The energy crisis** Power struggle

12 **France** The man who fell to earth

12 **Global instability** Hungry and angry

14 **The euro zone** The ECB's next headache

16 **Britain's growth crisis** Why can't Britain build world-leading companies?

Letters

18 On Colombia, environmental goals, NewGlobe, family names, the whole self

Briefing

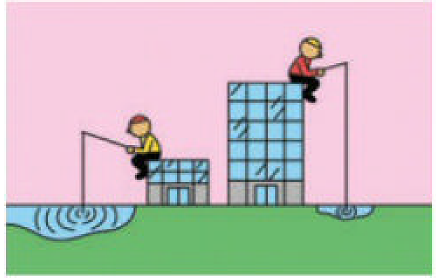
20 **Nuclear energy** Can it get cheaper?

Technology Quarterly: The energy transition

Electrifying everything does not solve the climate crisis, but it is a great start
After page 46

Summer reads Improve your mind and lift your spirits with a selection of our most beach-friendly stories—refreshed all season long
economist.com/summer-reads-2022

Britain



23 Growth capital

24 Memorials to Windrush

25 Public-sector wages

25 Science funding at risk

26 Coastal erosion

28 Culture collections

30 **Bagehot** Brexit backlash

Europe

31 Macron's troubles

32 Ukraine's weapons

34 Italy and Vladimir Putin

35 Slovenia comes good

35 A revolution in Andalucía

36 **Charlemagne** Bullets and bail-outs

United States

37 Asian-American voters

39 A trans-rights muddle

39 A petrol-tax holiday?

40 California's school hours

40 Church and state

41 Uranium mining

42 **Lexington** The Biden-Harris problem

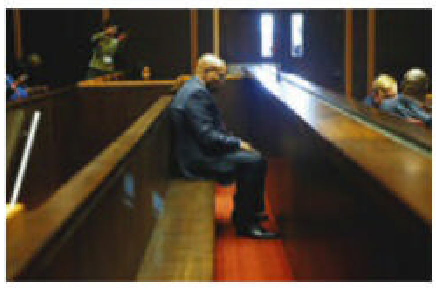
The Americas

43 Colombia turns left

44 **Bello** The Amazon

46 Bad sex education

Middle East & Africa



47 South Africa graft

49 Ramaphosa's new woe

49 Israel's fallen government

50 Saudi Arabia's reputation

Contents continues overleaf

Asia

51 Indonesian illiberalism
52 Big fish in the Mekong
53 An Afghan earthquake
53 Central Asian migrants
54 **Banyan** The legacy of BTS

China

55 Declining mental health
56 A new aircraft-carrier
58 The Taiwan Strait
58 An iconic eatery sinks

International

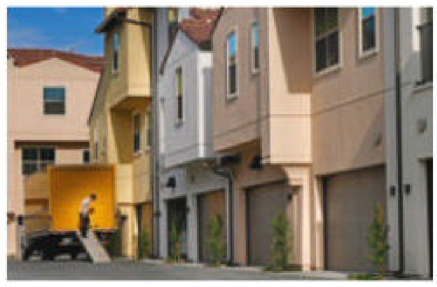
59 Growing global unrest

Business

63 Alphabet's health plans
64 Disrupting drugs
65 Communist Party v fun
66 Why everyone wants Arm
67 **Bartleby** Pity the managers
68 **Schumpeter** EY's split personality

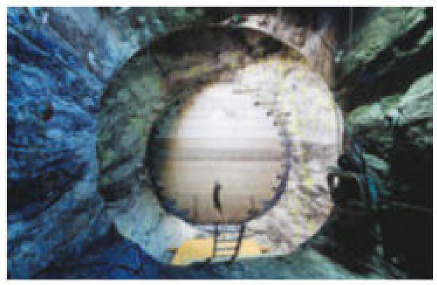
Finance & economics

69 Housing in America
70 The euro's doom loop
71 Italy's debt dynamics
72 Crypto carnage
72 Fintech fizzles
73 **Buttonwood** Stock valuations
74 Where is inflation low?
74 The BOJ v investors
75 Investing in natural gas
76 **Free exchange** Inflation expectations



Science & technology

77 Storing nuclear waste
78 Fallopian-tube unblocking
79 Doubts about Sputnik V
79 The biggest bacterium yet
80 A mastodon's biography



Culture

81 Portugal's pioneering feminists
82 America's anthem
83 A Manhattan street vendor
83 North Korean hackers
84 Nuclear nightmares
86 **Back Story** Pet Shop Boys' magic

Economic & financial indicators

88 Statistics on 42 economies

Graphic detail

89 Most of the world's grain is not eaten by humans

Obituary

90 Roman Ratushny, a fighter for a better Ukraine

The Economist

Volume 443 Number 9302

Published since September 1843
to take part in *"a severe contest between intelligence, which presses forward, and an unworthy, timid ignorance obstructing our progress."*

Editorial offices in London and also:
Amsterdam, Beijing, Berlin, Brussels, Chicago, Dakar, Dallas, Dubai, Johannesburg, Madrid, Mexico City, Moscow, Mumbai, New Delhi, New York, Paris, San Francisco, São Paulo, Seoul, Shanghai, Singapore, Tokyo, Washington DC

Subscription service
For our full range of subscription offers, including digital only or print and digital bundled, visit: **Economist.com/offers**

If you are experiencing problems when trying to subscribe, please visit our Help pages at: **www.economist.com/help** for troubleshooting advice.

To manage your account online, please visit my.economist.com where you can also access our live chat service which is available 24/7. To call us, contact our dedicated service centre on 00800 771 12711 or +44 (0)203 868 6843.

Please recycle

PEFC
PEFC/16-33-582

PEFC certified
This copy of *The Economist* is printed on paper sourced from sustainably managed forests certified by PEFC
www.pefc.org

Gustavo Petro, a former leftist guerrilla, won **Colombia's** election. Mr Petro, an ex-mayor of Bogotá, will become the country's first left-wing president in August. He won 50.4% of the vote to 47.3% for Rodolfo Hernández, a populist property tycoon. Investors are nervous; Mr Petro has sought to reassure them by suggesting he would appoint a centrist finance minister. But he still plans to ban oil exploration, open-pit mining and fracking, and give all persistently unemployed people a government job. Colombia's currency and stockmarket wobbled after the result was announced.

No majority for Macron

Emmanuel Macron suffered a serious political reverse when his electoral grouping, Ensemble, lost its majority in **France's** parliamentary election. Only recently re-elected as president, Mr Macron faces the prospect of a second term in which he will find it hard to advance his legislative agenda. Some analysts think he may have to call a fresh election. His prime minister, Elisabeth Borne, offered her resignation, but Mr Macron has so far not accepted it.

Spain's ruling party, the Socialists, also suffered an election reverse when they lost control of the assembly in Andalucía, Spain's most populous region, and normally a Socialist stronghold.

Ukraine awaited the result of an EU summit that will confirm that it be formally recognised as a candidate for membership of the club (membership is still years away). Moldova got the same recommendation, but Georgia was told it had more work to do.

Russia threatened **Lithuania** with "seriously negative" consequences for blocking rail shipments of goods subject to sanctions from Russia to the Russian exclave of Kaliningrad. Lithuania says it is enforcing EU rules.

The **German** government said it would need to burn more coal. This reversal of previous green policies was part of a package of measures to avert an energy crisis caused by a reduction in gas flows from Russia. Households' heating usage could also be capped.

A bill that would enhance background checks for people under the age of 21 who try to buy a **gun** advanced in the United States Senate. The bill has enough Republican support to overcome a filibuster. By global standards it is the mildest of gun-control bills, but John Cornyn, a Republican from **Texas**, was booed at his party's state convention for supporting it. The same convention rejected the election of Joe Biden in 2020 as illegitimate and vowed to abolish the Federal Reserve.

Israel's unwieldy eight-party coalition government collapsed, paving the way to the country's fifth election in four years. Under a prior arrangement Yair Lapid, who has been serving as foreign minister, will take over as a caretaker prime minister from Naftali Bennett. Binyamin Netanyahu, who was prime minister for 12 years before he was ousted by the coalition, will try to win back the top job.

Muhammad bin Salman, **Saudi Arabia's** de facto ruler, visited **Turkey** for the first time in years, hoping to normalise relations that were damaged when a Saudi journalist was murdered in 2018 at the kingdom's consulate in Istanbul. He met President Recep Tayyip Erdogan, who would welcome Saudi cash to prop up a tottering economy.

Jihadists killed at least 130 civilians in **Mali's** central Mopti region. The military government blamed the atrocities on a group linked to al-Qaeda.

A meeting of leaders of Commonwealth countries opened in **Rwanda**, the club's newest member. Press coverage focused on the host's dismal human-rights record, which has come under renewed scrutiny because Britain's government is trying to deport asylum-seekers to Rwanda.

An earthquake in **Afghanistan's** south-east, near the border with Pakistan, killed at least 1,000 people. The Taliban government asked aid agencies to send teams to the area.

Dozens of people died and hundreds of thousands lost their homes in floods across north-eastern **Bangladesh** and **India**. Authorities in Assam, a state in India's north-east, said the flooding may have set back infrastructure development in the hill areas by a decade.

A court in **Japan** dismissed a challenge to the country's ban on same-sex marriage. Three gay couples had argued that the ban was unconstitutional. Some parts of Japan, including Tokyo, offer something akin to civil partnership to same-sex couples. Most Japanese favour allowing gay marriage, but national law does not.

South Korea launched satellites into orbit using its own rocket for the first time, a big advance in its ambition to become a space power. The first test of the Nuri rocket ended in failure last October when an engine burned out.

China launched a new aircraft-carrier, its first to be locally designed and third overall (America, by comparison, has 11). The ship, which will use electromagnetic catapults to launch planes into the air, is still years away from active service. Days after its launch, 29 Chinese military aircraft, including fighters and bombers, flew near the airspace of Taiwan, which scrambled jets to shoo them away. Such incidents are becoming more common.

The British government gave its formal assent to the extradition to America of **Julian Assange**, who has been charged under America's Espionage Act for publishing classified material on WikiLeaks. Mr Assange will appeal against the decision.

A **"bill of rights"** that would, among other things, mean British judges are not bound by decisions from the European Court of Human Rights, a non-EU body based in Strasbourg, was introduced in the British Parliament. The government disliked the court's recent, last-minute intervention to stop the deportation of some asylum-seekers to Rwanda. Britain wants to remain a party to the European Convention on Human Rights.

A level playing field

FINA, the global body that regulates competitive swimming, voted to bar **transgender women** from competing in top-flight women's races if they have undergone any phase of male puberty. It will create an "open" category, in which anyone can compete. It joins a small but growing number of sporting bodies with similar policies, including rugby union and USA Powerlifting. FIFA, football's governing body, and World Athletics are to review their polices on transgender competitors. Rugby league has banned transgender women from international women's tournaments.

Britain's annual **inflation** rate hit 9.1% in May. Food prices accounted for much of that, but road-fuel prices were up by 32.8%, year on year, the biggest such increase in that category since the data were first compiled in 1989. Britain already has the highest inflation rate among G7 countries. The Bank of England recently increased its main interest rate for the fifth consecutive time, to 1.25%. The squeeze on household costs is pushing up wage demands. Train drivers went on strike this week, crippling the rail network for five days. Nurses and teachers are also considering action over pay in a "summer of strife".

A union at **Rolls-Royce** rejected a 4% pay rise and a one-off £2,000 ($2,450) payment to ease workers' living costs. The company, which makes jet engines, is one of the biggest manufacturers in Britain. The union said it was considering its next steps.

More than 1,300 pilots for **Southwest Airlines** held a protest outside Dallas Love Field airport to complain about their overstretched working arrangements. Southwest, like other big carriers, has been caught out by the strength of the travel revival. A lack of staff at airports in America and Europe is also causing turbulence, leading to regular flight delays. The situation will probably get worse as big airports, such as Heathrow, have increased their forecasts for passenger numbers.

Following the example of workers at Amazon and Starbucks, staff at an **Apple** store near Baltimore voted to join a union, the first time employees at the tech giant have opted for unionisation. The crusading store staff are Apple's CORE: the Coalition of Organised Retail Employees.

Sales of **homes in America** fell again in May, according to the National Association of Realtors (the tally excludes newly built properties). The decline was the fourth in a row, after sharp rises in the worst of the pandemic, and sales are back to where they were in 2019. However, the median price of a home rose for the 123rd month running, to $407,600, up by 15% year on year.

More expensive money pits

A shift in expectations about inflation and tighter monetary policy are pushing up **mortgage rates** in America, according to Freddie Mac, a government-sponsored mortgage backer. The rate for an average 30-year fixed-rate mortgage has doubled over the past year.

The **Russian rouble** hit a seven-year high against the dollar. It has gained the most of any currency against the greenback this year, despite the loosening of capital controls and a reduction in interest rates. A strong rouble undermines Russia's exports and public finances, a headache for the government, which is mooting whether to set an "optimal" exchange rate.

Meanwhile, the **Japanese yen** fell to a new 24-year low against the dollar. This follows the Bank of Japan's commitment to stick to a monetary-easing policy that targets a short-term interest rate of -0.1%, just as America's Federal Reserve steps up an aggressive round of monetary tightening.

China's crude-oil imports from Russia leapt to a record level in May, equivalent to almost 2m barrels a day. Russia is now once again China's main supplier of oil, displacing Saudi Arabia.

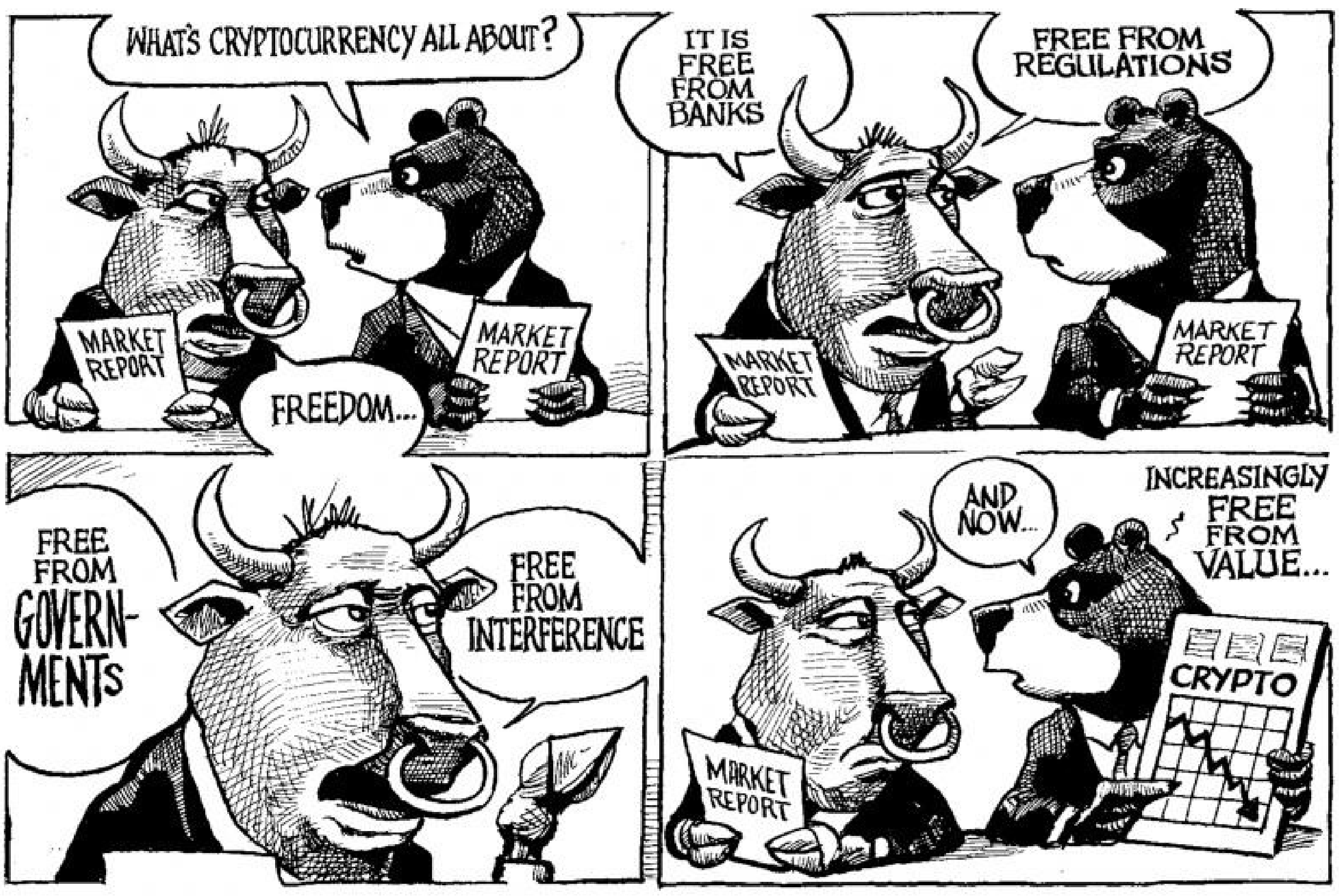
America's Supreme Court declined to hear an appeal from **Bayer** against the $25m awarded to a man who blamed his non-Hodgkin's lymphoma on his exposure to Roundup, a weedkiller. Bayer took on a mighty legal mess when it acquired Monsanto, which made Roundup, in 2018. The company has set aside $16bn to resolve litigation on Roundup's alleged harmful effects. The Supreme Court's decision not to hear the appeal may mean that Bayer fast-tracks the remaining suits.

There was another twist in the lengthy battle to take over **Spirit Airlines**, when Jet Blue Airways again increased its offer. Spirit is also considering a bid from Frontier. A combination with either suitor will create America's fifth-biggest airline in terms of passengers.

Kellogg decided to split its business into three publicly traded companies, based around cereals, snacking and plant-based foods. Growth in its cereals division, which houses Froot Loops, Rice Krispies and Special K, has stalled as more people forgo breakfast.

A greener great outdoors

Winnebago, a maker of trailers and motorhomes that are a familiar sight on America's highways, reported solid earnings for its latest quarter. The company has shrugged off inflation fears by increasing its prices to offset the cost of rising materials. With the price of petrol reaching an all-time high in America, Winnebago recently completed a 1,380-mile (2,220km) test trip of an all-electric motorhome. The size of a large van, it is smaller than a regular recreational vehicle, but 60% less costly to run than a petrol-powered one.




TAGHEUER.COM
PORSCHE
CARRERA
TAG HEUER

The Economist

Power struggle

How to fix the world's energy emergency without wrecking the climate

This year's energy shock is the most serious since the Middle Eastern oil crises of 1973 and 1979. Like those calamities, it promises to inflict short-term pain and in the longer term to transform the energy industry. The pain is all but guaranteed: owing to high fuel and power prices, most countries are facing soggy growth, inflation, squeezed living standards and a savage political backlash. But the long-run consequences are far from preordained. If governments respond ineptly, they could trigger a relapse towards fossil fuels that makes it even harder to stabilise the climate. Instead they must follow a perilous path that combines security of energy supply with climate security.

In Europe what was long imagined as a nightmare of freezing midwinter nights has instead erupted as a midsummer fever dream. A heatwave forced Spanish gas demand to near-record highs, even as, on June 14th, Russia began to lower the flow of gas along the Nord Stream 1 pipeline to western Europe, sending prices soaring by 50% and raising fears that rationing may be introduced later this year. Elsewhere, Americans are paying $5 for a gallon of petrol (€1.25 a litre), fuelling the inflation that opinion polls say is their biggest worry and President Joe Biden's worst headache. Australia's power market has failed. Everywhere you look there are shortages and fragility.

Energy shocks can become political catastrophes. Perhaps a third of the rich world's inflation of 8% is explained by soaring fuel and power costs. Households struggling to pay bills are angry, leading to policies aimed at insulating them and boosting fossil-fuel production, however dirty.

Mr Biden, who came to power promising a green revolution, plans to suspend petrol taxes (see United States section) and visit Saudi Arabia to ask it to pump more oil. Europe has emergency windfall levies, subsidies, price caps and more. In Germany, as air-conditioners whine, coal-fired power plants are being taken out of mothballs. Chinese and Indian state-run mining firms that the climate-conscious hoped were on a fast track to extinction are digging up record amounts of coal.

This improvised chaos is understandable but potentially disastrous, because it could stall the clean-energy transition. Public handouts and tax-breaks for fossil fuels will be hard to withdraw. Dirty new power plants and oil- and gasfields with 30- to 40-year lifespans would give their owners more reason to resist fossil-fuel phase-outs. That is why, even as they firefight, governments must focus on tackling the fundamental problems confronting the energy industry.

One priority is finding a way to ramp up fossil-fuel projects, especially relatively clean natural gas, that have an artificially truncated lifespan of 15-20 years so as to align them with the goal of dramatically cutting emissions by 2050. In particular Europe and Asia, which must wean themselves off Russian gas and coal respectively, have too little liquefied natural gas (LNG) capacity. The trick is to get business to back schemes designed to be short-lived. One option is for governments and energy grids to offer guaranteed contracts over this period that provide an adequate return on the understanding that capacity will be shut down early. Another is to pledge eventual state support to make these projects cleaner, for example through carbon capture and storage.

This does not mean easing up on the drive towards renewables—the most successful part, to date, of the world's generally poor response to the climate crisis. Every extra kilowatt-hour from the sun fed into Europe's electricity grids is one fewer that comes down a Russian pipeline. Governments must improve the reach, capacity and storage capabilities of their grids and remove the obstacles that continue to make it harder to add renewable capacity than it should be. The design of power grids and markets is squarely a matter for governments and they are too often trapped in 20th-century thinking.

As our Technology Quarterly reports, 21st-century thinking turns on new ways to provide smart, resilient grids with the zero-carbon "firm" power that makes dependence on renewables safe and effective. Hydrogen stripped from water with renewable electricity, or from natural gas with steam in facilities that store the emissions, may be crucial here. So, in many places, may nuclear power (see Briefing). Climate-conscious atomic enthusiasts often focus on whizzy but unproven small-scale nuclear plants. What matters more is to improve the building of big ones. Where there is strong and co-ordinated anti-nuclear opinion, governments must win support by showing that there are better safeguards against accidents (see Culture section) and new ways to store waste, as our report from Finland explains (see Science & technology section). Politicians need to tell voters that their desire for an energy transition that eschews both fossil fuels and nuclear power is a dangerous illusion.

The last necessity is to make the industry predictable. That may sound strange given that 20th-century energy markets coped with wars, coups, revolutions, booming Chinese demand and new technology. But the climate transition has added an extra layer of uncertainty even as it simultaneously requires a massive increase in investment. In order to reach net-zero emissions by 2050, annual investment needs to double to $5trn a year, according to the International Energy Agency. The risk is that this latest crisis, and the chaotic government response to it, make investors warier instead.

A different kind of revolution

Spurring investment means eschewing gimmicks including greenwashing, protectionist plans to build domestic green supply chains, and silly prohibitions by banks on gas projects (see Finance & economics section). Instead it will require steadily extending measures with more certainty about which energy sources can be used and for how long. That means enhanced disclosure so that firms understand the externalities they create, an expansion of carbon prices so that they have a sense of the cost of pollution, and regulations that mandate the phasing out of dirty technologies. The great energy shock of 2022 is a calamity. But it could also be the moment when better government policy triggers the investment needed to resolve the conflict between having a safer supply of energy and a safer climate. ■

France

The man who fell to earth

Emmanuel Macron loses his majority in parliament. Can he now get anything done?

LESS JUPITER than Icarus, Emmanuel Macron came crashing down this week. On June 19th French voters did something that was last seen over 30 years ago: they denied a newly elected president a majority in the National Assembly. It is not quite impossible to govern without one, but for the next five years Mr Macron will be scratching around for the votes he needs to get anything done. That is bad news for France—and for Europe too, which sorely lacks a leader of global stature. Angela Merkel left the field last winter, and the man who had hoped to reshape a continent after her departure will have his work cut out just keeping his own house in something that resembles order.

This outcome should not have been as surprising as it felt. In the first round of the presidential election in April, slightly more than half the electorate cast votes for one or other candidate of the political extremes. Enough of them then rallied round Mr Macron in the run-off to allow him to handily defeat Marine Le Pen, the leader of the populist National Rally. But the impressive result masked the fact that Mr Macron, a buttoned-up technocrat who has never been able to shake off the label of *le président des riches,* is loved by only a few, and loathed by many. He won just 28% of the vote in the first round, after all. The French gave him his job back, but they also decided to strip him of much of his authority. Clearly, Mr Macron will need to do things differently.

But what, exactly, and how? To understand the scale of the task ahead, consider how Mr Macron is in some ways the victim of his own success. In his first term his political machine was all-conquering, poaching the best and brightest from the centre-right Republicans and the centre-left Socialists. By straddling the mainstream, he pushed dissatisfied voters to Ms Le Pen's hard right or the radical left of Jean-Luc Mélenchon. For Mr Macron to pacify the angry, left-behind voters who gave both these candidates a huge electoral boost will not be easy, especially without spending even more money that France does not have.

Ideally Mr Macron would continue to pursue the difficult long-term reforms that France badly needs—simplifying its labyrinthine pensions system, laying the foundations for its energy transition and prising open its rigid, highly centralised education system. Yet the future looks hard. Mr Macron's legislative agenda is up in the air. He has summoned the party leaders to talks. The constitution gives him considerable powers, particularly in the areas of foreign and defence policy, and he also has the right, if need be, to force his budget and one other piece of legislation through parliament by decree in each sitting. But if he is seen to abuse that authority, he may provoke a no-confidence vote that could bring down his government and perhaps force yet another parliamentary election.

One option is to try to assemble ad hoc majorities for individual bills. His parliamentary grouping, Ensemble, has 245 seats; 44 short of a majority. He may, for instance, hope to appeal to the Republicans to get his pension reform through; or to the Socialists and the Greens to help him out with the energy transition. Yet both measures will face resistance and if early elections are thought likely, no one will want to risk losing their own voters to the Macron-loathing extremes.

France, with its almost monarchical presidency, lacks a tradition of coalition government. In Germany, the Netherlands or the Nordic countries such arrangements involve weeks or months of negotiation, to hammer out detailed policy agreements. French politics, as so often in the past, is deeply polarised, perhaps too much so for even the most limited agreement on policies. Mr Macron will therefore need to alter that culture. This will require him to embrace a new political style: no longer Jupiterian, controlled and analytical, but open, transactional and instinctive. It will not come naturally, but if he fails, his second term will be doomed to fail too. ■

Global instability

Hungry and angry

A wave of unrest is coming. Here's how to avert some of it

JESUS SAID that man does not live by bread alone. Nonetheless, its scarcity makes people furious. The last time the world suffered a food-price shock like today's, it helped set off the Arab spring, a wave of uprisings that ousted four presidents and led to horrific civil wars in Syria and Libya. Unfortunately, Vladimir Putin's invasion of Ukraine has upended the markets for grain and energy once again. And so unrest is inevitable this year, too.

Soaring food and fuel prices are the most excruciating form of inflation. If the prices of furniture or smartphones rise, people can delay a purchase or forgo it. But they cannot stop eating. Likewise, transport costs are baked into every physical good, and most people cannot easily walk to work. So when food and fuel grow dearer, standards of living tend to fall abruptly. The pain is most intense for city dwellers in poor countries, who spend a huge part of their income on bread and bus fares. Unlike rural folk, they cannot grow their own crops—but they can riot.

Many governments want to ease the pain, but are indebted and short of cash after covid-19. The average poor country's public debt-to-GDP ratio is nearly 70% and it is climbing. Poor countries also pay higher interest rates, which are rising. Some of them will find this unsustainable. The IMF says that 41 are in "debt distress" or at high risk of it.

Sri Lanka has already defaulted and melted down. Angry and hungry mobs have set fire to vehicles, invaded government buildings and spurred their reviled president into pushing out the prime minister, who is his brother. Riots have erupted in Peru over living standards, and India over a plan to cut some jobs-for-life in the army, which rankles when so many yearn for security. Pakistan is urging its citizens to drink less tea to save hard currency. Laos is on the brink of default. Anger at the cost of living doubtless contributed to Colombia's election of a left-wing radical as president on June 19th (see Americas section).

The Economist has built a statistical model to examine the relationship between food- and fuel-price inflation and political unrest. It reveals that both have historically been good predictors of mass protests, riots and political violence. If our model's findings continue to hold true, many countries can expect to see a doubling of unrest this year (see International section).

The greatest risk is in places that were already precarious: countries such as Jordan and Egypt that depend on food and fuel imports and have rickety public finances. Many such places are badly or oppressively governed. In Turkey the supply shock has accelerated ruinous inflation caused by dotty monetary policy. Around the world, the cost-of-living squeeze is adding to people's grievances and raising the chance that they will take to the streets. This is more likely to turn violent in places with lots of underemployed, single young men. As their purchasing power falls, many will conclude that they will never be able to afford to marry and have a family. Frustrated and humiliated, some will feel they have nothing to lose if they join a riot.

Another way inflation destabilises societies is by fostering graft. When wages do not keep up with prices, officials with needy relatives find it even more tempting to extort money from the powerless. This infuriates those who are preyed on. Recall that the trigger for the Arab spring was the suicide of a Tunisian hawker, who set himself ablaze to protest against constant demands for pay-offs from dirty cops.

If unrest spreads this year, it could add to the economic pain. Investors dislike riots and revolutions. One study finds that a big outbreak of political violence typically knocks a percentage point off GDP 18 months later. The damage is worse when protesters are angry about both politics and the economy combined.

Averting the coming explosions will be hard. A good start would be to scrap policies that discourage food production, such as price controls and export curbs. Farmers in countries like Tunisia leave fertile land unploughed because they have to sell their crop to the state for a pittance. Governments should let farmers reap what they sow. Also, far less grain should be wastefully burned as biofuel (see Graphic detail).

Several countries are asking for bail-outs. International financial institutions must strike a tricky balance. Saying no could spell chaos—and do lasting harm. But so could bailing out woeful governments, by entrenching bad and unsustainable policies. Bodies such as the IMF, whose negotiators arrived in Sri Lanka and Tunisia this week, should be generous but insist on reforms. They should continue to monitor carefully how their money is spent. And they should act swiftly. The longer all this anger is allowed to fester, the more likely it is to explode. ■

The euro zone

The ECB's next headache

How fighting inflation could imperil the single currency

IS THE EURO area entering another sovereign-debt crisis? Indebted Italy must pay 1.9 percentage points more than Germany to borrow for ten years, nearly double the spread at the start of 2021. The borrowing costs of Spain, Portugal and even France are up sharply, too—and spreads were even higher before the European Central Bank promised on June 15th and 16th to turn the tide. As in the nightmares of 2012, the central bank is working on a plan for bond-buying to prevent weak countries from spiralling towards default. Echoing Mario Draghi's promise to do "whatever it takes" to save the euro area, Christine Lagarde, president of the ECB, warned on June 20th that anyone doubting the central bank's resolve would be "making a big mistake".

The ECB's pledges should forestall a crisis for the time being. Yet be in no doubt, in the long run simply depending on the central bank to underwrite the debts of the euro zone's governments leaves the currency union intolerably fragile.

Having spent $2trn supporting its economies through the pandemic, Europe is more indebted than it was a decade ago. Italy, the bloc's third-largest economy, has towering net debts worth nearly 140% of its GDP, up from 108% at the start of the previous euro crisis in 2010. France's balance-sheet looks almost as dodgy as Italy's did after the global financial crisis. High inflation will ease the burden somewhat this year. But as the ECB raises interest rates to get inflation down, the cost of servicing what remains will rise.

High interest rates take time to make themselves felt in countries' budgets: Italy's outstanding debt has an average remaining tenor of almost eight years. The lag creates time for the ECB to prevent a crisis in which fears of default become self-fulfilling by raising borrowing costs. The central bank is used to walking the line between preventing runs and giving spendthrift countries an incentive to incur debts at its expense. As in the 2010s, it will undertake to contain spreads, but its help will probably come with strings attached.

The ECB also has a formidable new problem to solve: working out how to fight inflation and support indebted countries at the same time. In most of the 2010s and early in the pandemic the bank could justify buying Italian or Portuguese bonds partly because that was also a helpful economic stimulus. Inflation was below its 2% target. Now, by contrast, it is throwing cold water on the economy by raising interest rates, so it must justify any bond-market interventions solely on the basis of fighting financial fragmentation. Their stimulative effect is unhelpful.

To square the circle the ECB may "sterilise" the effect of bond- ▸▸

buying on the banking system, by using other instruments to soak up the money that its purchases inject. Yet sterilisation is only a partial solution. Higher spreads for weaker borrowers are a natural consequence of monetary policy, so suppressing them blunts the effect of interest-rate rises. The stimulus may be small, but its mere existence at a time when inflation is too high would make bond-buying harder to defend in court when hawks challenge its legality—as they inevitably will.

En garde Lagarde

The biggest threat is that containing spreads will not be enough to protect vulnerable economies. Investors expect the ECB to raise interest rates to 2% by the end of the year. As a result even rock-solid Germany, which by definition pays zero spread, is now charged 1.8% to borrow for ten years, up from -0.5% less than a year ago. If rates were to rise further, Italy would start to look wobbly, even if spreads could be contained at their current level. The country probably cannot tolerate yields on its bonds much above 4%. Around that point, the goals of price stability and defending indebted countries would become irreconcilable.

Should interest rates surge, the euro area would look dangerously frail. The only way to make it safe is fiscal and financial integration that relieves the burden on the ECB. One part of that is breaking the "doom loop" running between indebted sovereigns and the local banks that own their debt—a project that has seen some progress (see Finance & economics section). Yet even if Italy's banks could withstand an Italian default, European policymakers would never countenance throwing a €2trn bond market to the wolves. Hence the contradiction between monetary union and fiscal separation would remain unresolved.

And the only fix is more collective spending by the euro zone countries. The €750bn "Next Generation" fund, born during the pandemic and financed by joint borrowing, is already doling out cash, which should reduce pressure on national budgets. The more spending is centralised, the easier it will be for indebted states to run the surpluses that may be necessary for their debts to be sustainable if interest rates rise. Many in Europe will not like the transfers from north to south that result. But such are the flaws in the currency union that the alternatives—fragility and inflation—may be even worse. ■

Britain's growth crisis

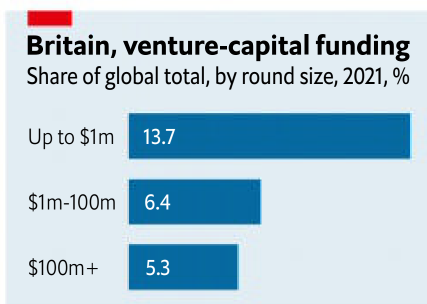
Tiddlers, not titans

As new firms get bigger, the capital they need dries up

BRITAIN IS A good place to be a budding entrepreneur. The country's share of global venture-capital (VC) funding has doubled since 2018, to twice its share of global GDP. One out of every seven dollars the world invests in the earliest-stage "pre-seed" firms is invested in Britain. Although financial markets have taken a hammering this year, British VC funds have record amounts of unspent capital to throw at tomorrow's winners.

But Britain is not a good place to turn promising startups into titans. There are many reasons for that, from Brexit to poor productivity. But a big stumbling block is that as British firms grow, the capital they need dries up along the way (see Britain section).

By the time these companies are raising tens of millions of dollars, rather than a few hundreds of thousands, their share of global VC funding has halved. "Deep tech" ventures, which try to develop industry-disrupting new technologies like quantum computing or artificial intelligence, fare especially poorly. And at the top of the capital ladder, Britain's once-mighty stockmarket has drifted into insignificance. In 2006 it accounted for 18% of the equity capital raised in global initial public offerings. This year it has raised under 1%.



America provides a sobering contrast. It has spawned four trillion-dollar behemoths in the past five decades. Britain has not created a business worth even a tenth as much in more than a century. In 2011 the FTSE 100 index of leading shares contained only two globally respected tech firms, Autonomy and Arm. Now it has none. Autonomy has been sold to Hewlett-Packard, an American giant, and its reputation tarnished by fraud claims (which its erstwhile leaders deny). Arm was bought by SoftBank, a Japanese conglomerate, and is now considering relisting on the NASDAQ (see Business section).

Comparisons between Britain and America are often misplaced. Much of America's success in nurturing corporate titans was forged in the crucible of Silicon Valley, which has far more than abundant growth capital to recommend it. First-mover advantage in the VC market, long-standing partnerships with America's Department of Defence and a culture that celebrates enterprise—they all turbocharge innovation. But Britain's courts, excellent universities and world-class financial centre should make it unusually fertile ground for firms to grow, too.

What should be done? One focus ought to be to simplify corporate-governance rules. Britain has had more iterations of its baroque governance code in the past 25 years than it has had prime ministers. The result is a tangle of worthy disclosure requirements that distracts fledgling firms. Another should be to seek to attract those rare experts capable of making sensible commercial decisions in deep-tech areas like quantum computing. Britain's excellent research universities are already a lure. One idea would be to create fellowships that combine an investment role with an academic one.

But the top priority is to direct the £4.6trn ($7.4trn) of assets held in British pension and insurance funds into more productive areas. Less than 1% of these assets is in unlisted equities. Defined-benefit pension schemes' allocation to the British stockmarket has sunk from 48% to below 3%. The government should dilute the pension-fee cap that crimps investment in early-stage firms. It should reform accounting rules that incentivise funds to load up on low-yielding gilts rather than riskier equities. The plethora of tiny pension funds—like the 90-odd local-government schemes—should be merged so they can invest at scale. Britain has assets seeking returns, firms hungry for capital and a financial centre that can bring them together. It can do better. ■

Drugs and biodiversity

Bello described the palpable fatigue across the Americas with the war against drugs (June 11th). In the case of Colombia the historic absence of the state in the difficult terrain that accounts for half the drug industry's territory has been a main reason for its success. As Bello says, improving security and boosting legal economic activity in these areas would be much more effective than yanking up coca plants. Crop substitution is not easy in these remote areas. However, Colombia is the second-most biodiverse country in the world and the tenth most vulnerable to climate change. It is rightly committed to tackling deforestation.

The areas at risk are the very same where coca is grown, indeed the latter is the cause of much of it. To stop and reverse deforestation Colombia would need a large workforce, which would be drawn from those who would otherwise have continued to grow coca. As security improves more employment would come from ecotourism, which Colombia does very well in its coffee zone.

Other countries are keen to help Colombia's efforts. Let us hope that the new president seizes this opportunity.

SIR KEITH MORRIS
British ambassador to Colombia, 1990-94
London

Businesses saving the planet

It was wrong to imply that the efforts of Mark Carney, Larry Fink and Jamie Dimon to "stop global warming and create a fairer, more enlightened form of capitalism" constitute wokeism (Schumpeter, June 11th). Capitalism and global business are transforming from focusing purely on shareholders' financial returns to a conviction that society has a right, indeed a duty, to hold companies accountable for their actions. This is eloquently elucidated by Hubert Joly in his book, "The Heart of Business". Far from creating confusion, which investor-driven environmental, social and governance (ESG) does in abundance, this concept of corporate citizenship makes life simpler. Everyone knows how to tell a good citizen from a bad citizen. The same goes for companies. Messrs Carney, Fink and Dimon are on the right side of history.

NICHOLAS DUNGAN
Chief executive
CogitoPraxis
The Hague

Education methods

"Golden tickets", (June 9th) reported the optimistic findings of a study into the standardised and transformational teaching methods used by NewGlobe. These methods produce greater learning in all types of programmes, including government ones. Yet, this was missed in your article by reflecting common misinterpretations of a multi-partner programme study in Liberia.

NewGlobe's methods are not expensive, even when deployed by existing, government-salaried teachers and administrators. The Liberian study's authors focused on total costs, whereas marginal costs drive scale and sustainability, as evidenced by NewGlobe's subsequent rapid expansion in Liberia. Also, NewGlobe's methods worked as well or better than any other operator within the Liberian experiment. The only available comparable data were published in the first-year report. The authors chose not to provide comparable data in the final report and explicitly warned against trying to use that report to compare school operators.

Better teaching methods are sorely needed to improve learning in low- and middle-income countries; few are evidenced to work at scale.

STEVE CANTRELL
Chief impact officer
NewGlobe
Glendale, California

All in the family name

Johnson's enjoyable column on the terms used to denote family relationships in languages other than English resonated with me (June 4th). The Batak, an ethnic group native to Sumatra, have a rich collection of titles used inside and outside the family. Which one to use depends on factors including the relationship between clans and the generation in respective family trees, as well as sex and any ties that may exist through marriage. This takes some understanding. On first meeting, Bataks will commonly spend a few moments determining what they should call one another. For this native English speaker, despite 20 years of marriage to a Batak and a good degree of fluency in the language, the system is as baffling now as it was when I first encountered it.

OLIVER CRAVEN
Hinckley, Leicestershire

In one sense, English offers greater precision than Johnson acknowledges. The French *belle-mère* is used for both mother-in-law and stepmother. The old *marâtre* for stepmother is pejorative and used principally in fairy tales.

JAMES TEBBOTH
Buckingham, Buckinghamshire

The Armenian language also features complex terms for relatives. Parents of married couples refer to each other as *khnami*. It is connected to the verb for caring. Marriages are not individual undertakings in Armenian culture. They create wider families.

NAREG SEFERIAN
Arlington, Virginia

Being who you are

I was disappointed by Bartleby's view that we should "not bring your whole self to work" (June 4th). As well as the strict separation of an employee's professional and private life, there is a third space of social interaction in the workplace. This is the space for water-cooler conversations, of internal and external networking, where being exactly yourself is an asset and pretending to be someone else is not going to help you.

This is the space where you do not have to lie about having a same-sex partner or a child with special needs when people ask you on a Monday if you had a fun weekend. So many people have had to fight during their careers to be able to be themselves at work, to enjoy a space where sexist, homophobic and racist jokes are no longer the norm.

LUC VITRY
Philadelphia

Employees are renegotiating the social compact as we move to the digital age of work and the physical boundaries between our work and personal lives melt away. They are demanding greater autonomy in choosing when, where and how to work, yet also yearning for a deeper purpose and connection to their colleagues.

CHRISTINE DAUCHEZ
New York

Bartleby warns against bringing your whole self to work, suggesting you "bring your role self" instead. Buddhism sidesteps this dilemma nicely: there is no self.

BRENDAN KELLY
Professor of psychiatry
Trinity College Dublin

Letters are welcome and should be addressed to the Editor at
The Economist, The Adelphi Building, 1-11 John Adam Street, London WC2N 6HT
Email: letters@economist.com
More letters are available at:
Economist.com/letters

Nuclear family

HINKLEY POINT

Energy security gives climate-friendly nuclear-power plants a new appeal. To make good on it they have to get easier to build

THE WORLD'S largest crane, Big Carl, trundles up and down the railway which bisects the site. To the south are cavernous temporary structures which serve as factory floors, sheltered from the elements, cranking out modules of steel and concrete. Big Carl (pictured, above) takes gentle hold of these components, lifts, turns and gently sets them down. Piece by gigantic piece, the newest nuclear power plant in the Western world is taking shape. When it is finished its two nuclear reactors will be able to supply Britain's grid with 3.2 gigawatts (GW) of power, providing about 7% of the country's electricity needs.

Over the four years that Hinkley Point C (HPC) has been under construction on the edge of the Bristol Channel in the west of England, it has consistently been held up as an example of the industry's current problems. Nuclear energy's long-standing cost and schedule issues used to mean it was hard put to compete with natural gas and coal. Now they make it hard for nuclear to compete with ever-cheapening renewable energy.

When the British government and EDF Energy, the plant's owner, signed the relevant contracts in 2013, HPC was expected to produce a megawatt-hour for £92 (then $145). The same amount of energy from a new offshore wind farm was at the time expected to cost £125. Nine years on, HPC is two years behind schedule and £10bn over budget; so its power will cost more. Offshore-wind producers, for their part, are offering energy at less than £50 (now $60) per megawatt-hour. The cost of electricity from solar panels has fallen yet further. Campaigners who have long seen nuclear as dangerous can now call on economists who say it is just too expensive.

Beyond all that, the plant faces the problem of being built by a company in increasingly dire straits. The other European plants based on the reactor design EDF calls EPR—the design used at Hinkley—are also behind schedule. Its existing reactors in France are causing concern, too. Corrosion problems discovered in 2021 have seen a number of them shut down for inspection and repair at a time when the cost of natural gas, and thus electricity, has soared.

High prices have meant the amount the company has had to pay to cover its lack of performance is particularly high; in March it announced its profits would be €11bn lower as a result. Another €8.4bn hit came through the French government's order that EDF supply electricity to re-sellers below the wholesale market rate to protect consumers from cost increases.

For all its woes, though, by the standards of Western-designed and -built nuclear plants, HPC is ahead of the curve. The EPRs at Olkiluoto in Finland and at the Flamanville C plant in France started construction in 2005 and 2007 respectively. Neither has yet been paid for a watt fed into the grid. The same is true of Vogtle, an American plant designed around two Westinghouse AP1000 reactors which began construction in 2009; by 2017 it had driven Westinghouse into bankruptcy. All three are between two and three times over their original budget and getting on for a decade behind schedule.

To see reactors completed and connected to the grid with any degree of regularity and timeliness you must go instead to China and Russia. Between 2008 and 2021 Rosatom, a state-owned firm, started and completed ten reactors at five power plants in Russia. China has been building reactors of various designs, including AP1000s and EPRs. The China General Nuclear Power Group set to work on its two EPRs in Taishan, in southern China, after construction was already under way at Olkiluoto and Flamanville and finished by 2019.

This has meant that those Western countries still interested in building nuclear power plants have increasingly looked to non-Western companies to build them. At the beginning of this year Rosatom was expecting to build four reactors in the EU, 7% of the 70GW of nuclear capacity it has plans for beyond Russia's borders. In February Britain's nuclear regulator approved the Hualong One, a Chinese reactor design, for use at Bradwell, a nuclear site in Essex.

Then came the war in Ukraine. On February 15th, as Russian forces massed on Ukraine's border, Bulgaria definitively nixed any Russian involvement with a nuclear plant that was to be built next to the northern town of Belene. Finland's Minister for Economic Affairs, Mika Lintila, has repeatedly said that it would now be "absolutely impossible" to grant a permit for a planned Russian-built nuclear plant in Hanhikivi to go ahead. In March the Czech Republic excluded Russian reactors from a tender for which they had previously been the leading candidate.

Heat and light

Hungary's opposition has been attacking plans for two new Russian reactors at the Paks plant in the centre of the country on the basis that they would expose the country to untenable Russian influence. Viktor Orban, the pro-Russia prime minister, might be immune to their arguments. But Western sanctions make it doubtful that Rosatom could complete the build. A more general worry about inimical control over such assets has seen the Chinese plans for Bradwell put in doubt.

At the same time as sending countries already interested in new nuclear plants in search of new companies to build them, the invasion of Ukraine also underscores a more general energy-security argument in favour of nuclear power plants: they can afford their owners a security of electricity supply. The EU's reliance on Russian gas has boosted Russia's income even as its artillery flattens Ukrainian cities; since mid-June, Russian moves to limit that supply have sent prices through the roof.

If European countries had more nuclear plants, their reliance on Russian gas would be reduced; there is a reason why Finland, where the practical alternative has long been Russian gas, is keen on the technology. When President Emmanuel Macron of France announced on February 10th that the country would be building a new set of nuclear plants, he praised renewables and nuclear as the "most sovereign" way of producing electricity. During a visit to HPC in April, British prime minister Boris Johnson was explicit that the reactor was part of an "energy-security strategy": "We cannot allow our country to be dependent on Russian oil and gas."

As Mr Macron noted, energy security adds to the technology's pre-existing appeals; it is comparatively safe and it is climate friendly, both of which make it preferable to fossil fuels (see chart). According to an analysis by Our World in Data, a research organisation, burning coal to generate a terawatt-hour (TWh) of electricity is associated with some 24.6 deaths, largely because of particulate air pollution. Natural gas is about ten times less deadly. Including roughly 4,000 deaths linked to the Chernobyl disaster and the 573 people who, according to *Yomiuri Shimbun*, a newspaper, died as a result of "fatigue or the aggravation of a chronic disease due to the [Fukushima] disaster" the number for nuclear is just 0.03 deaths per TWh.

As to climate, if industrialised countries are to do their bit in keeping the rise in global average temperature, compared with that of the pre-industrial age, well below 2°C—the target set in the Paris agreement of 2015—they need quickly to purge fossil fuels from electricity grids. Plausible models show clearly that, even with big grids and a lot more energy-storage capacity than is available today, this is much cheaper when the grid includes not just

wind and solar, which are both intermittent, but also "firm" generation which produces electricity at a relatively steady rate.

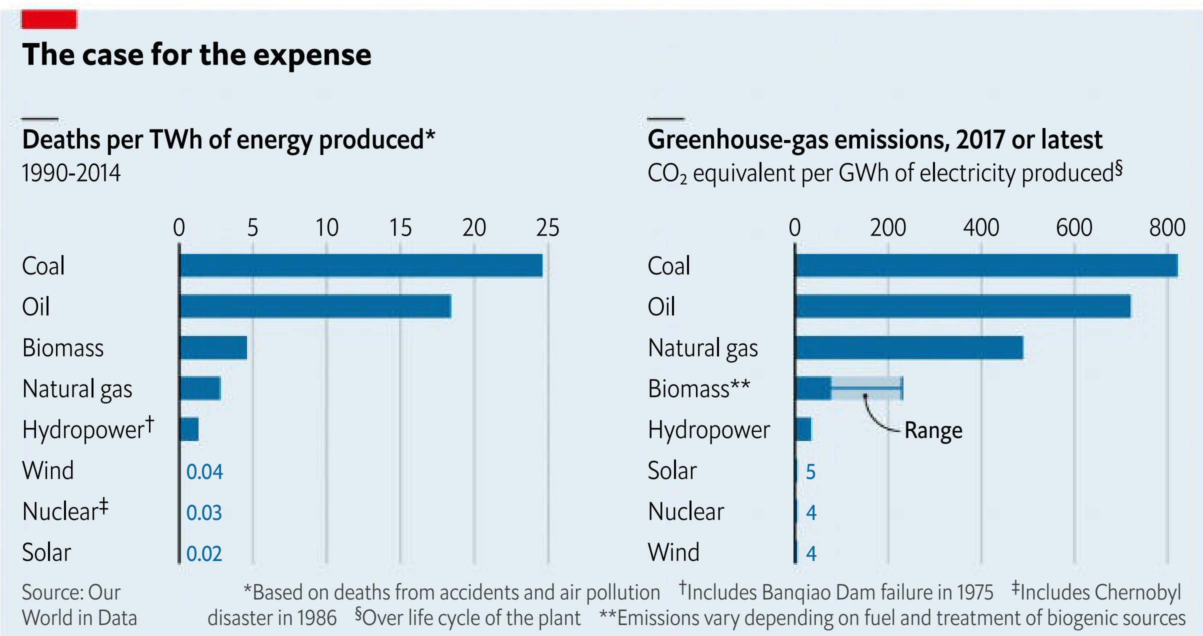
It has long been argued that this role might be taken by fossil-fuel-powered plants fitted with technology for carbon capture and storage (CCS) and that may yet be the case; but there has been almost no deployment of the technology at large scale yet. Hydroelectricity and nuclear power are the only methods of producing such power without emitting carbon dioxide that have ever been deployed on a large scale. And sites suitable for big new hydroelectric plants in developed countries are very few and far between.

Saving the planet

The climate case for nuclear has given rise to a lot of excitement about new types of reactor, notably smaller ones which make more use of components created in factories far from their sites. But these small modular reactors (SMRs), promising as they may be, are still for the most part at early stages of development. The only proven form of nuclear power that can be expected to provide fresh gigawatts to rich-country grids in the 2030s is the form that is around today: big, slow-to-build and cumbersome reactors like the EPR.

This means that HPC is not just the latest in a line of thousand-days-late, billions-of-dollars-short boondoggles. The plant is a crucial test of whether Western financing, construction and supply chains can be improved in ways that curb the industry's chronic time and cost overruns. To the extent that it can be built more efficiently than its predecessors, and pave the way for future construction to be better still, it is a bellwether for the industry.

One of the reasons that nuclear plants have to be built better is that they need to cost less. Financing is always going to be a



bit expensive, because even before you take the almost certain delays into account the time frame for building them is a lot longer than that for other sorts of large power plant. "You don't start getting paid until you produce electricity on the grid," says Julia Pyke of EDF, who leads the financing for the next British plant the company is planning, Sizewell C. "The longer your construction period, the more you roll up interest."

If the time required was long but predictable that would be one thing. But the risk that the project will run into trouble which sees the schedule drawn out further, or even cancellation, means the plants do not just have to borrow for a long time, they also have to borrow at high rates.

These uncertainties reflect the fact that nuclear construction often fails to meet the high standards to which it is understandably held. When regulators notice things, they have to be put right. The concrete used at Olkiluoto was initially not up to scratch, with too much water in the mix. Then there were problems with the systems used to monitor and control the plant, leading to legal battles with two contractors, France's Areva and Germany's Siemens. Flamanville is dogged by faulty welding. According to Reuters, a news agency, 800 of the 3,000 people working on the plant are repairing bad welds.

In one way these delays can be seen as reassuring badges of the technology's safety; regulators came, found shortcomings and had them fixed. It is hard to be sure that the same would happen on Russian and Chinese projects, either at home or in export markets such as Egypt or Pakistan. And there is some reason to believe that a system where there was more experience with new builds would see fewer such cock-ups. Unfortunately the cock-ups, by adding to the costs, make new reactors rarer and building up that experience harder.

No Western country has a workforce with experience in making the things both well and quickly (HPC is the first to be built in Britain for 30 years). Supply chains are not only hugely complicated but also bespoke, not routine. They thus tend towards the crufty. This results in failure reinforcing failure. Building goes badly; investors, aware of the risks of delay or cancellation, charge a lot for the money they provide; demand for new plants goes down; no one learns to do the building better.

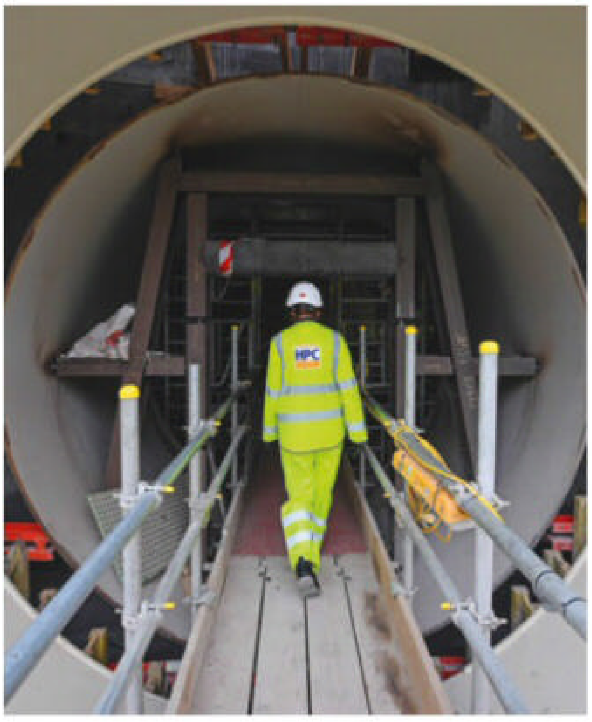
To break this cycle requires both better building and new financing models. The construction at HPC is using modern planning and prefabrication techniques which are designed to make the build more likely to come in on time. Instead of being welded piece-by-piece, in situ, reactor components are built "offline", away from the reactor itself, then hoisted into place: hence the need for a very big crane. Similar sorts of reform have been tried before; the AP1000, in particular, was designed with this sort of approach in mind. This time they may actually be working. Simon Gould, a specialist welder with TISSOT Industrie who worked on both Flamanville and Olkiluoto calls the Hinkley system "a game changer". EDF says construction of the second of HPC's reactors is going 30% faster than construction of the first did as the new approach hits its stride.

Sizewell C should benefit not just from this process improvement, but also from a financing regime called the Regulated Asset Base (RAB). Already used in other British infrastructure projects, it allows interest payments to be covered by charges to consumers' bills during the construction period. Similar arrangements have been tried before for American nuclear plants. Britain's National Audit Office thinks the version it has designed is better.

Paying for it all

Having consumers pay off interest during construction reduces the size of the principal on which interest must be paid in future, thereby reducing overall costs. For example, for a loan of £8bn with an interest rate of 9%, which is the rate at which EDF was able to borrow money for Hinkley, the accumulated interest on the loan is larger than the principal by the time construction is completed. The company reckons that some 60% of HPC's final cost will be the cost of financing its construction.

On March 31st Parliament passed legislation allowing RAB to be adopted for Sizewell C. The decision to go ahead with the plant is expected any day. Ms Pyke expects the RAB deal will not just allow interest to be paid off before earnings begin but also lower the rate at which lenders charge interest in the first place, though by how much she cannot say. In return for their enforced upfront generosity, consumers should, in the long term, get cheaper electricity. At HPC, EDF was able to get the government to agree to a high price for its electricity more or less in perpetuity to overcome the acknowledged hurdle of the financing costs. At Sizewell it will face a regime that allows prices to come down over time on the say-so of a yet-to-be-instituted regulator.



Looking for the light at the end

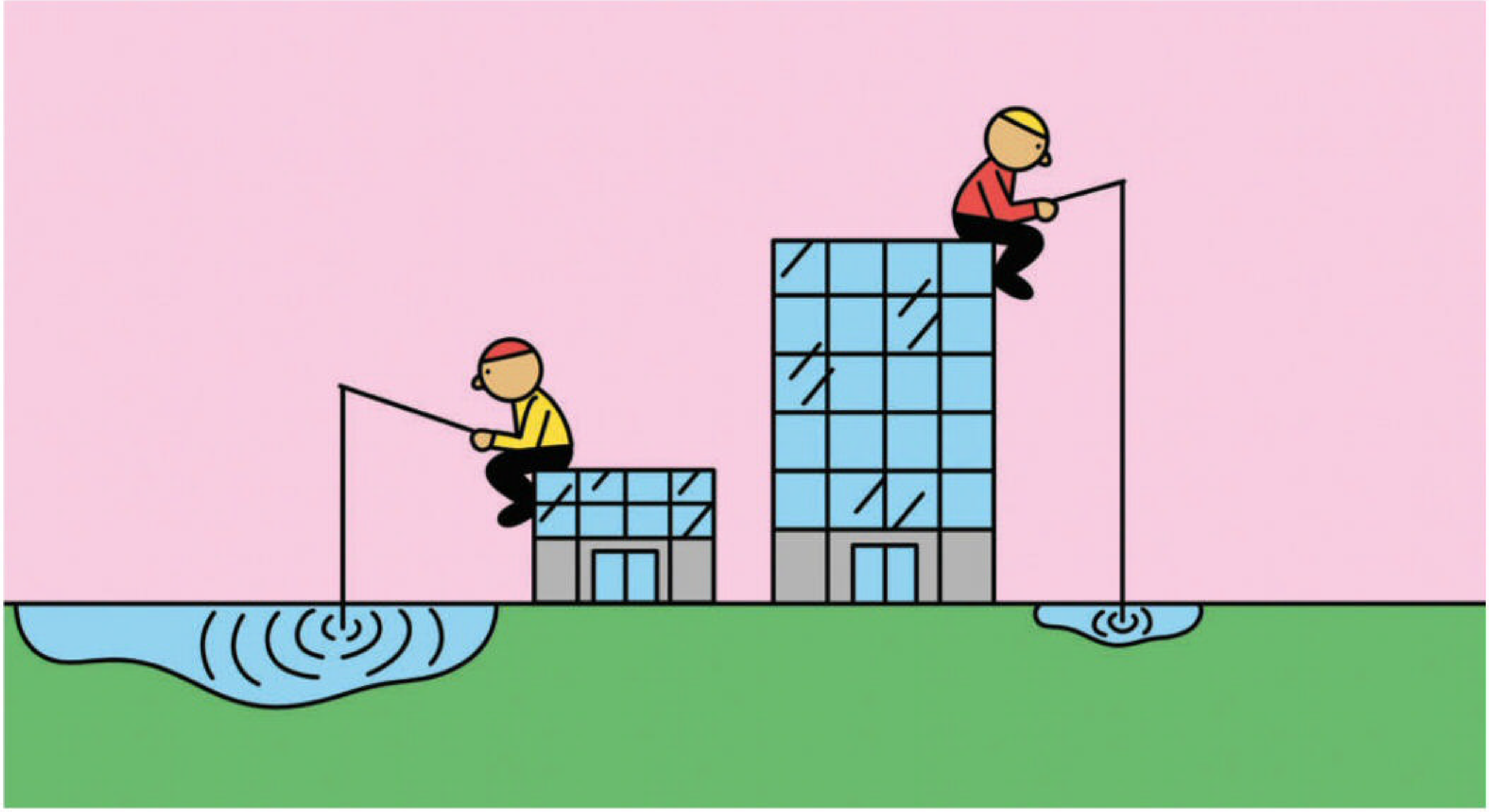
Other companies based in democracies make nuclear plants, but they are untried in Europe. Japan's nuclear industry has built many power plants at home, and after restarting those closed down post-Fukushima, has plans for more. But it has never built overseas. Two Japanese plants planned for Britain have fallen through in the past decade. Westinghouse, now owned by a private equity group, makes money on refuelling and maintenance but, understandably after its losses at Vogtle, has no firm construction plans.

That said, Westinghouse is in talks with both Poland and the Czech Republic about the reactors they want to build. Poland has also been talking to Korea Electric Power Corporation, better known as KEPCO. The company has never yet built a plant in Europe, but it has built one overseas, in the UAE, and is owned by a democratic and friendly government. In March that government's new leader, President Yoon Suk-yeol, said he would abandon the previous government's policy of phasing out nuclear energy, and committed to boosting the export of nuclear reactors.

New vendors could improve the outlook. So might the eventual deployment of SMRs. An American company called NuScale has a deal to build a set of six small reactors in Romania which together would supply 462MW to the grid. Rolls-Royce, a British engineering company, is touting larger SMRs, each of which produces more than all six of those NuScale ones; it, too, is in talks with Poland.

If such designs really do allow power plants to get up and running in just a few years, new interest could bloom in both Europe and America. But that is not a reason for abandoning attempts to make big nuclear plants cheaper and easier to build. To replace the electricity generated by burning Russian gas and substitute Western-designed nuclear plants for cancelled Russian ones, Europe would need at least 40GW of new nuclear capacity over the coming decade and a half. That is plenty for all. And if Europe could get good enough at big plants to offer them for export that would be a significant bonus. A world in which all new nuclear programmes have to rely on China and Russia is geopolitically unappealing.

Big Carl, it seems, must do more than lift the 1,000-tonne loads he faces at HPC. He has a potentially world-improving industry to set straight. ■



Growth capital

Start up, fade away

Britain is a great place for startups but a bad one for aspiring corporate titans

BRITAIN'S GROWTH CRISIS

The Macmillan report of 1931 was nothing if not ambitious. Commissioned by the Treasury, its objective was "to inquire into banking, finance and credit...and to make recommendations calculated to enable these agencies to promote the development of trade and commerce and the employment of labour". Today it is best known not for its musings on central banking or the gold standard, but for its diagnosis of the "Macmillan gap".

Wall Street "devoted itself" to American industry, the report said. Germany owed its "great industrial development" to an "entrepreneur spirit in banking". But the City's strengths lay in international commerce and foreign bonds. So the Square Mile was of limited use to domestic firms trying to raise long-term equity capital—and particularly to small and medium-sized companies looking for up to £200,000 (£9.5m, or $11.6m, in today's money).

Freshen the language and adjust the figures, and the report might have been written today. Britain's financial-services industry employs 1.1m people, generates 7% of the country's economic output and contributes a tenth of the Treasury's tax revenue. But this clout is not harnessed to build the industries of the future. Too often, when it comes to scaling a promising startup into a domestic heavyweight, equity capital dries up along the way.

Of America's five biggest firms by market capitalisation (Apple, Microsoft, Alphabet, Amazon and Tesla) three were founded after 1990, and the others in the 1970s. Four have valuations in the trillions. The average age of the five biggest firms with headquarters in Britain (Shell, AstraZeneca, Linde, HSBC and Rio Tinto) is 135. None is worth over $250bn.

To see where the problems lie, look at the typical life cycle of a company. Most entrepreneurs begin their businesses with their own money and that of friends and family. Once they need sums in the hundreds of thousands, however, they usually sell a proportion of the firm's ownership to institutional investors (a "pre-seed round", in the jargon). Further rounds follow when the startup needs to raise more money: "seed" once it's around a million, "Series A" when it's closer to five million, "Series B" when it's more, and so on until the letters run out. Eventually, a successful firm may be trying to raise such a hefty amount that its best option is to list on the stockmarket.

At the early stages, Britain excels. Venture capital (VC), once the preserve of Silicon Valley, has flooded into Europe in recent years, with Britain being the prime beneficiary. British startups raised 14% of the money invested globally in pre-seed rounds in 2021, and 11% of the total in seed rounds. (For comparison, the country accounts for around 3% of global GDP.) "Any decent entrepreneur with a decent idea can get seed capital," says one investor. But move up the scale, and raising capital gets progressively harder (see chart on next page). By the time they are after $15m or more, British startups' share of global funding has more than halved. A modern-day Macmillan gap still yawns.

"Deep tech" ventures, which try to develop truly innovative technologies like ar- ▸▸

→ Also in this section

24 Memorials to Windrush

25 Public-sector wages

25 A threat to Horizon

26 Hard choices on coastal erosion

28 Britain's culture collections

30 Bagehot: Brexit and cakeism

tificial intelligence or quantum computing, face particular difficulties in attracting scale-up capital. Such firms are essential to building new industries—research into search engines was once a niche pursuit. But spending on research and development chews through cash, and any revenue is likely to depend on a small number of clients or pilot schemes.

As a result potential investors "can't just look at a set of financials and say 'this is a business that is working'", says Anne Glover of Amadeus Capital, a VC firm. Instead, they need to understand how the prototype works, the industry it is trying to disrupt and how long it will take to make a viable product. Almost by definition, such investors are thin on the ground. "There are easier bets to make," says Harry Nelis of Accel, another VC firm.

That is a problem everywhere, but it is more acute in Britain than in other comparable countries. According to an analysis by British Patient Capital, a government-owned investor, just 49% of British deep-tech firms reach their second funding round, compared with 63% for American ones. By the sixth funding round, the average American deep-tech firm has raised £113m; the average British one just £25m. After adjusting for GDP, deep-tech firms in America, China, Israel and Sweden are all better funded than British ones.

For firms that do manage to scale up, other sources of capital become available. By the time they are looking to raise hundreds of millions of dollars, they can tap the private-equity market. Private-equity investors struck deals worth $1.1trn in 2021, around a fifth of which was for British firms. But as firms grow bigger still, they often seek amounts that can only be found on the public market. And here another funding gap opens up. Britain's stockmarket is a shadow of its former self.

Until relatively recently, the London Stock Exchange was an international hub for raising equity capital. In 2006 18% of the funds invested in initial public offerings (IPOs) globally were raised in London. No longer. Over the five years to 2021 that figure was 4%; so far in 2022 it is below 1%. The City's biggest IPO, for Glencore, a mining giant, was more than a decade ago.

One big reason is the behaviour of sources of long-term capital with a natural slant towards British markets. New Financial, a think-tank, reckons that defined-benefit pension schemes, whose assets total £1.8trn, have reduced their allocation to London-listed equities from 48% in 2000 to less than 3% today. Of the £6trn of assets in British insurance funds, pension schemes and retail holdings, only 12% is invested in Britain's stockmarket.

Tech firms perceive mainstream British asset managers as being somewhere between indifferent and hostile, prizing earnings today over the promise of growth tomorrow. Although tech stocks have endured a hammering everywhere recently, those listed in London have fared especially poorly. One VC investor, asked whether he would consider listing a promising British startup in London rather than on the New York Stock Exchange or on the Nasdaq, responds with laughter. Even as scale-up investors try to build a ladder for fledgling firms to climb, says Ms Glover, "it is as if the top rungs have been removed".

You only need to look to Germany's *Mittelstand* companies, which employ over half of the country's workers, to see that creating American-style behemoths is not the be-all-and-end-all of growth. But it is common lore among VC investors that the most potent spurs to entrepreneurship and innovation are examples of wild, untrammelled success. Writing as the Depression set in, the authors of the Macmillan report understood that encouraging early-stage companies to grow would be key to reviving Britain's economy. That is as true today as it was 90 years ago. ■

Rounding down

Britain, share of global venture-capital funding, %

By round size, 2021

Source: Dealroom

Public art

Heavy metal

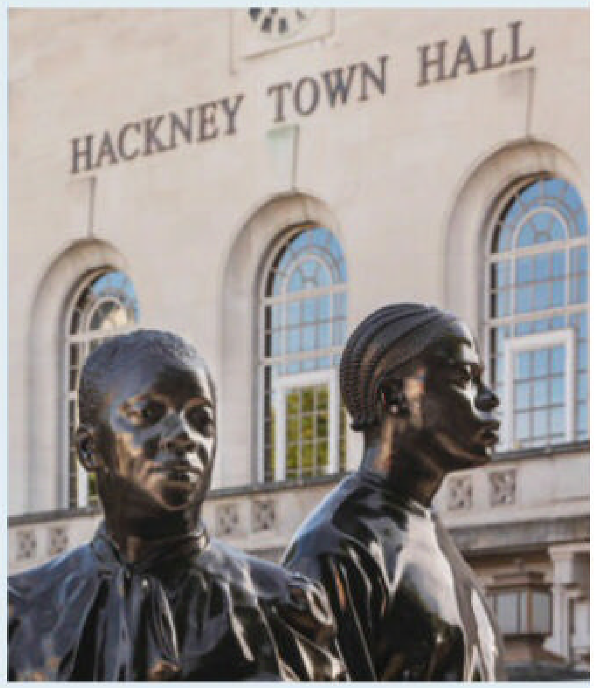
Britain finally gets round to memorialising post-war migrants

As the passenger ship *Empire Windrush* chugged towards Britain in 1948, carrying hundreds of Jamaicans, the government shuddered. "This unorganised rush is a disaster. We knew nothing about it," an official told the *Daily Herald* newspaper. Another warned that "it will be difficult, if not impossible" for the new arrivals to find jobs.

If Afro-Caribbeans felt a little unwelcome then, they received an even clearer signal decades later. In 2018 it transpired that Caribbean-born Britons were being harassed and even deported on the ground that they could not prove their legal status. They had entered the country as British subjects before immigration rules tightened in the early 1970s. They had no immigration papers because there was no need.

Now the government is trying to atone. On June 22nd, exactly 74 years after the *Empire Windrush* arrived, Prince William unveiled a state-funded statue in Waterloo railway station. A Jamaican sculptor, Basil Watson, has portrayed a man, a woman and a child dressed in 1940s clothes and hats standing on old-fashioned suitcases.

The sculpture aims for historical accuracy. But some argue that it misses. "It's not good history," says Arthur Torrington of the Windrush Foundation, a charity. The earliest migrants did not pass through Waterloo, although later ones did. And it is a little odd to portray them as awed travellers. Many had been stationed on Royal Air Force bases during the second world war, and knew Britain.



A composite commemoration

On the same day two other bronze figures were unveiled in Hackney, in east London. Thomas J. Price digitally scanned 30 local people who feel a connection to the Windrush migrants. Then he used the images to create statues of a man and a woman. The figures wear modern clothes and stand on the ground; the man has sloping shoulders and a hand in his pocket. Rather than depicting a historical event, Mr Price has folded the past into the multi-racial present. "No trilby hats," he says. "It's about celebrating who's here now."

Public-sector pay

Wage fright

The government is trying to hold down inflation by practising pay restraint

BRITAIN'S TRAIN network came to a halt on June 21st and June 23rd as striking rail workers protested against a below-inflation pay offer, among other things. With further strikes planned for June 25th, the disruption threatens to endure. It also threatens to spread. The biggest teachers' union has warned of industrial action in the autumn. Doctors, nurses and local-government employees could go on strike, too. Together the health-care and education sectors account for around 60% of public-sector employment.

The underlying problem is that high inflation is eating into people's income. In May prices rose at an annual rate of 9.1%, the highest level since 1982 and much more than was expected when the government set departmental budgets last October. The Bank of England expects the inflation rate to hit double digits later in the year.

That has made conflict over wages all but inevitable. Public-sector employees want their pay to keep pace with rising prices: one teachers' union is demanding a 12% pay award, for example, against a government suggestion of 3%. But each one-percentage-point increase in the wage bill would cost the government around £2.4bn ($2.9bn), or 0.1% of GDP. That would require offsetting spending cuts, higher taxes or more borrowing.

Reconciling these tensions will not be easy. Beyond the expense, the government fears that giving in to unions' demands would encourage workers in the private sector to raise their pay requests, too, risking a wage-price spiral. It also worries that higher borrowing could boost demand at a time when the economy would struggle to absorb it; tighter monetary policy would be the result. And the Treasury has already announced measures designed to offer the most vulnerable households protection against rising prices. An inflation-matching pay rise could compensate people twice, at least in the short term.

Arguments line up on the other side, too. Trade unions are not wrong to say that many staff will struggle to make ends meet. Next April the state pension will rise by at least September's rate of inflation—why should public-sector employees not be afforded the same protection as pensioners? It is ultimately for the Bank of England to keep inflation under control, and for the government to set the level and quality of public services it desires.

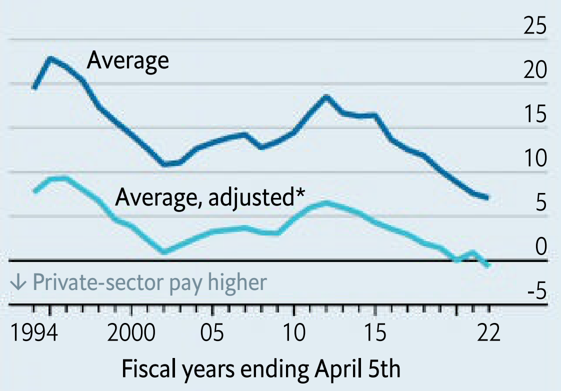
One increasingly salient consideration is the risk of public servants fleeing to the private sector—or not joining at all. Over the three months to April pay in the private sector, excluding bonuses, grew at an annual rate of 4.8%, compared with just 1.8% in the public sector. According to Ben Zaranko of the Institute for Fiscal Studies, a think-tank, average pay in the public sector is still higher than in the private sector but the gap between the two has narrowed significantly (see chart). Indeed, if you adjust for differences in the two workforces for factors like age and education, the premium disappeared altogether in 2021-22, although this does not account for relatively generous public-sector pensions.

Over the coming months the government will consider recommendations from eight pay-review bodies, and then haggle with an array of unions over the amounts. The upshot will be variety in the generosity of pay deals, both within and across occupations. Within occupations, workers at different levels of seniority are likely to get different pay bumps. During the austere 2010s, for example, more experienced teachers and higher-paid NHS staff got smaller increases than junior and lower-paid colleagues.

As for differences between industries, outcomes depend on everything from average salaries to political sensitivities. Workers in the National Health Service (NHS) will be trickiest to handle. Health-care workers draw on a deeper reservoir of public sympathy than, say, rail workers; reducing NHS backlogs is a political priority; and rising demand for private-sector health-care gives workers other options. Last year they were among the few groups of public-sector employees to receive a cash pay rise. One study found that 10% growth in the pay of NHS nurses in London, relative to the private sector, would enable a 7% increase in their employment. A shift in the other direction would pile more pressure on to a creaking system. Deals will eventually be struck. But expect more disputes in the meantime. ■

Narrowing gauge

Britain, difference between public- and private-sector hourly pay, %



Source: IFS

*Controlling for characteristics such as age, location and education

Horizon Europe

Science friction

A row over Northern Ireland threatens scientific research in Britain

KEVIN LAM is a chemist at the University of Greenwich working to kill two birds with one stone. He hopes to develop chemical reactions that can produce hydrogen without any carbon emissions while creating by-products of value to other industries. That would increase the availability of a clean source of energy and simultaneously incentivise its production.

But Dr Lam's challenges are not restricted to the lab. His research is caught up in the dispute between Britain and the EU over the Northern Ireland protocol, a part of the Brexit withdrawal agreement that keeps the province inside the EU's single market for goods. The British government recently introduced legislation to override parts of the protocol unilaterally, ramping up tensions with Brussels.

Science is an unlikely hostage in this stand-off. Should Britain scrap the protocol, the EU has warned that it will, among other things, throttle the access that British-based boffins have to Horizon Europe, the world's biggest multilateral funding programme for scientific research. Previous versions of this programme have helped to finance everything from vaccine research to the Large Hadron Collider, the world's largest particle accelerator. This iteration, which runs from 2021 to 2027, will make over €95.5bn (£82bn) available to researchers in participating countries.

Being cut off from Horizon would hurt. Although it has been a big contributor to the budget for European research funding, Britain has enjoyed disproportionate benefits from the programme. In Horizon 2020, the predecessor scheme to Horizon Europe, Britain provided the most lead researchers and received the second-most funding of any member country.

Britain has not been a full member of Horizon since leaving the EU but the Trade and Co-operation Agreement signed in December 2020 provisionally accepted it as an "associated" country. Under this compromise arrangement British researchers could still bid for Horizon funding in exchange for an estimated £14bn contribution to the EU, to be paid over seven years. "It was the best possible deal from both sides," says Beth Thompson at the Wellcome Trust, a medical-research charity.

But the country's associate status has not been ratified and is now in jeopardy. Many of those who have already received grants have been told that they must move ▸▸

to an EU member state to be sure of retaining access to the funds. Some researchers will choose to leave. Others may cancel their plans to move to Britain. For Dr Lam, who is due to receive over £420,000 as part of a multinational project, the worry is that British collaborators are now seen as more trouble than they are worth given uncertainties over funding and other Brexit-related hassles.

The British government is working on a "Plan B" to make up for the missing funding if Britain is not part of the programme. If that were to happen, the pain would be felt on both sides. "We will lose as a consequence of not being part of Horizon. But of course Horizon will lose because we're not part of it," says Robin Grimes, foreign secretary of the Royal Society, the national academy of sciences. "Which is increasingly, it seems, the road we are on."

Yet Britain stands to suffer more. Its scientific success is partly based on the opportunities for co-operation that Horizon membership brings. Over half of Britain's collaborative papers are with EU partners; these relationships risk being eroded. Winning a competitive EU-wide grant looks good on a CV, a perk that cannot be replicated by a domestic programme. "The reality is that money alone can't make up the gap," says Ms Thompson. ■

Coastal erosion

Uncertain shore

HAPPISBURGH

Hard choices on the Norfolk coastline

Short-term thinking, a visual guide

THE HILL HOUSE INN, a pub in Happisburgh on the Norfolk coast, has hosted a beer festival in its garden for 20 years. How long the tradition will continue is uncertain. By 2055 the heart of Happisburgh—including the pub and a 14th-century church—will be at risk of toppling into the sea. One part of the village has already disappeared: a holiday caravan site, whose old groundworks stick out of the cliffside.

Norfolk, a county on the east coast of England, loses an average of 0.4-2 metres of coastline every year, depending on the precise location, and climate change will make the problem worse. Its cliffs are made of clay and sand: when high waves or storms wet them, they can simply slide into the water. Three kilometres from Happisburgh, the old fishing village of Eccles on Sea has almost entirely gone; the site of another medieval village, Shipden, has long been submerged. The Committee on Climate Change, which advises the government, reckons that up to 82,100 properties across England could fall into the sea by the end of the century; most of those at risk in the next two decades are in Norfolk or up the coast, in Yorkshire.

For years, following a storm surge in 1953 in which 307 people drowned, the policy in Norfolk was to hold the line against the sea wherever possible. Concrete sea walls and timber revetments absorbed the energy of the waves; wooden groynes kept sand from washing downshore. But in the 1990s, as defences aged and the cost of upkeep ballooned, attitudes shifted. Guided by the Environment Agency, the local authorities now choose where to strengthen the shoreline and where to let erosion run its course based on cost and an area's economic value.

On some parts of the coast, nature does a lot of the protective work already. Where the shoreline curves to the west, salt marshes protect some towns from flooding. To the south, in places like Winterton-on-Sea, large sand dunes help to slow erosion. Elsewhere mankind lends a hand. Sea walls protect towns like Sheringham and Cromer. In 2019, 1.8m cubic metres of sand was placed along the coastline near the Bacton gas terminal; among other things, this "sand engine" absorbs energy from the waves that would otherwise batter the cliff.

But Happisburgh and other rural villages lack the natural protection, economic heft or strategic infrastructure to justify costly defences. Indeed, further down the coast, Great Yarmouth relies on sediment from Happisburgh's eroding cliffs to maintain its own dunes. In 2004 the local authorities and the Environment Agency released a draft of a new shoreline-management plan to let Happisburgh's coastal defences fail. That approach still prevails; signs at the beach warn of debris from eroding revetments and groynes.

The question that arises as a result is what to do about the people whose property is at risk of disappearing. Property owners cannot buy insurance for erosion. Nor does the Environment Agency want to overcompensate homeowners for houses lost to the sea, for fear it would incentivise new clifftop construction or hand cash to owners of second homes. But there is a moral case for offering help, especially to buyers who purchased their properties before the policy shifted from holding the line to letting defences fail.

Some experiments have already taken place. In one such, North Norfolk District Council attached the right to build on other sites in Happisburgh or nearby towns to nine at-risk houses in the village and to the caravan park. The theory was that this planning permission would be valuable enough on its own for private developers to buy the land that was about to fall into the water, giving homeowners a way to move without relying on the government to buy them out. In reality, the sea wasn't prepared to hang around to see whether the scheme worked; the district council had to step in with an offer to relocate people before they lost their homes. But a government review of the programme did not rule out trying something similar again. Details of a new scheme are due to be unveiled next year.

Back at the Hill House Inn in Happisburgh, the owner, Clive Stockton, is unsure if he would move even if he could sell up. He and his wife bought the pub before news of the plan to stop defending Happisburgh's coast; the business was meant to provide them with backup income after he had gone into freelance work. Mr Stockton has since accepted that some people will have to move. But when it comes to whether he would leave or just wait until the pub tumbles into the water, he says: "I'd have to think long and hard about it." ■

Biology

Cultural history

COLINDALE

From viruses to bacteria, a look inside Britain's culture collections

A SAMPLE OF human coronavirus (catalogue number 2008101V) will set you back £282 ($347). Browse on through the catalogue and it offers you the chance to buy a dose of Herpes simplex virus and cowpox for the same price or a sample of salmonella for £164. Ordering anthrax bacteria, perhaps understandably, is more expensive: £321. As Stephen Baker, a professor of microbiology at Cambridge, puts it, it is like reading "an Argos catalogue for micro-organisms". Albeit one whose menu offers the option not to "Shop garden furniture" but to "Browse bacterial strains" or click on the "Chlamydia Biobank".

These are the online price lists for Britain's culture collections—in the agar-plate-and-white-coat sense rather than the earnest-play-and-silk-scarves one. Culture collections are a little-celebrated but essential part of modern research. To study a disease scientists need reliable samples. These are the places—the libraries of maladies—that provide them.

Britain has four national culture collections (one each for bacteria, viruses, fungi and cell lines) as well as smaller independent ones. Whatever their specialism, all do more or less the same thing: they store the cultures that matter, and have done so for a long time. This makes them, says Mr Baker, "like a microbiological ice core...[of] infectious diseases".

Britain has one of the deepest and most august bacterial ice cores in the world. Britain's national bank of bacteria, the National Collection of Type Cultures (NCTC), was founded in 1920, though its oldest sample—it inherited some from other collections—is a vintage 1885 *E. coli*. Among its celebrity strains is a dose of *Haemophilus influenzae* believed to have come from Alexander Fleming's own nose. (That one, acknowledges Sarah Alexander, the head of all four collections and curator of this one, has "sentimental" value.)

The bacterial collection is kept, in part, behind razor wire in Colindale, a suburb of North London. Its prices might be openly available; its samples are not. To order them requires passing several layers of security—more for the nastier ones, which demand licences, training and security checks. The store room itself is bright, cool, clinical and filled with the sort of filing cabinets to be found in any office.

Until you open them. Inside are rows and rows of small, numbered glass ampoules filled with powder. In one is NCTC 10418, better known as *E. coli*. In another is NCTC 14208, which causes "super gonorrhoea". NCTC 13142, a pale yellowish powder, is antibiotic-resistant MRSA. Round the corner, behind more layers of security, are NCTC 10340 (which causes anthrax), NCTC 13912 (TB) and NCTC 12945 (cholera). This is where catastrophe is catalogued.

The collection also enables diseases to be deciphered and their history to be written. Over the past few years researchers at the Wellcome Trust Sanger Institute in Cambridge have taken 3,000 samples from here and sequenced their DNA. To take a century-old strain and to read its stream of AS, CS, TS and GS, says Professor Nicholas Thomson, who leads the research, is like opening "a whole history book". Bacteria have been sequenced before—but not at this scale or to this depth in time.

History and genomics can feel like an odd combination. Conventional historians tend to pay little attention to maladies. Apart from the occasional Pepys or Procopius, most prefer grander topics for their pens than an outbreak of buboes or a troublesome bout of diarrhoea. And the science of genomics is the sort of whizzy speciality that seems designed for the present and future tenses, for the diseases that threaten today and the cures that might be discovered tomorrow.

This attitude, says Mr Thomson, is wholly mistaken. History is crucial to understanding disease. Unlike the holdings of conventional libraries, the genetic texts of bacteria are constantly evolving. Culture collections offer texts that are frozen in time. These are not first editions but they are certainly earlier editions. Sequence them and researchers can therefore see how this change in the script led to that disease suddenly spreading or becoming more virulent. Such collections are, says Mr Thomson, "now more relevant than they've ever been".

To understand how important such research can be, it helps to visit another, private collection of samples—this one held in Surrey by an organisation called CABI. Behind a locked door sit some 28,000 fungi, many of them in glass jars. Like the dreams in the BFG's cave, each fungus behaves differently inside its container. Some are formless blobs, others like snowflakes, others still like little puffs of smoke. In one jar a fungus has formed a sinister dark blob; this is IMI 173135, better known as Dutch elm disease. In another a fungus has turned into a pale, flesh-coloured splodge: that one is IMI 181530, potato blight.

Such libraries matter because they contain death, but also because they contain possibility. In any one of them might lie "genes or isolates that you'd suddenly recognise to be really important", says Mr Thomson. Science and serendipity dance together—and the collection in Surrey offers perhaps the best example in the world.

Inside one of its rooms stands a tall, grey safe. Inside the safe is a large green box, and inside that is another, little larger than a matchbox. In old-fashioned cursive writing its label tells you that this is sample "IMI 24317". Open it and you see a small, underwhelming smear of brown, as if gravy had been spread on a glass slide. This is Fleming's other, and better-known, bequest to the world—*Penicillium notatum*. ■

Mould breaker

Bagehot | Remainers' cake problem

The case for a softer Brexit is clear. How to get one is not

IT WAS THE autumn of 2016 and Brexiteers were still high on the fumes of the EU referendum earlier that year. Everything, they agreed, was going to be terrific. Seventy-five Tory MPs called for a new royal yacht to mark Britain's rebirth. As for the fiddly detail of Britain's new relationship with the EU, Boris Johnson, then the foreign secretary, had it covered. "Our policy is having our cake and eating it. We are Pro-secco but by no means anti-pasto."

Donald Tusk, the Polish president of the European Council, saw Britain's predicament rather more clearly. Its wish to avoid the EU's legal jurisdiction and to end the free movement of people left only the choice of a hard Brexit or no Brexit at all. The cosy deal many Britons imagined could be cooked up was, Mr Tusk thought, an illusion. "There will be no cakes on the table. For anyone. There will be only salt and vinegar," he warned.

The divorce has proved as bitter as Mr Tusk foresaw. The row over the Northern Ireland protocol has soured any hopes of a new era of friendship. The economic damage is plainer by the day. Britain's GDP was 5.2% lower by the end of last year than it would have been if Brexit hadn't taken place, calculates John Springford of the Centre for European Reform, a think-tank. Brexit has caused a sharp decline in Britain's trade openness that will drag on productivity and wages in the years to come, according to a new Resolution Foundation paper. The Centre for Economic Policy Research reckons Brexit added 6% to food prices in two years. A promised burst of deregulation has not materialised. Salt and vinegar are plentiful; of cake, barely a crumb.

As a result Remainers are finding their voice again. Tobias Ellwood, a Tory critic of Mr Johnson, has called for Britain to rejoin the single market. Stella Creasy, the leader of the Labour Movement for Europe, urges her party not to let the prime minister define Britain's relationship with the EU. Even pro-Brexit newspaper columnists call for a thaw with Brussels.

But if the damage from Brexit is obvious, the remedies are not. Since the referendum in 2016 opponents have failed to rally around an alternative model, flitting between softening Brexit and fighting it altogether. The Conservative right soon jettisoned fuzzy thinking in favour of a hard and unified negotiating strategy. The Remain movement is still prone to its own version of Mr Johnson's cake-ism: offering up vague aspirations that ignore the structural difficulties of a closer relationship with the bloc.

Imagine that Sir Keir Starmer, the leader of the Labour Party, becomes prime minister in 2024. Relations with Brussels would improve overnight: no longer would the British government threaten to violate treaties it did not like. In time, life could become a little jollier for Britons who still feel themselves European. A new government could pursue the perks that Mr Johnson spurned, such as participation in Erasmus, a worthy student-exchange programme, and visa-free travel for artists and athletes. If the arrangements for Northern Ireland were settled, the door would open to Britain staying in Horizon, a huge scientific-funding programme.

Just like its Leave counterpart, the Remain movement was largely propelled by culture. These signs of rapprochement would cost little and assuage some. But easing the economic damage caused by Brexit is far harder. Britain could try to rejoin the EU, which polls suggest four in ten Britons favour. But no British prime minister will hurry to reopen the wounds of the referendum, whose sixth anniversary fell on June 23rd. Any campaign for re-entry must confront the fact that it would mean a far deeper form of integration than the one that went before, including a commitment to join the euro. The insincere, pick-and-choose membership Britain once enjoyed is gone for good.

Mr Ellwood's plan for Britain to rejoin the single market as a non-voting participant has many backers. But the problems that caused Theresa May to reject this arrangement have not gone away. Even if Britain came round to the free movement of people, an essential part of the pact, it would also have to swallow outsourcing the most sensitive questions of regulatory policy on banking, data, mergers and labour markets to its competitors in perpetuity. Such a deal works for Norway, a small country whose biggest exports are oil, gas and fish. For Britain, a quarrelsome services-based economy, it would be inherently unstable. Rejoining the customs union would bring modest benefits but it would require abandoning the independent trade policy built up over six years. Control, once taken back, is hard to surrender.

That leaves only tinkering. A deal on food standards that eases flows at the border is possible. So too, in time, would be streamlined customs rules and mutual recognition of the qualifications of architects and lawyers. But such improvements would only marginally reduce the costs of Brexit.

Spongy thinking

There is very little middle ground between the trade deal Britain has now and the freedoms granted by the full-fat single market. Mrs May tried to forge a bespoke deal, only to be thwarted by European leaders who saw it as cherry-picking. The arrival of a friendlier prime minister wouldn't much change how the EU regards its fundamental economic interests, says Georg Riekeles, a former adviser to Michel Barnier, the EU's chief Brexit negotiator. When Mr Johnson ordered a hard Brexit, the EU was happy to serve it up.

Tory Brexiteers warn darkly of a fragile Brexit being killed by stealth if they lose power. Were it so easy. To deepen Britain's trade agreement would require clear objectives and a willingness to chisel away at the EU's position, year after year. Fitful Britain lacks this strategic patience. It is more likely that the country will be stuck with Mr Johnson's deal, perhaps for decades. With each anniversary, almost everything Remainers feared would happen has come to pass. Yet they still do not have a plan for what they saw coming. It is vindication, but it does not taste sweet. ■

→ Also in this section

32 Ukraine's weapons problem
34 Italy and Vladimir Putin
35 Slovenia comes good
35 A revolution in Andalucía
36 Charlemagne: Bullets and bail-outs

French parliamentary elections

Jupiter waning

PARIS

France faces stagnation after the president loses his majority

When Charles de Gaulle drafted the modern French constitution in 1958, he sought to end the parliamentary instability that had brought gridlock to the previous republic. By and large France has since turned into one of Europe's most stable polities. Street theatrics are common. But general elections deliver clear results. Governments succeed each other promptly. Now, however, France looks to be heading for trouble after Emmanuel Macron's centrist alliance, Ensemble, lost its parliamentary majority. It was a disastrous election result for the president.

On June 19th, at the run-offs in the two-round general election, Ensemble won just 245 seats, 44 short of a majority and 105 fewer than Mr Macron and his allies had won in 2017. That leaves him weakened, and his top-down governing style impeded. Mr Macron now needs to work out how to lead in a country that has no experience of post-election coalition-building. France may learn to act more like consensus-minded Germany; but some worry it will end up more like bickering Belgium.

The result was worse than polls had predicted. Elisabeth Borne, the technocratic prime minister appointed in May, won a seat in Normandy. But some of Mr Macron's closest allies lost theirs, including Richard Ferrand, the parliamentary speaker, and Christophe Castaner, leader of his parliamentary party. Three ministers were also spurned by voters, and resigned. "It's a nightmare," says one Ensemble deputy.

Even in its shrunken state, Ensemble will remain the biggest party in parliament. But it now faces two big, feisty opposition blocks. On the left, Jean-Luc Mélenchon's alliance, the New Popular Ecological and Social Union (NUPES), secured a hefty 131 seats. The 70-year-old former Trotskyist stitched the grouping together for these elections, absorbing the Socialists, Communists and Greens. The result, he declared, was a "monumental slap in the face" for "*le pouvoir macroniste*".

This week a beaming Mr Mélenchon guided his new deputies through the National Assembly on his last day as a deputy, since he himself did not run for re-election. His group's durability has yet to be tested. The parties disagree on much, from Europe and NATO to nuclear energy. Already each constituent party has wriggled out of Mr Mélenchon's grip to sit separately in parliament. But if they work together, they will have the clout to delay and in effect even block legislation.

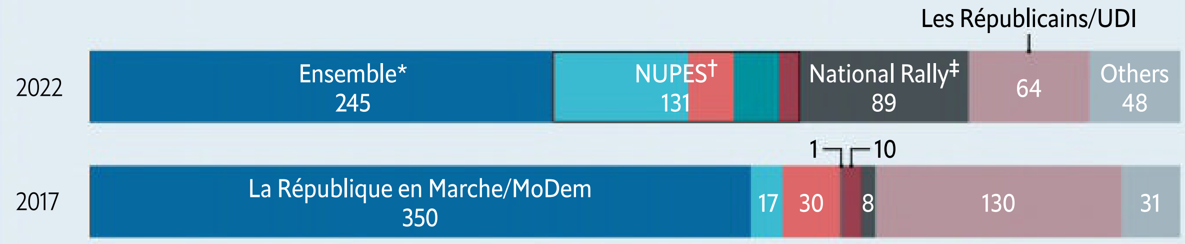
On the populist-nationalist right, Marine Le Pen's National Rally (RN) pulled off an even greater electoral coup. She secured her party's best legislative result ever, winning 89 seats, a ten-fold increase on its tally in 2017. The RN won seats even in places where it has no base, such as rural constituencies in the Dordogne and Normandy.

Ms Le Pen's success marks the astonishing normalisation of her brand of politics. The old rule, by which voters of various stripes put aside their differences to back any candidate who could keep Ms Le Pen's party out, is in shreds. Rather than take a stand against her, many voters stayed at home. Fully 24% of those who in the first round backed a NUPES candidate who was then eliminated, voted for her party in the second. Mr Macron claimed that the election was about order (him) or chaos (the extremes). Voters ignored him. The RN won 53 of the 107 constituencies where it was in a run-off against Ensemble. RN now has a bigger parliamentary presence than the centre-right Republicans or any of the constituent parties that make up NUPES.

By denying Mr Macron a majority, voters sought to punish a president they re-

Ouch!

France, National Assembly election results, seats won



*Renaissance and centrist allies †La France Insoumise (72), Socialists (24), Greens (23) and Communists (12) ‡National Front in 2017

Source: French Interior Ministry

elected but dislike, curbing his powers and forcing him to govern differently. His top-down presidency has helped to revive the economy, create jobs and protect firms and lives during the pandemic. Yet these policies did not win over enough voters. Many of them apparently resented the way Mr Macron's muted campaign seemed to be taking victory for granted. His unilateral manner of governing also irks people. If Mr Macron cannot change, voters seemed to have been saying, they would simply have to force his hand.

This week, after Mr Macron had consulted party leaders, he ruled out forming a government of national unity. But he has no simple alternatives. He could try to secure a pact, possibly with the Republicans, who won 61 seats. Some of the Republicans' party members are in favour, but so far the leadership has refused. Or he may install a minority government, perhaps enlarged by new defections, and seek backing, bill by bill. This would be tough if he tries to raise the pension age, as he has promised, but easier if he wants to subsidise rising energy bills. France had a minority government in 1988-91, led by Michel Rocard. But its shortfall was only 14 seats. Even so, Rocard made use 28 times of a constitutional rule to bypass parliament, in effect; this procedure has since been curtailed.

For now, the president has refused to accept Ms Borne's resignation. Yet the bruising times ahead argue for replacing her with a weightier figure. Bruno Le Maire, the finance minister and an ex-Republican, is one name circulating. Nobody, though, will find the new set-up easy. Mr Macron is pragmatic and a persuasive deal-maker, but not good at sharing power. Parliamentary culture is confrontational, theatrical and divisive. "We no longer have the political culture of compromise and consensus-building," says Chloé Morin of the Fondation Jean-Jaurès. Clément Beaune, the Europe minister and a newly elected deputy, commented wryly that French voters have "handed us a flat pack, without an instruction manual".

In the best-case scenario, the revival of parliamentarism could act as a healthy check on presidential fiat, and even a source of compromise. De Gaulle intended parliament to control the executive, not act as a rubber stamp. "The president needs to return to the role of arbiter, and not run everything himself," says one of his deputies. This might even help to defuse the anger that spills on to the streets. "We are not necessarily heading for paralysis," argues Roland Lescure, another Ensemble deputy; "But we will need to learn new habits."

A more likely outcome is uncertainty and stagnation. Mr Macron's government could face a vote of no-confidence as soon as July 5th. The constitution allows him to dissolve parliament and call new elections at any point. "It's not in his nature to give up trying to do things," says a close ally. The question is whether he can fight his instinct to do those things alone. ■

Ukraine's weapons

Running on empty

Ukraine needs more; the West is slowly stepping up

When the leaders of France, Germany, Italy and Romania visited Kyiv on June 16th, they came bearing gifts. "We are doing everything so that Ukraine wins this war," declared Emmanuel Macron, France's president. He vowed to send six more state-of-the-art CAESAR artillery pieces "in the coming weeks", on top of the dozen delivered so far. Boris Johnson, Britain's prime minister, popped up in Kyiv a day later and promised a big new military-training programme. And on June 21st a Ukrainian official said that the Panzerhaubitze 2000, a formidable German self-propelled howitzer, had arrived.

Such help is desperately needed. In recent weeks Ukraine has made some gains in southern Kherson province, and on June 17th it sank a Russian vessel reinforcing Snake Island, a small Russian-occupied fortress in the Black Sea. But these are small consolations next to the steady gains that Russia's army has made in the eastern Donbas region, where the fighting is concentrated. Russia now controls most of Severodonetsk, a town that lies deep in a Ukrainian salient under attack from three sides, with resistance confined to an industrial zone in the west. The town can now be supplied only by river. Russian forces are also making gains west of Severodonetsk around Slovyansk, attacking the same salient from the north.

One reason for these setbacks is that Russia's army is concentrating its forces and using them more methodically than it did in the first stage of the conflict—when it attacked along several different axes at the same time, dispensing with rudimentary principles of warfare. Russia also has a big advantage in raw firepower. On June 14th Anna Malyar, Ukraine's deputy defence minister, said that Ukraine was firing 5,000-6,000 shells a day, one-tenth of Russia's barrage. Mykhailo Podolyak, an adviser to Ukraine's president, Volodymyr Zelensky, adds that in some places Ukraine's artillery is outnumbered ten to one.

Russia is also using long-range rockets, which allow it to strike Ukrainian positions while remaining safe from retaliatory fire. Ukraine is largely out of ammunition for its own Soviet-era Smerch and Uragan rocket-launchers, which can fire much farther than conventional artillery. A recent video showed Ukrainian soldiers operating a DIY rocket-launcher—an aircraft rocket pod strapped to a truck-towed trailer—revealing both ingenuity and scarcity.

Ukrainian casualties have reached shocking levels. On June 9th Mr Podolyak said that 100-200 Ukrainian soldiers were dying a day, a figure that Mark Milley, America's top general, described as "in the ballpark" of the Pentagon's assessments. Ukraine's call for more arms has thus reached a new intensity. "Today we have about 10% of what Ukraine has stated that we need," complained Ms Malyar.

But more powerful weapons are in the pipeline. Around ten rocket-launchers—American HIMARS and British MLRS—are due to arrive shortly, and the Biden administration is considering whether to send four more. These fire guided missiles with a range of up to 84km. Some Ukrainian crews have already been trained to use them in Germany, and more are being taught. General Milley said that the quality of these weapons would eventually show on the battlefield: "The Russians are just doing mass fires without necessarily achieving military effect...The Ukrainians, on the other hand, are using much better artillery techniques."

In public, at least, American and European leaders sound hawkish about sustaining this flow of arms. "We will stay focused on this for as long as it takes," insisted Lloyd Austin, America's defence secretary, in Brussels last week. "As long as necessary, until peace returns to a free and independent Ukraine, we will remain committed," tweeted Mr Macron. In private,

there are doubts. NATO countries are clean out of the sort of ammunition needed by Ukraine's Soviet-era weapons: "It's gone already in three months," says one European defence official. "It doesn't exist any more." The plan, to be formalised at a NATO summit starting on June 28th, is to help Ukraine's armed forces switch more fully to NATO kit. That is a huge undertaking, and will take time.

Europe's own stocks of munitions are low, and finding extra workers and components for complex weapons, like Javelin or Stinger anti-aircraft missiles, is hard. Moreover, as countries like Germany and Poland rearm at breakneck pace, demand will outstrip defence manufacturers' capacity to produce. Shortly before his trip to Kyiv, Mr Macron warned that France had entered a "war economy in which I believe we will find ourselves for a long time". The 18 CAESARS that France has sent or promised to Ukraine make up almost a quarter of the country's entire stock.

America and its European allies have demonstrated extraordinary unity over nearly four months of war. Almost all want to see Ukraine emerge as a secure and sovereign state. But what that means in practice is not always clear, and seems to be shifting over time. In April Mr Austin said that America's goal was to sap Russia's strength: "We want to see Russia weakened to the degree that it can't do the kinds of things that it has done in invading Ukraine." At a gathering of defence ministers the next day he added, "Ukraine clearly believes that it can win, and so does everyone here." Last week he was more circumspect, saying cryptically that America's aim was a "democratic, independent, sovereign and prosperous Ukraine". Twice America's defence secretary was asked whether he still wanted Ukraine to win. Twice he ducked the question. ■

Italy

The Putin effect

ROME

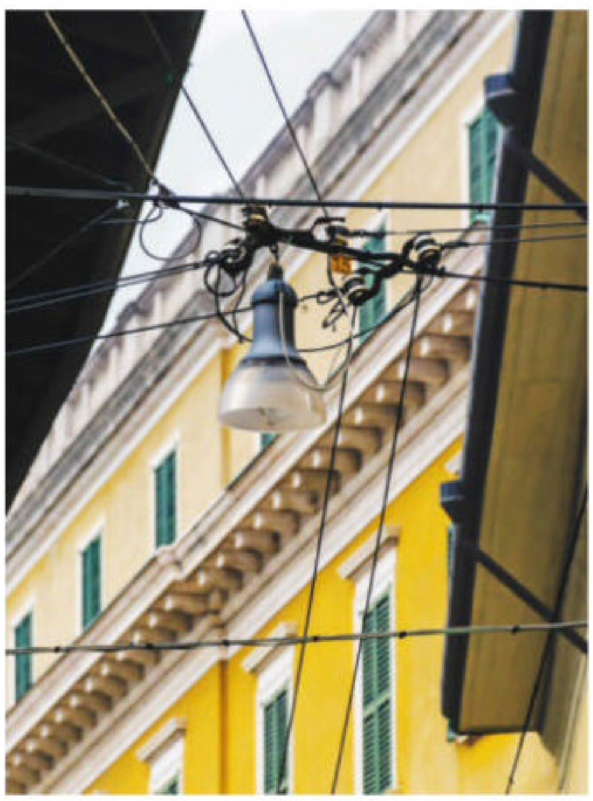
Italy is the latest victim of Ukraine-related divisions

AMONG THE least expected reactions to Russia's invasion of Ukraine was Italy's firm response. Under Mario Draghi, Italy has backed sanctions on Russia that are painful for its own economy and has supplied weapons to Ukraine—though exactly which, and how many, remains unclear.

That secrecy illustrates the political sensitivity of Mr Draghi's resolve. The party in his broad coalition with the biggest parliamentary contingent is the anti-establishment Five Star Movement (M5S). It is splitting apart over Ukraine.

Averse to being dragged into a foreign conflict, the M5S contested earlier sanctions against Russia over its annexation of Crimea in 2014. Since March the Five Stars have been led by Giuseppe Conte. As the independent prime minister of a M5S coalition with the populist Northern League between 2018 and 2019, Mr Conte frequently cosied up to Vladimir Putin. And over recent weeks, he and most of his lawmakers have criticised arms shipments to Ukraine. A minority that notably includes the foreign minister, Luigi Di Maio, has continued to back the government's line.

Matters came to a head this week as the parties in Mr Draghi's broad coalition struggled to agree on a resolution to put to parliament ahead of the European summit on June 23rd and 24th. On June 19th the M5S's executive publicly rebuked Mr Di Maio for his hawkish stance, and within two days the foreign minister's supporters were preparing a breakaway parliamentary group. Their critics argue that Mr Di Maio's real motivation is personal: remaining in the M5S would subject him and others to a rule that bars elected representatives from serving more than two terms.


At least Putin keeps the lights on

One of Mr Di Maio's followers said they were aiming to win over some 70 of the movement's 227 lawmakers. Another said the name of the new group would be Together for the Future. The defections will have no immediate effect on the government's stability. All the signs were that Mr Di Maio would stay in the cabinet and that his supporters would continue to back the government. But it remains to be seen whether Mr Conte will pull the rest of the Five Stars out of the governing majority in the months ahead.

Trailing in the polls, the M5S is a shadow of the party that took nearly a third of the vote at the election in 2018. But its division into mutually hostile camps would not necessarily be good news for the supporters of a firm line on Ukraine. Enrico Letta, the leader of the centre-left Democratic Party and a firm supporter of Mr Draghi, had been counting on a pact with the Five Stars to prevent Italy's hard right from taking power at the next election. The rightist party with the most support, the Brothers of Italy, has a conventional pro-NATO stance. But Matteo Salvini, the leader of the populist Northern League, has been altogether more ambiguous.

The election is due next year and, as it approaches, two linked factors will become increasingly significant. One is public opinion. A poll for the European Council on Foreign Relations found support for Ukraine weakest in Italy of all the ten countries surveyed: 27% of Italians blame America, the EU or Ukraine itself for the war. The second factor is the threat of gas shortages next winter. No sooner had Mr Draghi arrived in Kyiv with his French and German counterparts on June 16th than Italian energy firms began reporting a drop in supplies from Russia.

In 2020 Russia accounted for 43% of Italy's gas imports. Germany buys even more of its gas from Russia (66%). But Italy relies on gas for a much higher proportion of its energy: 43% in 2020 compared with 27% in Germany. Mr Draghi and his ministers have scurried to Algeria, Angola, Congo-Brazzaville, Mozambique and most recently Israel to find replacement supplies. But only Algeria is linked by pipeline to Italy.

As the minister for ecological transition, Roberto Cingolani, told parliament on May 3rd, the government's strategy depends on two things. It needs two floating regasification facilities to be brought into service by the start of 2023, and for Russia not to turn off the tap before the end of 2022. Neither is a given. ■

Slovenia

The turnaround

LJUBLJANA

A bit of good news from the Balkans, for once

"KARMA IS A bitch!" says Robert Golob, who assumed power as Slovenia's new prime minster on June 1st. Slovenia's greatest looming problem is reducing the country's dependence on Russian gas and oil, and not many people in the country know more about energy than Mr Golob himself. With the news dominated by Ukraine, Slovenia's election on April 24th failed to make much impression abroad. But the political demise of Janez Jansa, the former prime minister and an enthusiastic fan of Donald Trump and of Hungary's Viktor Orban, marks an about-turn for the tiny country of 2.1m people.

In the past few years Mr Jansa, who has been in and out of government since 1990, has railed against a supposed communist "deep state" and the media, both of which he said were out to get him. Like Mr Orban, he attacked his enemies as "puppets" of George Soros, a Hungarian-born billionaire and philanthropist. Like Hungary, Slovenia under Mr Jansa had been steadily moving in an autocratic direction.

When he took over a small Green party in January Mr Golob was a relative unknown, despite dipping in and out of national politics for decades. Nonetheless his party won a whopping 34% of the vote in April. Along with his coalition partners, Mr Golob now commands a comfortable 53 of 90 seats in parliament.

In his youth Mr Golob was a whitewater kayaking fan and competed in Yugoslav teams abroad. Now he laments he has no time to relax while he works to make sure that the "future is something to be joyous about and not to be afraid of". In the meantime, he has to keep the lights on. His father did the same on a more modest scale as the manager of a hydropower plant. Mr Golob studied electrical engineering and for 17 years ran a successful energy company. Wrenching Slovenia away from its dependence on Russia for 30% of its oil imports and 90% of its gas will be hard, he says, but by no means impossible.

Slovenia's economy is now roaring back post-covid-19. Its GDP grew by 9.8% in the last quarter year-on-year, although inflation is running at 8.1%. Tourists, who underpin around 10% of the economy, are back in force. Business is cautiously optimistic, though unnerved by the presence of a party called the Left in Mr Golob's coalition. It wants lavish public spending.

In terms of foreign policy the government plans not only to end the era of Orban-imitation, but also to make new friends. Tanja Fajon, the new foreign minister, was a member of the European parliament for almost 13 years and a journalist in Brussels for eight years before that. The era of alliances with Poland and Hungary despite their questionable commitment to European values is over, she says. The focus is now on France, Italy and Germany.

Where Slovenia can make a difference in influencing policy is in the western Balkans. Ms Fajon has long championed bringing the region into the EU, but a challenge looms which could lead to disagreements with the friends she hopes to make.

Ms Fajon worries that making Ukraine an official candidate to join the EU will raise false hopes there. At the same time, she thinks it will suggest to countries in the western Balkans that accession rests on politics, rather than reform. As it is, the EU has lost credibility in the region owing to its sluggishness to act on its promises. This week she has been lobbying hard for a trade-off. Give Ukraine candidate status, she suggests, but also give it to Bosnia. Open long-delayed accession negotiations with North Macedonia and Albania, too, and let Kosovars travel to Europe's Schengen zone without visas—something they were promised back in 2018. ■

Spanish politics

The great riposte of Córdoba

SEVILLE

A stunning victory for Spain's opposition in Andalucía

"CONGRATULATIONS, CALIPH." Thus did Alberto Nuñez Feijóo salute his party-mate, Juanma Moreno, for a rampaging victory for the conservative People's Party (PP) in regional elections in Andalucía on June 19th. Formerly the heart of an Islamic empire, Andalucía is Spain's second-biggest and most populous region. It has long tended to the left. The Socialists ran it from the advent of Spanish democracy in 1978 until 2019.

But this time its voters gave the Socialist Party the biggest kicking it has ever had in the region, and handed the PP its first absolute majority in the regional assembly. The party triumphed in all eight of the region's provinces. It won the city of Seville for the first time in any election of any sort, notes Elías Bendodo, the party's number three. It pummelled Ciudadanos, a centre-right party that failed to win any seats at all.

The PP also halted the rise of Vox, a hard-right party whose first electoral breakthrough was in Andalucía four years ago. Vox sent one of its stars, Macarena Olona, to head its effort there. She ran an erratic campaign (at one debate she said that sex-education textbooks that discuss masturbation were the equivalent of perverts approaching children in parks).

The Socialists won the most seats of any party in the election in 2018, but a coalition of the PP and Ciudadanos nonetheless managed to form a government on the right. Its leader, Mr Moreno, has been a genial and competent manager, and has brought down taxes. Nationally, the PP has moved to the centre. Since Mr Feijóo took over a few months ago, he has made a point of sounding civil and sensible. Mr Moreno took a similar tone in the campaign.

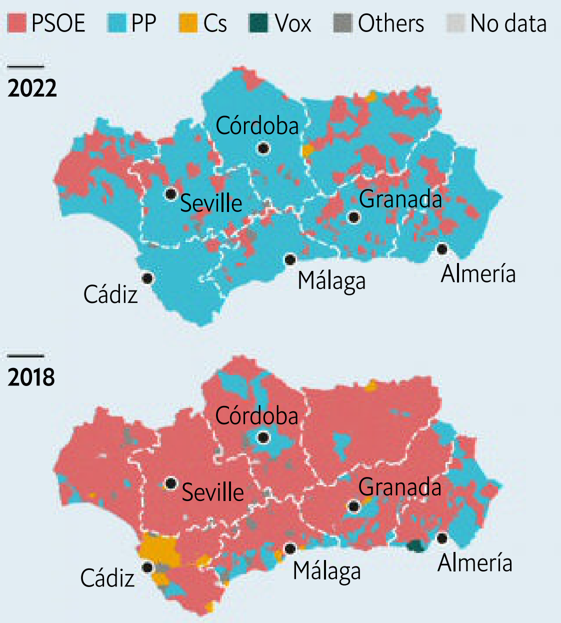
The Socialists, for their part, failed to inspire. Juan Espadas, their leader in the region, struggled to make a compelling case for replacing Mr Moreno, instead harking back limply to the economic growth the Socialists brought in the past. But voters also remember a legacy of corruption from the long Socialist hegemony, notes Andrés Santana of the Autonomous University of Madrid.

The PP is naturally keen to spin its regional triumph as a prelude to taking power nationally next year. But those elections are not due until November 2023, and the party's recent national rebound has only managed to bring it level with the Socialists in the polls. In a year and a half, anything can happen. After all, the PP took Andalucía.

Colour switch

Spain, Andalucía, regional election results

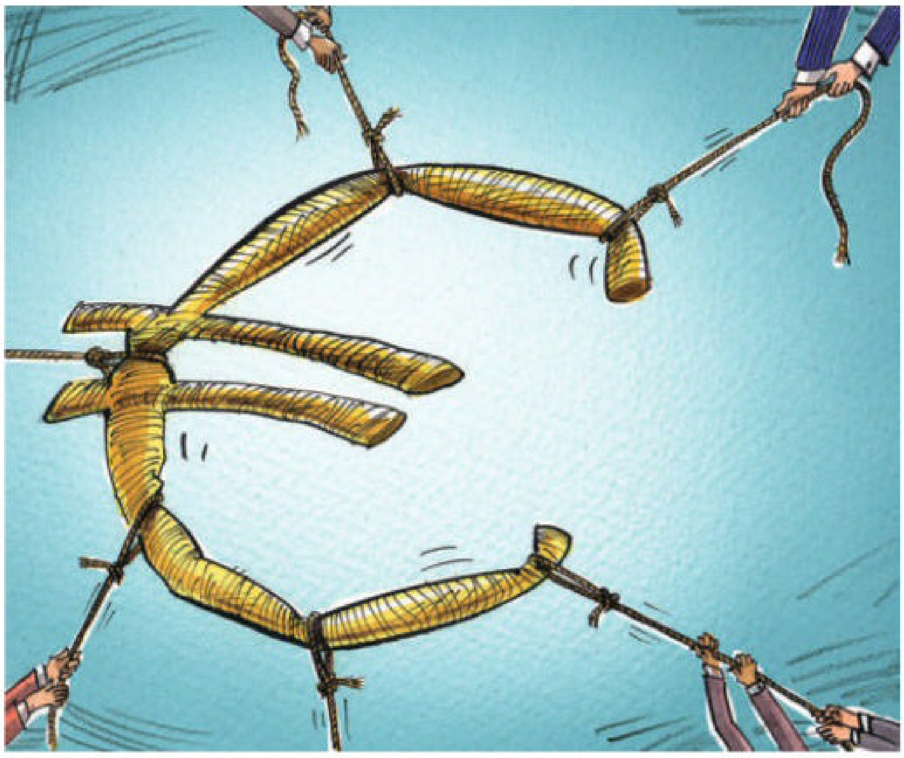
Leading party in each municipality



Source: elDiario.es

Charlemagne | From bullets to bail-outs

Briefly united over Ukraine, Europe faces divisions on the home front



Pandemics resulting in lots of deaths are a Bad Thing. Russia invading Ukraine: also Bad. What about finance ministers running large budget deficits in a downturn to keep the economy humming along? Well, that depends on whom you ask. Therein lies a brewing problem for Europe. Dealing with covid-19 then Ukraine has bound the continent together. The economic fallout from both will revive old debates that tend to tear it apart.

Next month will mark a decade since Mario Draghi, then president of the European Central Bank (ECB), promised to do "whatever it takes" to save the euro. The effectiveness of the spell seems finally to be wearing off. The euro zone is not yet in crisis. But once again countries in the south—notably Italy, whose prime minister these days is one Mario Draghi—are having to offer jittery investors higher interest rates to fund their debts than Germany, the continent's fiscal goody-two-shoes. Given that the emergence of "*lo spread*" in 2011 was a prelude to the carnage of the original euro crisis, its return is enough to set nerves jangling. Remember those all-night summits ten years ago, at which European leaders berated Greece and scrambled to save the single currency? Now imagine the same scenario with a diminished French president, surging inflation and war on the EU's doorstep.

Optimists argue that a re-run of euro-zone fragmentation—wonk-talk for when Italy and Germany look as though they don't belong in the same currency union—would be easier to handle this time. One reason is that measures were taken in the wake of the original crisis, such as making banks sounder. More important yet is the political situation. Europe has gone through a period of remarkable unity in the past two years or so.

Start with the response to covid. The (patchy) joint procurement of vaccines by the bloc's 27 countries got the most headlines. But even more notable was the setting up in July 2020 of a €750bn ($793bn) fund, known as Next Generation EU (NGEU), which resulted in large transfers of money from richer countries in the union to poorer ones. Forgotten, for a time, were the familiar squabbles pitting tight-fisted northern Europeans against supposedly spendthrift southerners. Instead, money raised by the EU (and in effect guaranteed by national governments) flowed to those who needed it most. Even if the scale was relatively puny, this was precisely the kind of redistributive federal budget whose absence many had blamed for the original euro miasma.

The case for unity over Ukraine is more contested. Hawkish leaders in eastern Europe think their counterparts farther west—Emmanuel Macron in France and Olaf Scholz in Germany most of all—are far too soft on Vladimir Putin, Russia's despot. But beyond the odd verbal volley, the EU's 27 member states have acted cohesively. They unanimously agreed on six packages of sanctions against Russia, and have sent lots of arms and cash to Kyiv. Bar a last-minute hitch, Ukraine was set to be recognised as a candidate to join the club at a summit of EU leaders on June 23rd, as *The Economist* went to press, despite early reservations in many countries.

Could the goodwill that made such unity possible carry the EU through a revived euro crisis? Early signs have not been encouraging. A French proposal to help parts of the bloc affected by the war in Ukraine through an NGEU 2.0 were shot down early on. Northern Europeans, led by the Dutch, argue that the original Next Generation fund was a one-off: an exceptional financial measure devised for a no-less-exceptional pandemic. That Italy became an early hotspot of the disease in Europe could be construed as an act of God. In contrast, the giant net debt load which the country has taken on over the years—now equivalent to nearly 140% of GDP—is seen as the act of Italians. Northern skinflints think that bailing them out would encourage future profligacy.

Against that, Italy has been an early victim of the ECB calling time on ultra-loose monetary policy. The expectation of a shift towards a more normal interest-rate regime, which the ECB announced on June 9th, prompted Italian borrowing costs to surge (until the bank promised to act to keep them under control). But the tightening of monetary policy is partly itself a product of the war in Ukraine, which sent energy prices—and so overall inflation—much higher, leaving the ECB with little choice but to act. Thus Italy can argue it is a victim of an act of Putin. Is that enough to prompt solidarity? Does Italy, once a steadfast friend of Russia, not bear some of the responsibility for its predicament?

And while the politics between countries may have become more harmonious, the opposite is true domestically. Central to any grand European bargain needed to stem a future currency crisis will be a confident Germany, willing to lead northern Europe into loosening the purse-strings. But Mr Scholz looks indecisive atop a three-way coalition, and is on the back foot in Europe given his party's past ties to Russia. At least he can command a majority to pass legislation, unlike Mr Macron in France, who now has no clear route to get reforms through a parliament he no longer controls. Italy is well run under Mr Draghi, but he is facing domestic turmoil and will step down as prime minister no later than next year anyway. The two longest-serving EU leaders, meanwhile, are Viktor Orban of Hungary, who ritually vetoes stuff to extort goodies from Brussels, and Mark Rutte of the Netherlands, who does so out of penny-pinching conviction.

Back in sight, back in mind

European harmony has been helped in recent years by governments not having to think too much about each other's public spending. That was true even before covid caused EU rules limiting national debt and deficits to be suspended (the edicts will come back, but not before 2024). Now the once-familiar realities of markets fretting over which country owes how much have returned. And, with them, the distinct possibility of rifts that rarely show Europeans in their best light. ■

→ Also in this section
39 A muddle over trans rights
39 A petrol-tax holiday?
40 California's school hours
40 Church and state
41 Uranium mining
42 Lexington: The Biden-Harris problem

Asian-Americans

Pivot to Asia

GARDEN GROVE, CALIFORNIA

How Republicans are hoping to grab a bigger share of the country's fastest-growing voting block

Lanhee Chen is a sort of unTrump (he was chief policy adviser to Mitt Romney's presidential bid in 2012). He is running to be elected California's state controller in November, a technocratic post designed to ensure money approved by the state assembly is spent properly. "I've got a record of working with Democrats," he says, "and my arguments for this post are non-ideological" (not something many movement conservatives would say). If he were to win, he would become the first Republican to hold statewide office in California since 2006. A second-generation Taiwanese-American, Mr Chen also represents one of the Republican Party's more audacious ambitions: to win the Asian-American vote.

Asian-Americans (often referred to as Asian-American/Pacific islanders, or AAPI) are blue. They voted for Joe Biden by two to one. That makes them more Democratic than Latinos, whose support for the party's presidential candidate dropped by more than ten points between 2012 and 2020.

With more than 11m eligible voters (nearly 5% of the total), Asian-Americans are the fastest-growing of all the country's main ethnic or racial voting groups. Once concentrated in New York and California, they now live in some of the country's most competitive districts. Central Ohio contains the largest Bhutanese community outside South Asia. Around 600,000 Asian-Americans live in and around Houston, another 600,000 in Dallas and 400,000 in the suburbs of Atlanta. In Georgia, according to TargetSmart, a data firm, the increase in Asian votes in 2020 over 2016 was more than five times Mr Biden's margin of victory in the state. The Democrats won both of Georgia's Senate seats, so the party's capture of the presidency and upper house might not have been possible without the surge in Asian votes.

Turnout of Asian-American voters rose by 50% between the mid-term polls of 2014 and 2018, and by as much as a third from 2016 to 2020. This was the largest increase of any ethnic group's votes and proved vital to Democratic victories. "We've gone from the margins", says Judy Chu, a Democratic congresswoman from California, "to the margin of victory."

But 2020 was an unusual year. The race took place amid widespread racist attacks against Asian-Americans. Between March 2020 and December 2021, according to an advocacy group, Stop AAPI Hate, nearly 11,000 "hate incidents" against Asian-Americans were reported to the group. Shocking shootings have included one at a hair salon in Dallas's Koreatown, and another at spas in Atlanta (where six of the eight victims were of Asian descent). Many Asian-Americans think Donald Trump's insistent references to "the Chinese virus" stirred up anti-Asian sentiment. "It made us realise that our vote was our voice," says Stephanie Murphy, who was born in Vietnam and represents a Florida district in Congress. The racism continues but Mr Trump is not on the ballot in 2022.

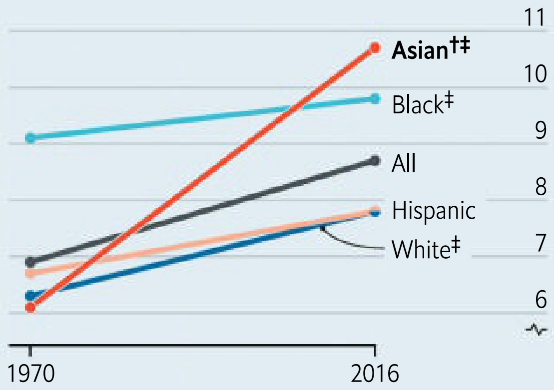
Asian voters are blue in another way. They share the national malaise about the current president's performance. Polling by *The Economist*/YouGov finds that Mr Biden's approval rating among Asian voters fell from 66% in July 2021 to 42% in March 2022, before recovering somewhat. The decline was steeper than among blacks or Latinos. The share of Asian-Americans saying America is on the wrong track rose by more than among other groups during the period, too.

▸▸

First among unequals 1

United States, income inequality by race

Ratio of income* at the 90th to the 10th percentile



*Adjusted for household size †Includes Pacific Islanders
‡Includes only non-Hispanics
Source: Pew Research Centre

Polls fluctuate but several elections in the past year point the same way. In November 2021 Glenn Youngkin won the governorship of Virginia for the Republicans. His campaign managers attributed this, in part, to AAPI worries about the economy. In February 2022 voters in San Francisco forced the recall of three progressive school-board members, reflecting AAPI frustration at positive-discrimination policies in schools which help black and Latino pupils but disadvantage high-scoring Asian-American ones. And in deep-blue New York City in 2021 a Republican ran for mayor on a tough-on-crime ticket. He lost easily yet won four wards with large concentrations of Asian-Americans. "Our party better start giving more of a shit about #aapi voters", tweeted Grace Meng, a Democratic congresswoman from Queens.

If these indications are any guide, Asian-Americans will swing back a few points towards Republicans in 2022. The question is whether marginal gains presage a broader shift. Will Asian-Americans be like Jewish-Americans, a reliable part of the Democratic coalition, or, like Italian-Americans, swing towards Republicans?

AAPI ever after?

There are two reasons to think the Republican Party could make big gains. First, Asian-Americans are a very varied lot. They come from a score of countries, speak over 100 languages and espouse different religions. Until recently, they barely recognised the term "Asian-American" except as a census category. People thought of themselves as Japanese-Americans, Korean-Americans or Vietnamese-Americans; these last make up a Republican-leaning subgroup, like Cubans among Latinos.

According to the Pew Research Centre, a think-tank, the richest 10% of Asian-Americans are richer than the wealthiest decile in any other group. Migrants from India and China account for a disproportionate share of tech workers; they include the bosses of Adobe, Google, Microsoft and Zoom. But the poorest AAPI tenth are slightly poorer than average and the gap between richest and poorest Asian-Americans has been growing faster than among Americans as a whole (see chart 1). The income gaps are even wider among Chinese-Americans (see chart 2). If they just voted their socioeconomic interests, Asian-Americans would split their votes. In 1992, a slim majority voted for George H.W. Bush.

Second, and uniquely among America's largest racial groups, Asian-Americans are immigrants. More than six in ten were born abroad (compared with 35% of Hispanics, 12% of African-Americans and 4% of white people). At current rates there will be 46m Asian-Americans by 2060, more than there are African-Americans today. Republicans would seem to have a plausible chance of attracting many newcomers.

In practice, however, new arrivals tend to engage politically with the party to which their family and neighbours belong (or else do not engage at all). This gives Democrats a first-mover advantage. As Asians poured in during 2000-20, the party of minorities reached out to them more than did Republicans, constrained by a strand of anti-immigrant nativism in their ranks. According to AAPI Data, a polling firm, Democrats outnumber Republicans among every group except Vietnamese-Americans. Overall, Asian-Americans identify with Democrats over Republicans

For richer, for poorer 2

United States, household income*

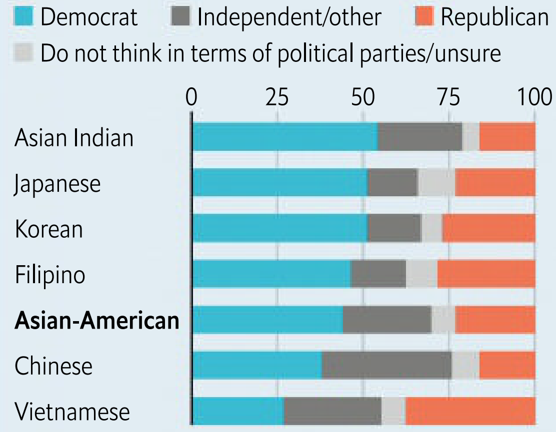
By ethnicity of head of household, 2017-19, $'000

*Adjusted for household size
Source: Pew Research Centre, American Community Survey

The Vietnamese exception 3

"Generally, do you usually think of yourself as a..."

United States, September 2020, % responding



Source: APIAVote, Asian-American Voter Survey 2020

by two to one (see chart 3).

The Asian-American shift to the left since 1996, argues Karthick Ramakrishnan, of the University of California, Riverside, constitutes the biggest political swing of any racial group in America. According to AAPI Data, 43% of Asian-Americans support bigger government with more services; only 19% say they want smaller government and fewer services. More than three-quarters want more federal action to combat climate change; four-fifths support stricter gun laws. Varun Nikore of AAPI Victory Fund, a political fundraising group, argues that, though Asian-Americans may be the most heterogeneous of America's ethnic groups, they vote and organise homogeneously, as a Democratic block.

Other features suggest that Republicans will find the block hard to split. Asian-Americans are better educated than average: over half have at least a graduate degree; among Indian-Americans the share is 75% (the national average is 38%). Having a degree is one of the surest predictors of voting Democratic.

Asian-Americans are slightly younger than average—and the median age of US-born AAPI is only 19, compared with 36 for all US-born people—and younger voters tend to lean to the left. A poll by CIRCLE, a research group attached to Tufts University, found that a staggering 78% of Asian-Americans aged between 18 and 29 supported Mr Biden in 2020, 20 points more than young voters nationally. And AAPI people born in America are more Democratic than new arrivals; they are likely to increase as a share of the total over time.

So, as the political significance of Asian-Americans rises, both parties have work to do. "We have to meet them where they are on their issues, not rely on identity politics," says Mrs Murphy. "The Republican Party has not always been welcoming to people of every colour," admits Mr Chen, sheepishly. Republicans are chipping away at the Asian-American block. They are not yet able to crack it open. ■

Trans rights

Lost in conversion

WASHINGTON, DC

Not for the first time, the Biden administration muddles its terms

UNTIL RECENTLY the term "conversion therapy" was used to refer to the barbaric and pointless practice of trying to turn a gay person straight. Of late it has been widened to include talking therapy that explores why a person's gender identity is at odds with their biological sex. President Joe Biden used that broader meaning in an executive order "advancing equality for LGBTQI+ Individuals", on June 15th. The order is designed to tackle discrimination suffered by "LGBTQI+" young people, which is laudable. But it refers to them as a single group (offering no definition of "queer" or "intersex"), which raises problems. It describes conversion therapy as "a discredited practice that research indicates can cause significant harm", yet fails to specify what it means when applied to trans-identifying children.

Some therapists who work with children with gender dysphoria worry that this could be interpreted to mean therapists should not investigate why someone feels distressed about their biological sex. This is not the same as trying to convince someone they are not gay. Sexual orientation and gender identity are different. Sexual orientation tends to be innate and fixed; gender identity can be nebulous and changeable. It also, increasingly, prompts medical interventions that can have irreversible, harmful effects. It has long been held that people with gender dysphoria should have therapy before drugs.

Increasingly, however, such talking therapy has clashed with "gender-affirmative" care, which accepts patients' self-diagnosis that they are trans. That is now considered best practice in America's booming trans health-care field. Therapy has been dismissed as "gatekeeping", even when applied to trans-identifying minors for whom gender-affirming drugs can be particularly harmful. There is growing evidence that puberty blockers given to trans-identifying children from the age of nine, and the cross-sex hormones that often follow, lead to sterility and inorgasmia. Finland and Sweden have mostly stopped prescribing blockers to under-18s in favour of talking therapy, because the evidence base for them is thin. Mr Biden's order, by contrast, asks federal departments to expand access to "gender-affirming care".

The order does not impose an outright ban on therapy for gender-dysphoric youth. But it will have a "chilling effect", says Lisa Marchiano, a Jungian therapist and a co-founder of the Gender Exploratory Therapy Association. Most decent therapists should be able to help people with gender dysphoria, she says. Yet America's focus on affirmation means many are wary of doing so. Instead, they refer children to gender therapists, who are likely to affirm a trans identity and suggest drugs. Some gay adults who struggled with gender nonconformity in adolescence say they believe that encouraging children with gender dysphoria to consider themselves trans is in effect conversion therapy.

This is not the first time the administration has muddled its terms in an effort to embrace trans rights. It has done so over sex and gender identity too. The Biden administration has suggested it is considering changing Title IX, an amendment made to the Civil Rights Act, to include "gender identity" alongside "sex". When Title IX banned discrimination "on the basis of sex" in federally funded educational institutions in 1972, it resulted in the provision of separate programmes for girls. The lost ground this enabled women to make up in sport was one of the biggest achievements in the battle for sexual equality in America. If female sports teams are forced to allow trans girls to join them, the era of female-only sports will be over.

On June 19th the International Swimming Federation voted to restrict transgender athletes from competing in elite women's competitions (unless they took blockers as children). Sensible policymaking like that seems a long way off in America. ■

Petrol politics

Pump and dump

WASHINGTON, DC

The best that can be said for Joe Biden's gas-tax break is that it is going nowhere

AMERICANS ARE mad about soaring petrol prices. Joe Biden's administration has tried to pin the blame on one man, calling it "Putin's price hike". Analytically, it is true that Russia's invasion of Ukraine is the main reason for the global energy crisis. Politically, though, that has not given much cover to Mr Biden, whose popularity has sagged. On June 22nd the president tried a different form of politicking: he called for a gas-tax holiday for three months.

For the tax break to work, it would have to deliver much lower prices at the pumps. That is unlikely for three reasons. First, the root cause of high prices is an imbalance between buoyant demand for oil and constrained supply. If the tax holiday were to encourage Americans to hit the road, it could backfire, revving up consumption without solving production bottlenecks.

The president's idea is tanking, too

A second snag is the matter of who benefits. Although the break is directed at consumers, producers can respond by raising pre-tax prices. A recent study by the Penn Wharton Budget Model, a research initiative, found that when Connecticut, Georgia and Maryland implemented petrol-tax holidays earlier this year, consumers captured as little as 58% of savings.

A final weakness is that there simply is not much fat to cut. The federal tax on petrol is just 18.4 cents a gallon. With prices at around $5 a gallon, a tax holiday would equate to a discount of less than 4%. State taxes are generally low, too. Average petrol taxes in the OECD, a club of mostly rich countries, are nearly five times higher than in America.

There is also concern about the fiscal downside. The petrol tax helps pay for America's highways. Mr Biden has pledged to plug the gap with other revenues, but that would take about $2bn a month. Perhaps the best thing that can be said about the tax holiday is that it is unlikely to get through Congress. Joe Manchin, a Democratic senator from West Virginia who has doomed other spending ideas liked by Mr Biden, has already signalled his displeasure.

Given all the flaws, why is Mr Biden bothering with it? In calling for the tax holiday, he said it would at least provide families with "a little bit of breathing room". Perhaps he hopes it would provide the same for his presidency.

California's schools

Snoozzzzzze on

WASHINGTON, DC

A new law brings relief for tired teens

CALIFORNIA'S TEENS can hit the snooze button a few extra times from July 1st. A new law requires all public high schools to start no earlier than 8:30am, half an hour later than the American average. Middle schools (ages 11-14) must start at 8am or later. California is the first state to require later start times for public schools. For 3.3m children, this will be a welcome relief.

Since the 1950s Americans have been moving away from cities to sprawling suburbs with limited public transport. Families became car-dependent and buses were used to get pupils to school. But to save money schools often have to share bus fleets. High-schoolers are usually picked up first, then middle school, to prevent elementary pupils from waiting in the morning darkness. The new law responds to research showing the effects of early starts and sleep deprivation on teens.

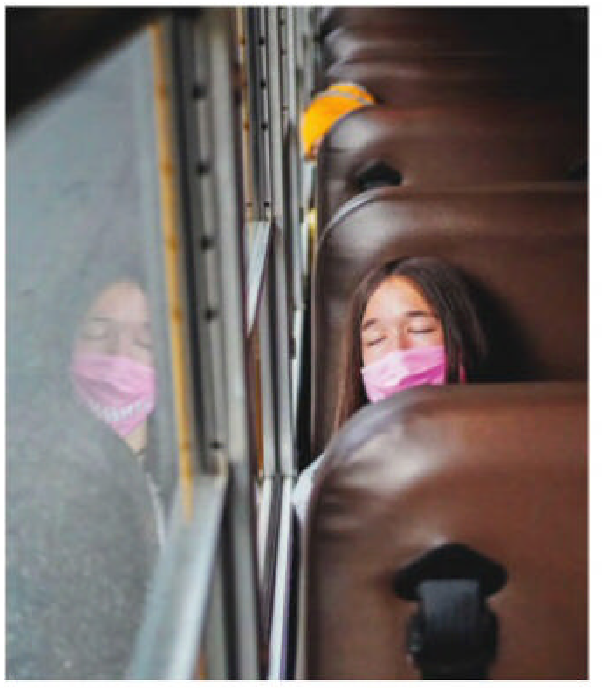
Poor sleep is associated with several woes. Physical-health problems can include insulin resistance and obesity. As for mental health, studies have found a link between lack of sleep and feelings of hopelessness, anxiety, depression and suicide. Sleep deprivation also seems to increase risky behaviours among teens, such as use of alcohol, tobacco and other drugs.

Concentration suffers. A county in Kentucky that pushed back its school-start time found that car-crash rates among teen drivers fell by nearly 17% (the rest of the state experienced an increase). More sleep boosts academic performance. A study of 29 schools in seven states found that attendance and graduation rates improved after start times were moved to after 8:30am.

Lack of sleep is widespread among teens. According to the Centres for Disease Control and Prevention, seven out of ten high-schoolers and six out of ten middle-schoolers do not get enough sleep. The Academy of American Paediatrics (AAP) recommends that schools start after 8:30am to minimise negative impacts on teen sleep. Yet only 17% of schools do so.

So why don't the teens just go to bed earlier? During puberty, adolescents' sleep cycle changes. They begin to go to sleep later (by about two hours) and wake up later as well. But they still require a full night's rest—8.5 to 9.5 hours, according to the AAP. Early school-start times disrupt this.

Sceptics worry that delaying school starts will not result in more sleep because teens will only go to bed even later. But this does not seem to happen. A meta-analysis (of 20 studies) found that later school-start times do indeed lead to more sleep.



California's got the message

California's bill has its critics. They point to logistical issues. The later start times could mess with parents' schedules. In winter the end of school could occur during dusk, pushing after-school activities later into the evening. The law also upset the teachers' union. The California Teachers Association argued that start times should be decided at the local level. The new law will not apply to rural districts, but all others will have to follow it.

Advocates say this change is all for the better. Developing proper sleep habits is imperative for a healthy lifestyle as a teen and into adulthood. Poor sleep in adulthood is linked with a litany of chronic illnesses: diabetes, Alzheimer's, hypertension and more. Teens need to sleep longer now, so they can be healthy later. ■

Religion in schools

A victory for God

NEW YORK

The Supreme Court erodes the separation of church and state

IN 1785 JAMES MADISON warned against taxing Virginians to pay salaries for teachers of Christianity. Requiring citizens to hand over just "three pence" to fund religious instruction, he admonished, is a dangerous "experiment on our liberties". On June 21st, 237 years later, the Supreme Court has come out against the chief author of the Bill of Rights—and Thomas Jefferson's vision of a "wall of separation between church and state"—in a dispute over a tuition-assistance programme in Maine.

The result in *Carson v Makin* is no surprise. The writing has been on the wall since 2017, when the Supreme Court ruled that public grants for cushier playgrounds must be open to secular and church-based preschools alike. Three years later, the justices said states may not exclude schools from an aid programme just because they have a religious affiliation. But in *Carson*, the court went further. As fewer than half of Maine's school districts operate a public high school, the state offers tuition assistance to parents who wish to educate their children in private—but not sectarian—schools. *Carson* requires Maine to scrap that caveat and extend the offer to schools with religious missions and curriculums.

In his majority opinion for every Republican-appointed justice, Chief Justice John Roberts presented this as "unremarkable". Maine's scheme "penalises the free exercise of religion" by denying parents the option of drawing on state funds to send their children to schools that teach their faith. Such funding does not violate the bar on an "establishment of religion".

Justice Stephen Breyer's dissent, joined by Justices Elena Kagan and Sonia Sotomayor, lamented the imbalance in the majority's treatment of the First Amendment's twin religion clauses. Free exercise and nonestablishment exert "conflicting pressures" on states seeking to respect individual belief while not unduly merging religion and state, Justice Breyer wrote. But the *Carson* majority "pays almost no attention" to the latter while "giving almost exclusive attention" to the former.

In 2004 Chief Justice Roberts's predecessor, William Rehnquist, held that states have flexibility when navigating the two principles. In *Locke v Davey,* Rehnquist found "play in the joints" between free-exercise and nonestablishment wide enough to allow Washington state to give scholarship funds for all courses except "devotional theology". The constitution might permit funding of pastoral studies, the court ruled then, but it does not compel it.

Chief Justice Roberts tried to distinguish *Carson* from *Locke,* yet did not explain why it is fine to bar funding of "vocational religious degrees" but not to withhold money for lessons on atmospheric layers as "evidence of God's good design". "The Court today", Justice Breyer wrote, "nowhere mentions, and I fear effectively abandons", the "long-standing doctrine" that states may erect a taller church-state wall than the constitution requires.

Justice Sotomayor's solo dissent added a touch of "I told you so". The court "should not have started down this path five years ago", she wrote, reflecting on her dissenting vote in the 2017 case. The ensuing "rapid transformation" of religious liberty, she concluded, has led America to a point where "separation of church and state becomes a constitutional violation". ■

Uranium

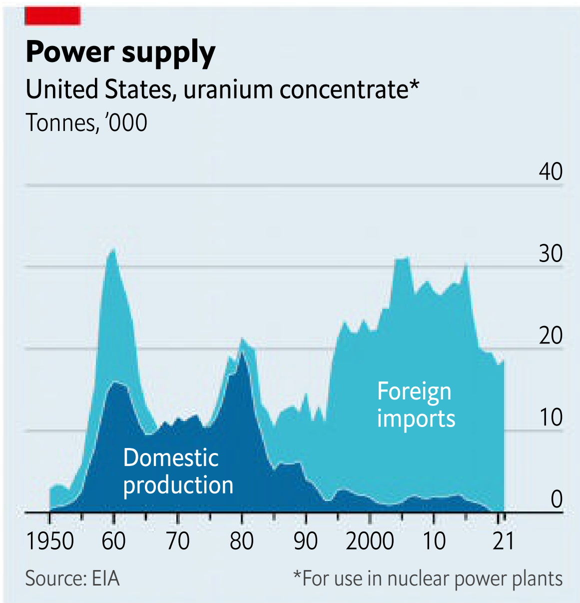
Fission impossible?

WHITE MESA, UTAH

Climate worries and war in Ukraine are changing the politics of nuclear power

EDWARD ABBEY, an author, national-park ranger and relentless curmudgeon, once described south-eastern Utah as the "most arid, most hostile, most lonesome... quarter of the state", and "the best part by far." Abbey's favourite bit of Utah is home to red sandstone canyons, sacred tribal lands, all manner of desert critters—and America's only operating uranium mill.

Uranium prospecting surged during the cold war as America built its nuclear arsenal. Low-enriched uranium fuels most nuclear reactors; very highly enriched uranium is used in bombs. Most mining took place on the Colorado Plateau, an area spanning swathes of Arizona, New Mexico, Utah and Colorado. At the industry's peak in 1980 it produced nearly 43.7m pounds (19.8m kg) of the stuff. Then things went downhill. American firms couldn't compete with cheap uranium imports from Canada and Australia, and, later, from former Soviet states. American companies produced just 21,000 pounds of uranium last year (see chart).

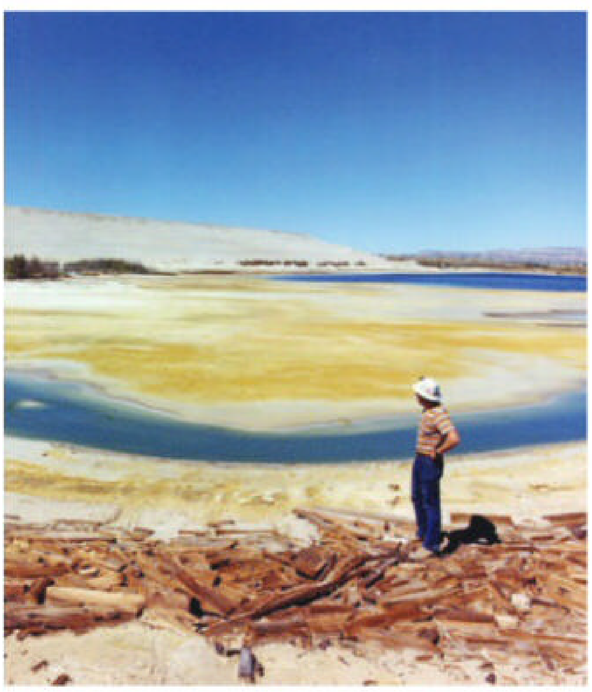


Yet the White Mesa mill in southern Utah is still converting uranium ore into yellowcake, a condensed powder. For decades the facility has seemed a relic of the region's boom times. But two things have conspired to breathe new life into America's uranium industry.

First, climate concern has begun to change the politics around nuclear power, which does not emit carbon. Roughly 20% of the power produced by American utilities comes from nuclear, making it the country's largest source of clean energy. To speed decarbonisation, the Biden administration wants to prop up America's existing nuclear plants and incentivise the development of new advanced reactors. Proponents of nuclear power argue that its steady, baseload power will be needed to keep the lights on when the sun doesn't shine or wind doesn't blow. There are signs that this argument is catching on. California is considering delaying the closure of its last nuclear plant, which is the state's largest single source of electricity.

Second, Russia's war in Ukraine has many countries squirming over their reliance on Russian energy. According to the Energy Information Administration, a government agency, 14% of America's uranium imports in 2021 came from Russia (and a further 43% from Kazakhstan and Uzbekistan). Russia is the only commercial supplier of the type of uranium needed to fuel new reactor designs, which aim to reduce costs and safety concerns.

John Barrasso, a Republican senator for Wyoming who has long wanted to prop up his state's uranium industry, has introduced a bill that would ban imports of Russian uranium. "We stopped oil, gas and coal," says Mr Barrasso. "There's no reason that we continue to import uranium when we have such an abundance in the United States." That feeling is bipartisan. Jennifer Granholm, Joe Biden's energy secretary, says the Department of Energy (DOE) is developing a national "uranium strategy". TerraPower, a firm co-founded by Bill Gates, initially planned to buy Russian uranium to power the reactor it is building in Wyoming. But even without a ban, it says it is no longer interested in Russian supplies.



Back to the 1970s, maybe

The politics of disavowing Russian uranium may look good on paper, but they could leave utilities and innovators like TerraPower in the lurch. Andrew Griffith, who works on nuclear-fuel supply chains at the DOE, likens the nuclear industry's woes to a chicken-and-egg dilemma. "The advanced reactors are going to have a hard time attracting investment when there's no fuel supply," he says, "and it's hard to attract investment in the fuel supply if there are no customers to purchase the fuel."

To jump-start things, the DOE is scrambling to ramp up mining and enrichment, in three ways. First, the department is powering up a small enrichment facility in Ohio, to demonstrate the technology. Second, some weapons-grade uranium can be "downblended" to create the lower-enriched stuff needed for reactors. Third, the department wants to incentivise the private sector, which is pushing for the creation of a Strategic Uranium Reserve similar to the petroleum stockpiles kept in underground caverns along the Gulf Coast.

America's uranium firms are salivating over the potential revival of their industry. Uranium sales are negotiated through long-term contracts rather than in an open market, given the element's use in nuclear weapons. So it is hard to get a pure price signal, says Ian Lange, an economist at the Colorado School of Mines. Cameco, a uranium producer, estimates that the price per pound was about $48 in May. Scott Melbye, the president of Uranium Producers of America, a trade group, says that is nearly the level firms would need in order to justify restarting long-dormant mines.

Should you choose to accept it

Tricky economics is not the only problem America's uranium industry faces. In many western communities uranium mining is unpopular at best, and considered criminal at worst. The Environmental Protection Agency estimates that there are more than 500 abandoned uranium mines on Navajo Nation lands alone. The Ute Mountain Ute tribe in White Mesa worries that the mill may be affecting their water and air quality. Development of a dormant mine about ten miles south of the Grand Canyon is vehemently opposed by environmentalists and tribes in Arizona.

The opposition to a uranium boom resembles the environmental-justice concerns that have doomed existing nuclear power plants. Mr Barrasso says shunning nuclear power in favour of a grid dominated by renewables would be foolish. You can't "power the world on the sun, the wind and wishful thinking", he says wryly. But the nuclear industry's utter dependence on government aid requires its boosters to engage in some wishful thinking of their own. ■

Lexington | The Biden-Harris problem

Democrats face the fact that they need a better candidate for 2024 than Joe Biden or his deputy

NOTHING RAISES the political stakes like an insurrection. As the House of Representatives' January 6th committee publicises yet more details of Donald Trump's scheme to steal the 2020 election, Republicans are doubling down against democracy. New Mexico's Supreme Court last week had to compel conservatives in rural Otero County to certify an election they had refused to because, conned by one of Mr Trump's conspiracy theories, they mistrusted vote-counting machines. In Nevada, Republicans elected as their candidate for secretary of state, the office that certifies elections, a man who says he would not have recognised Joe Biden's victory in the state. And on June 19th Texas's state Republican Party declared Mr Trump the rightful president, Mr Biden an impostor, and vowed to abolish the 1965 Voting Rights Act that enfranchised black Americans in the South. Mr Trump, maddened by the hearings, is said to be considering announcing his next presidential run within weeks.

For Democrats, the hearings and the Republican response to them make it all the more imperative that they retain the White House in 2024. Which turns their anxious minds to its current occupant. Mr Biden is even more unpopular than his twice-impeached predecessor. Only 39% of voters think he is doing a good job, and his chances of recovery look slim. Mr Biden's troubles are mostly attributable to a horrendous set of socioeconomic and political circumstances (including high inflation, the lingering covid-19 pandemic and the hyper-partisan furies Mr Trump unleashed on the right), most of which are getting worse.

With interest rates climbing, a recession and job losses look likely next year. By which time the Republicans, having won back the House at least in the mid-terms, will be heaping fresh troubles on the president's 80-year-old head. They may impeach him. They will certainly launch investigations into his son, Hunter Biden, whose dissolute lifestyle and lobbying are considered a much bigger scandal on the right than the Capitol riot.

To rise above this would take a politician of genius, which the president wasn't even before he started visibly slowing. Though nothing like the dribbling senile that right-wing commentators portray (people who have discussed policy with Mr Biden found him alert and well-briefed), he lacks energy and grip. This has probably contributed to his administration's missteps. It over-promised legislatively, given the Democrats' bare-minimum majority in the Senate, then under-delivered. Its staff of former Clintonites have proved bafflingly supine towards their party's electoral albatross, the activist left. Mr Biden's public speaking has meanwhile gone from gaffe-prone to often excruciating. He is rarely permitted to take off-the-cuff questions. Even his set pieces are white-knuckle affairs. The fact that his fall from a bicycle this week was a one-day headline showed how bad his press is: Mr Biden landing in a heap was a dog-bites-man story. No Democrat relishes the idea of him fighting another presidential campaign.

Yet his aides have described plans for one—because if Mr Trump runs again, it seems Mr Biden wants to. He rightly fears a second Trump term would be calamitous; yet the fact that he thinks he is the likeliest impediment to that points to another Democratic problem. If Mr Biden steps aside, the vice-president, Kamala Harris, is expected to be the Democratic nominee. And many fear she would lose to Mr Trump or one of his imitators, because of another combination of dire fundamentals and poor political skills. If America was not ready for a woman president in 2016, it is probably no readier for a black woman now. And Ms Harris, a Californian progressive unused to competitive elections, was exposed during her brief primary tilt in 2019 as an awkward campaigner with few fixed views. Mr Biden shone by comparison.

The question, then, is can Democrats bypass them both? "Literally every conversation I've had with a Democrat over the past three months has started with this," says a veteran activist. The conventional wisdom is, no. The diversity of the Democratic coalition makes its members cling to protocols, such as the vice-president's claim to be next in line, as a defence against schism. And bypassing a black woman would outrage the identitarian left. Yet a growing sense of panic is challenging that view. A flurry of recent reports in the *New York Times* and elsewhere feature quotes from unnamed Democrats calling on Mr Biden not to run and for a competitive primary, in which Ms Harris could participate (and show off the skills her supporters will say she has acquired in the West Wing) if she wished.

Expect such whispering to increase. Mr Biden is too old to run again. Ms Harris seems too flawed. Moreover, her claim on the nomination is hardly democratic. And there is no evidence that black voters would rally to her, as her defenders will also claim. African-Americans want the candidate likeliest to win, which is why they usually choose a moderate white man, as they did in 2020.

For what it is worth, your columnist expects the whispering campaign to succeed. Hillary Clinton's failure and Mr Trump's awfulness have made Democrats suspicious of coronations and above all fearful of a Republican presidency. All that is needed is an opportunity for them to air those sentiments—and the left, predictably unimpressed by Mr Biden, will probably provide one.

Third time lucky, Uncle Bernie?

A leftist challenge to him or to Ms Harris could crack open the nomination process just as Eugene McCarthy did in 1968, when his anti-war protest against an unpopular incumbent, President Lyndon Johnson, drew in more powerful challengers. If the indefatigable Bernie Sanders (who is a year older than Mr Biden), Ro Khanna or another left-winger looked able to win the ticket, more compelling centre-left candidates, such as Amy Klobuchar, Cory Booker or Pete Buttigieg, would surely pile in. It could be the activist left's single great contribution. ■

→ Also in this section
44 Bello: Murder in the jungle
46 Shoddy sex education

Colombia

Petrofied

BOGOTÁ AND CALI

How will Gustavo Petro, a former leftist guerrilla, govern Colombia?

"WE ARE WRITING a new history for Colombia, Latin America and the world," declared Gustavo Petro, the winner of Colombia's presidential election, in Bogotá on June 19th. His grandiloquence was perhaps understandable. When he takes office on August 7th Mr Petro will become the country's first left-wing president. He offers a radical departure from a century of right-wing and centrist rule. Mr Petro's running-mate, Francia Márquez, an environmental activist, will be the country's first black vice-president.

Mr Petro won by 50.4% to 47.3% in a run-off against Rodolfo Hernández, a property tycoon. He got 11.3m votes on a turnout of 58%, the highest in 50 years. The ballot was peaceful, in an election marred by death threats to both candidates and worries about potential fraud. Mr Hernández conceded defeat quickly.

The result makes Mr Petro the latest in a string of leftist leaders in Latin America who have come to power as part of an anti-incumbent wave. In Peru and Chile voters recently plumped for anti-establishment candidates. Brazil is also expected to lurch to the left in presidential elections in October. Yet though Mr Petro's agenda is radical, he will be constrained by a fractured Congress and Colombia's institutions.

Mr Petro's win was a victory for press-the-flesh campaigning over social-media savvy. He secured almost 3m extra votes between the first round on May 29th and the run-off, mainly through grassroots work among young and poor people. Turnout in Magdalena and Chocó, two of the country's poorest departments, increased by 16%. In Bogotá, where Mr Petro was once mayor, he got half a million extra votes.

Mr Hernández, by contrast, focused on finger-jabbing rants on TikTok. In the final week he cancelled media appearances and flew to Miami, saying his life was at risk. He mentioned the Virgin Mary and prostitutes in the same sentence, which his critics gleefully construed as an insult to the country's Roman Catholics. His standing among conservatives took a hit when a video emerged of him dancing on a yacht with a dozen young bikini-clad women.

This made Mr Petro seem more statesmanlike. He tried to calm jittery investors by suggesting he would appoint a centrist finance minister. In his election speech he defended capitalism, albeit half-heartedly, saying he would "develop [it], not because we adore it, but because we have to overcome premodernity and feudalism."

Nevertheless, many Colombians distrust their president-elect. Polls taken before the election found that he was less popular among older voters who had experienced more of the country's long-running armed conflict with insurgencies. For many Mr Petro's former membership of the M-19, a guerrilla group that demobilised in 1990, is a huge red flag.

Mr Petro has not reassured investors. His programme includes making university free and giving every persistently unemployed person a state job. (Unemployment is currently 11%.) He wants to ban oil exploration, open-pit mining and fracking—even though oil, coal and minerals make up around half of Colombia's exports. His proposal to grab money from private pension funds to bolster the public pot outrages savers and would weaken capital markets. The peso fell by 3% against the dollar on June 21st; the stock exchange fell by 4%.

Colombia's close relationship with the United States could also fray. Since 1999 it has received more aid than any other country in Latin America, mostly to fight drug gangs and guerrillas. Kevin Whitaker, the US ambassador to Bogotá until 2019, worries that Mr Petro's desire to end forced coca eradication and to stop extraditing drug kingpins would "fundamentally change ▸▸

Bello Murder in the Amazon

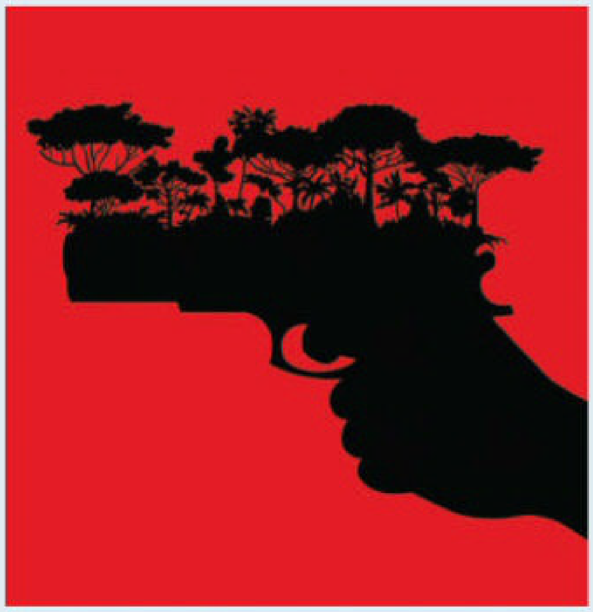
A double slaying reminds Brazilians how much their president scorns greens

Fly from Europe to Peru and you make landfall over Guyana. For almost five hours you then fly over a dark green carpet festooned with serpentine rivers, some a muddy brown, others inky black. Such, still, is the vastness of the Amazon rainforest. Yet this aerial view is deceptive. At ground level large swathes of the forest have been eaten away. It is an assault that began centuries ago, as colonists pushed up the rivers. Since the 1960s it has gathered pace, accelerated by the chainsaw, the bulldozer and the building of highways. At issue are two opposing visions for the region, of economic development or of environmental protection, and two groups of people: most indigenous tribes on the one hand, and ranchers, farmers, loggers and *garimpeiros* (wildcat miners) on the other.

Now this conflict has reached even the most hidden areas of the Amazon, as the murders earlier this month of Bruno Pereira, an adviser to indigenous tribes, and Dom Phillips, a British journalist, make clear. According to Brazil's federal police they were shot dead as they were returning by boat from a research trip in the valley of the Javari, a territory the size of Austria close to the border with Peru that is home to 16 tribes living in isolation. The police say their killers were illegal fishermen, three of whom have been arrested.

The pair are far from the first defenders of the forest to die violently. In 1988 the murder of Chico Mendes, the leader of a rubber-tappers' union in Acre, to the south of the Javari, caused international outrage. His killers were the sons of a rancher who wanted the union's land. Mendes's death contributed to far-reaching changes of policy in Brazil, coinciding with the country's democratic constitution of 1988. Governments banned wildcat mining, set aside large chunks of the forest as indigenous reserves or national parks, and stepped up enforcement of laws against deforestation. This change peaked under Luiz Inácio Lula da Silva and his environment minister of 2003-08, Marina Silva, who had worked with Mendes. Deforestation fell from 27,700 square kilometres (10,700 square miles) in 2004 to 4,400 square kilometres in 2012. By the same token, after centuries of decline, Brazil's indigenous population has been enjoying a sustained increase, from fewer than 100,000 in 1960 to 1.1m today, thanks to better health care and the protection of their lands and livelihoods.

Over the past decade environmental progress has reversed, however, owing both to pressure from the farmers' lobby and budget cuts. The fate of Messrs Pereira and Phillips highlights new threats. As Brazil has become a big consumer and exporter of cocaine, organised crime has spread across the Amazon. The Javari joins the Amazon where Brazil intersects with Peru and Colombia. It has become a drug route. Environmentalists say that narco-traffickers have diversified into environmental crimes, such as smuggling ill-gotten timber and endangered animals. The murder rate in rural areas in the Amazon is rising and is now above the national average.



The most insidious threat comes from Jair Bolsonaro, Brazil's president since 2019. He is contemptuous of environmentalism and of indigenous reserves, which he sees as unfairly blocking economic development (a minority of the indigenous agree with him). A former army officer, he embodies the military's nationalist view of the Amazon: that it must be settled if Brazil is to secure its sovereignty over it. And he won the votes of many of the 29m people who now live in the Amazon, including farmers, *garimpeiros* and townspeople.

Mr Bolsonaro has slashed spending on enforcement by Ibama, the environment agency, by two-thirds and reduced its powers. As for Funai, the body that protects indigenous people, Mr Bolsonaro called it "a nest of rats". He has brought in military officers to run it. All this has encouraged those who break environmental laws, such as the illegal fishermen on the Javari river. The president appeared to blame Mr Phillips for his own death, saying, "That Englishman was disliked in the area because he wrote a lot against *garimpeiros*, environmental issues, people didn't like him. He should have been much more careful."

Environmentalists hope that Lula, as the ex-president is known, will defeat Mr Bolsonaro in the presidential election in October. Lula's campaign platform promises to defend the rights and lands of indigenous people, to rebuild Ibama and Funai, and to fight deforestation. But in the Amazon, all that becomes harder with each year that passes.

the nature" of security cooperation. A free-trade deal signed in 2012 is also at risk. On June 22nd Mr Petro tweeted that he had called Venezuela's government to reopen the shared border.

Yet Mr Petro will struggle to implement his big plans. His coalition has only 15% of seats across both houses of Congress. Though he can expect support from some centrists and the five senators formerly in the FARC, a Marxist guerrilla group which demobilised in 2016, he would still need to make alliances with established parties. That may disappoint his base.

Many fear that Mr Petro's plan to "democratise" Colombian institutions means stuffing them with his followers. But this will be difficult. The departing president, Iván Duque, was able to appoint the attorney-general, public prosecutor, comptroller and procurador, who disciplines public servants. A state of emergency to combat hunger, which Mr Petro once promised to call, is unlikely to pass muster with the Constitutional Court. Similarly, the Central Bank's independence is enshrined in the constitution. Mr Petro can only appoint three out of seven members of its board during his term. He is unlikely to count on the army for much support.

The question is how Mr Petro will react if such institutions restrain him. He has vowed to release 160-odd people jailed after protests last year. To do so, he will need to face down the prosecutor. As mayor he had a reputation for being irascible. For some, none of this matters. "Petro represents change," says Paola Quiñonez, an activist. "If the economy suffers, that's OK. The people have lived through hunger, poverty and insecurity before." Nearly half of Colombians are less sanguine. ■

Sex education

Birds, bees and not much else

BUENOS AIRES AND PANAMA CITY

Latin America lacks decent sex education in its schools

Two 14-year-old students at Jesus and Mary College, a Roman Catholic girls school in Buenos Aires, squirm as they describe their classes on sex. Last year they learned about fertility and sexual organs ("It was really embarrassing!" says one). This term they have talked about the process of giving birth, but they are not sure what else they will learn. The teachers refused to answer some of the questions that their classmates were allowed to write in anonymously. "They said it wasn't appropriate to talk about it in school and we could ask our family members these things," recalls the other.

Sex education is patchy across Latin America, a mostly Catholic continent. Although on paper every government in the region tells schools they must teach their pupils about the birds and the bees, many fail to do so. A survey in 2020 in Brazil showed that only a quarter of teachers had undergone training in how to talk to their pupils about sex. "We train ourselves from our own interest," says Vicky Fernández Blanco, a nursery-school teacher in Argentina who teaches her charges how to ask for consent before hugging a friend, and so on.

A few countries are better at sex education than others. In Mexico, where the constitution enshrines secular education, public-school textbooks show, with simple illustrations, how boys can just take down their trousers to learn about their sexual organs, while girls can use a mirror. (However, these textbooks are not used everywhere.) In Argentina in 2011 the ministry of education produced a textbook to help parents talk to their children about puberty, masturbation, contraception and how sexually abusing children is a crime.

But in much of the region sex education is indistinguishable from a biology lesson. Although abstinence is seldom actively promoted, information on contraceptives can be out-of-date or limited to condoms. "They mentioned interrupting coitus, which I don't think is a very good suggestion," says Ariadna, a 15-year-old at a public school in Argentina. Teachers are often silent about abortion, not least because it is illegal in parts of the region. Any talk of sex is nearly always about the heterosexual variety. "It would have been nice to have heard something about the LGBT community [at school]," says Igor Farah, an 18-year-old in Brazil.

Many parents, having been through the same system, are unable to fill in the gaps. Sometimes they lack knowledge, says Guadalupe, a 24-year-old who works with charities to teach young people in the Mexican state of Oaxaca about sex. Adults in her hometown have long taught their children they can get pregnant from sitting on a toilet. Other parents are just squeamish. Euphemisms are common, such as "*palomita*" (little dove) for vulva.

Many children turn to the internet. But that complicates things, reckons Yuri Pitti, who works at Aplafa, a sexual-health organisation in Panama. "Before the fight was about access to information, now it's about access to good information," she says. Boys tend to have unrealistic expectations of sex from watching porn, in particular.

Perhaps as a result of shoddy sex ed, teen pregnancies are common in Latin America and the Caribbean, though the rate has fallen (see chart). Some 18% of births in the region are to mothers under 20. Only sub-Saharan Africa does worse. Covid-19 may have interrupted progress. In Panama the number of pregnant girls aged 10 to 19 increased by 8% in 2020 compared with 2019, possibly because of lockdowns and school closures. Sexually transmitted diseases are rising in some countries, too.

Some politicians are trying to change matters. Gabriel Boric, Chile's new 36-year-old president, wants to introduce "non-sexist education". He wants to make it mandatory to teach children at all levels not only about sex, but sexual diversity and gender stereotypes. He wants schools to hand out condoms and for sex education to include topics such as abortion (which may soon be legal in Chile).

In April the government of Panama introduced a sex-ed law that means that children now have to be taught how to avoid pregnancy and sexually transmitted diseases, and how to find help if they are being abused. Mexico's ruling Morena party is planning to include sex ed in its laws on children's rights. This would mean, on paper, that teachers have to talk about contraceptives and the like. Last year Cuba's dictatorship announced it would update its "family code" from the 1970s. If that passes a referendum, it will mean that sex ed includes classes about sexuality.

But in some places sex education has become caught up in the culture wars. In Peru legislation which would allow parents to stop sex-ed classes from happening if they do not like them was expected to become law this week. If teachers do not take parents' concerns into account, they can be fired. Esdras Medina, the lawmaker who promulgated it, once blamed floods caused by El Niño on sex education in schools. "Con Mis Hijos, No Te Metas" (Don't Mess with My Kids), a parents' pressure group which started in Peru in 2016, has spread across the region. The group successfully agitated for two education ministers in Peru to be fired.

Similarly, in 2016 the municipal government of Santiago, the capital of Chile, tried to introduce a textbook for teenagers entitled "100 Questions about Adolescent Sexuality", which included segments on what a clitoris is, how long penises are on average, menstruation, LGBT people and healthy relationships (it advises that they involve "mutual respect, communication and trust"). Conservatives objected, calling the book a sex manual. A centre-right politician won the municipal election soon after and took it out of circulation. The new mayor falsely claimed it promoted anal sex as a way to avoid pregnancy. Mr Boric's plans may face a similar backlash. ■

Still stubbornly high

Births per 1,000 women, 15- to 19-year-olds

Source: World Bank

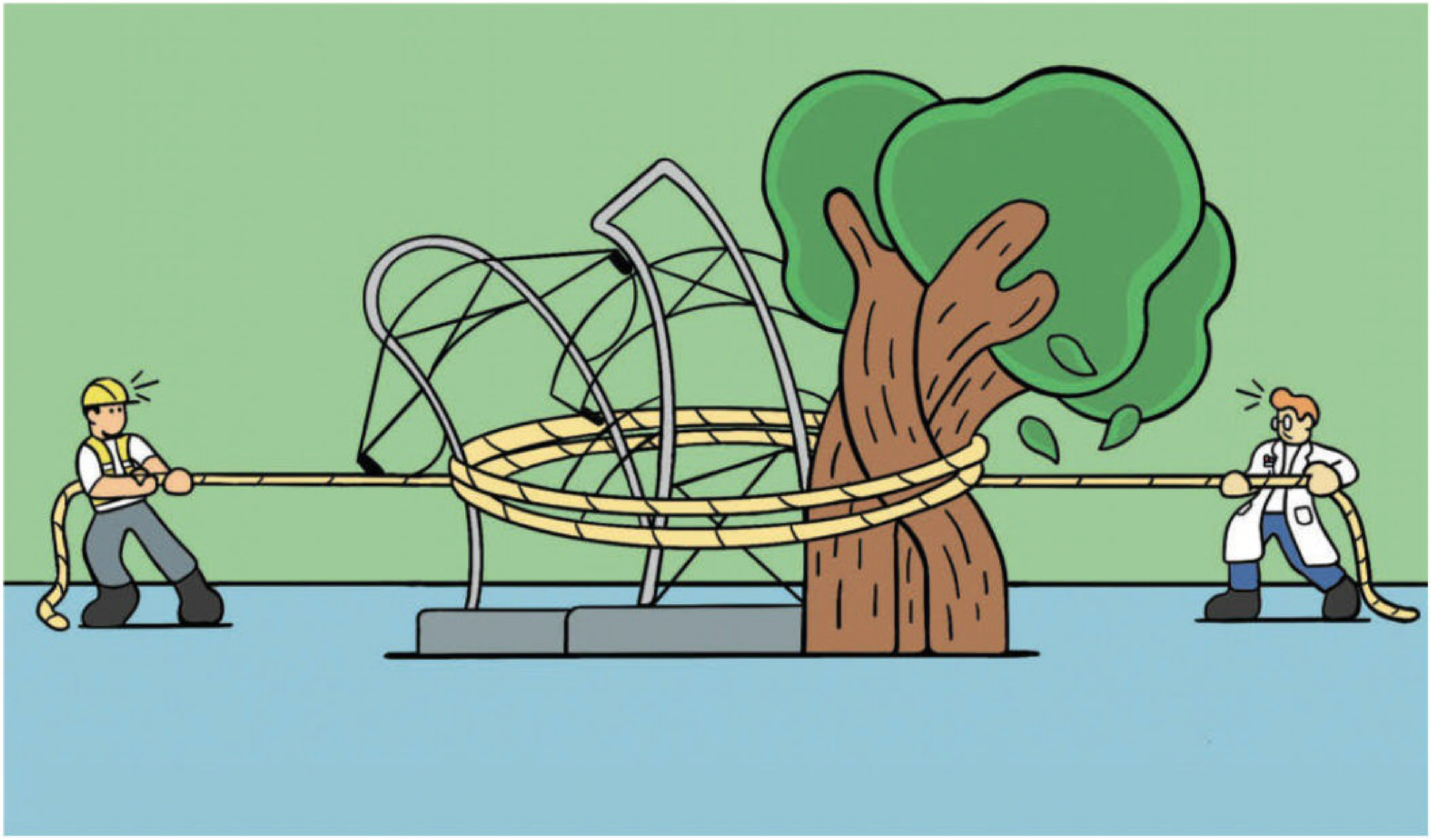
TQ

The Economist
Technology Quarterly:
Climate technology

→ June 25th 2022

3 Electrifying everything
5 Demand management
6 Energy storage
8 Minimising methane
9 Burning natural gas
12 Beyond the grid

The energy transition



The energy transition

Electrical tension

Electrifying everything does not solve the climate crisis, but it is a great start. Vijay Vaitheeswaran reports on what the transition still needs

Walking into the grid control room at 50Hertz, a Berlin-based utility, on the morning of May 13th felt like walking onto the bridge of a spaceship: screens full of data, an air of competent calm and the underlying sense of an immense flow of power being guided on its journey. This hyper-secure site (and its mirror in another location) are charged with controlling the flow of electricity to 18m people in eastern and northern Germany.

Today the screens show 28% of that flow coming from wind farms and 24% from solar panels. A decade ago the custodians of the grids which keep the rich world's lights on would have told you this was impossible. Renewables were too troublesome, too hard to balance with demand moment by moment, too prone to fluctuations in the frequency of the current they provided. In 2011 a symposium of electricity mavens convened by MIT concluded that "Too much electricity generation from intermittent renewables is as much of a problem as too little generation."

This scepticism was understandable. Dirk Biermann, who is in charge of system operations at 50Hertz, points out that grid operators "are very conservative when it comes to system operations because, at any price, we have to make sure that the electricity supply is maintained." Nevertheless it was misplaced. The grid 50Hertz oversees is quite capable of running a transmission grid with 50-60% wind and solar power.

And the progress is not over. The company aims to be able to handle a 100% wind-and-solar grid by 2032. Mr Biermann sees that target as demanding—"We have to speed up"—and anticipates "moments of tension" on the way. But he thinks it will be done. Some places, after all, are already doing it, if only for fairly short periods. Neighbouring Denmark has at times run its entire power grid on wind power alone. At 3.39pm on April 3rd over 97% of California's power came from just wind and solar. A decade of technical, managerial and systems-engineering progress has put the design and management of grids dominated by renewables within the sober, risk-averse grasp of people who run electric grids. What was once touted as a fundamental barrier to the transition from fossil fuels has been done away with.

The rub of the green

The ability to use renewables for the lion's share of a grid's supply, coupled with the fact that renewables have been made cheap and are getting yet cheaper, is the basis of a decarbonisation strategy all but universally accepted by those determined to stabilise the climate. Make the power on electric grids emissions-free, cheap and copious. Start electrifying all processes that now require fossil fuels—such as powering cars, or heating homes and steel foundries—where electrification is clearly possible. It does not deliver everything that is needed. But it delivers a lot.

Two decades ago the high price of emissions-free generating capacity made such a trajectory look both far-fetched and scary. Now it is seen by many as an opportunity. But it faces serious obstacles. This report looks at opportunities and obstacles alike. It also looks at the impact that the war in Ukraine is having on both. ▸▸

One big issue is back-up. If there was twice as much renewable capacity on the 50Hertz patch—as there well could be in the 2030s, given present trends on cost and deployment—then on this breezy spring morning the grid would have access to all the power it needed. But after sunset during extended periods without wind, no amount of extra capacity is any help, however cheap it may be.

Mr Biermann says part of the answer to such *Dunkelflaute*—dark doldrums—is to expand the grid, bringing in renewable energy from a wider range of sources. Another part is to find ways to lower demand when supply is dicey. And increasingly capable batteries and other storage systems will be vital. But there will also be a need for back-up.

In Germany it will not be nuclear. The country's last nuclear plants are due to be shut down this year as part of a process begun in overreaction to the meltdown at Fukushima in 2011. And in no country should it be coal. With those options untenable, Germany has built up its renewables on the basis that, in the long run, back-up will be provided by burning hydrogen produced using the grid's copious renewable resources. As the hydrogen-production capacity is built up, Mr Biermann says the plan had been to use natural gas as a stop-gap, slowly tapering it off as the hydrogen supply increased. This is not a perfect solution since, although gas produces fewer climate emissions than coal, it does still produce plenty of them. But it is a technically plausible one.

Politically, not so much. The Russian invasion of Ukraine did not just send natural-gas prices soaring. It also opened up concerns about security of supply, and the strategic viability of a supply dominated by a powerful enemy. In 2021 the EU imported 45% of its natural gas from Russia; for Germany, Europe's biggest gas consumer, the figure was 55% (see map).

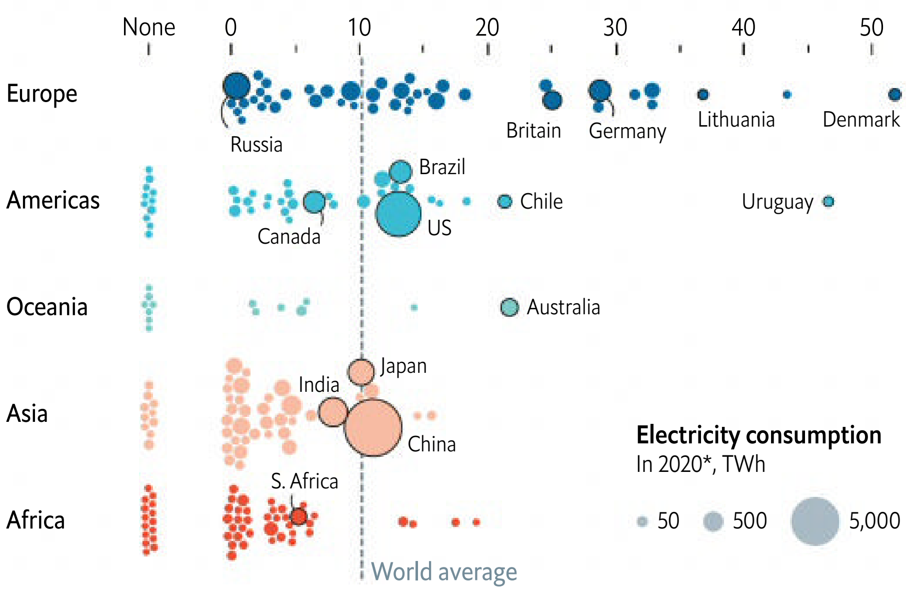
Complex trade-offs

The basic logic of post-Ukraine energy security, which applies far beyond Germany, is to rely as little as possible on flows of hydrocarbons from geopolitically dodgy sources. At one level it is a goal well served by adding renewable capacity to the grid as fast as possible. A kilowatt-hour from a solar panel or a wind turbine is one that does not need to be bought in the form of gas.

Increasing renewable generating capacity yet faster is already a priority for people who are devoted to climate security. In other ways, though, the two agendas diverge. However quickly they are crowded onto the grid, renewables cannot entirely eliminate Europe's need for gas; as well as providing back-up when renewables are not producing electricity, gas is vital to Europe's industrial heartland, not to mention heating many of its homes. So energy-security hawks want to increase greatly Europe's capacity to import liquefied natural gas (LNG).

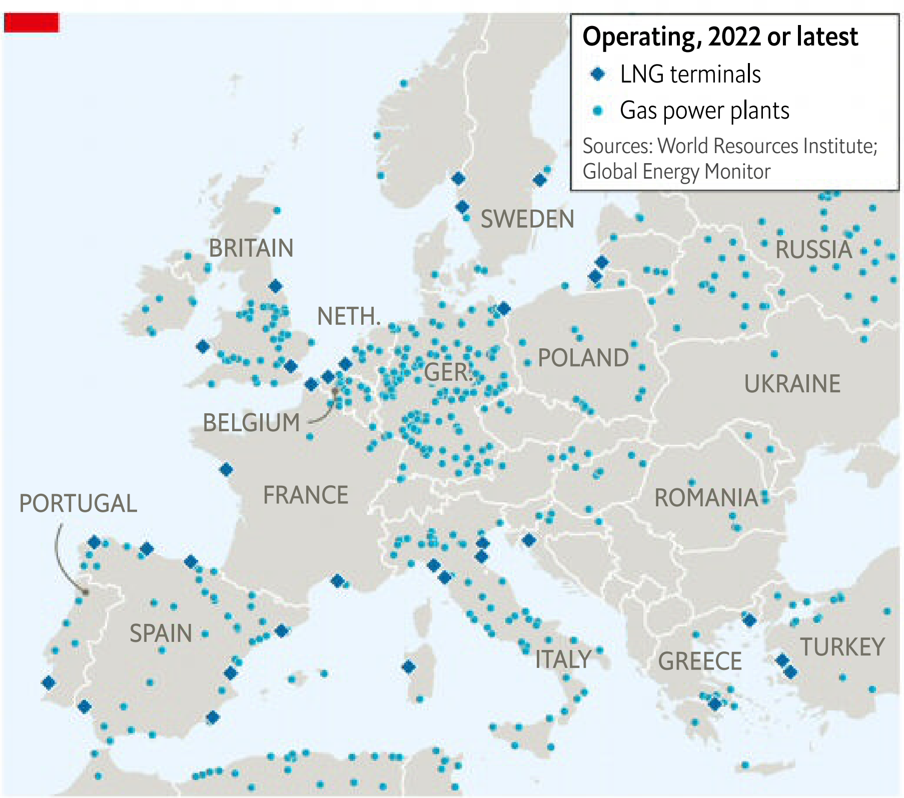
Here comes the sun

Wind and solar, share of electricity generation, 2021*, %



Sources: Ember; EIA

*Or latest available



Climate hawks look on this with trepidation. They argue that a low- to no-emissions future is not just a matter of reducing fossil-fuel use in existing infrastructure; it is about establishing system-level change through a once-and-for-all replacement of infrastructure. Investment in alternative sources of hydrocarbons on the scale needed to replace Russian supplies within a decade, they fear, will see hydrocarbons embedded in Europe's electricity system for decades to come. "Get new gas, then go green" is pitted against "To go green means no new gas".

The issue is not unique to Europe. Similar concerns were raised when Gavin Newsom, California's governor, announced that there would be a role for natural gas in a new $5.2bn "strategic reserve" of capacity designed to ensure that the state's ambitious expansion of renewable power would not lead to blackouts.

These trade-offs between energy security and climate security are complicated further by one of the fundamental issues plaguing the race to decarbonise the economy. Is the technology needed already available? Or does it still need to be developed?

At one extreme are those who argue that all the tools necessary for radical decarbonisation already exist, and that the energy transition is a matter of finding political support for their deployment at an ever greater pace and scale coupled with a willingness in the rich world (and sometimes, implicitly, in the developing world too) to make do with less energy. At the other are those who say that the transition will require whole rafts of technology not yet out of the lab, and in some cases not even in the lab.

The technical and the political are intertwined. If you believe that climate catastrophe looms in the near future you more or less have to believe in a technologically come-as-you-are transition. If you are deeply averse to climate action which requires massive political and economic disruption you will tend to favour going long on research.

This report will look at which technologies needed for a fast transition to a green grid are already available and deployable, and which need more work. It will look at what is required in order to do without natural gas and at how gas can be made more genuinely climate friendly, thus aligning energy security and climate security. Before doing all that, however, it will look at a technology that makes everything easier: one that lets grids manage demand, as well as supply. ■

Empowered demand

The people's power

Getting the most out of tomorrow's grid requires digitisation, demand response and perhaps a dash of democracy

FREQUENCIES MATTER. When a singer misses a note, a choir's harmony can be ruined. When an electric grid wobbles around off key, equipment attached to it can be badly damaged. Worries about the fluctuations that renewables might bring with them in the frequency at which an electrical grid operates (50 hertz, or cycles a second, in most of the world, 60 hertz in much of the Americas and a few parts of Asia) have caused grid operators to be leery of renewable energy.

Now some renewables have developed perfect pitch. On May 11th Huawei, a Chinese technology goliath, unveiled the latest version of FusionSolar, a smart-home system that combines solar cells and energy storage. One of its features is "grid-forming" software which allows the system to set itself precisely to the grid's frequency, helping to stabilise it.

Distributed energy resources (DERs) like smart houses with solar panels demand more from grids—but systems like FusionSolar allow them to offer more, too. Taking up that offer is not easy. A grid connecting millions of systems that draw power at some times and supply it at others becomes "increasingly complex to plan for, orchestrate and keep in balance," says Audrey Zibelman. After three decades as a utility executive, network operator and regulator in America and Australia Ms Zibelman now works at X, the irritatingly named outfit which serves as a "moonshot" incubator for Google's parent company, Alphabet. Her project there, Tapestry, aims to provide what she calls "Google Street View for the grid". With copious sensors, data from DERs and smart software she aims to make the grid manageable at a level of subtlety never seen before.

Combining DERs with this ability to see what is going on in exquisite detail is a challenging task. There is a risk that so much data will prove paralysing. But those who can pull it off will see real benefits in terms of flexibility. Many of the new things being connected to the grid in large numbers, such as heat pumps and electric vehicles, have significant room for manoeuvre as to when, and how much, they consume. If what they have to offer can be accurately appraised and matched to what is happening on the supply side that flexibility becomes a powerful economic asset.

Demand management is a breakthrough long discussed and just as long deferred. Utilities which were heavily regulated, monopolies or both saw little reason to "modify, adjust, manage, shape, shift or shed customers' demand," Fereidoon Sioshansi writes in a recent book, "Variable Generation, Flexible Demand". They just added capacity and passed on the costs. Providing customers with price signals did not live up to the promise market-minded reformers imagined for it. Ordinary people do not want to spend all their time on energy day-trading sites to save a few pennies on power. As Amory Lovins, an alternative-energy guru who co-founded a think-tank called the Rocky Mountain Institute (RMI), has long argued, what people want from energy is simply "cold beer and hot showers".

Acknowledging this is the key to the strategy Mr Sioshansi champions: "we need to automate things, essentially bypassing the customers." New DER-enabled smart grids are an excellent way of doing this. Customers can set preferences as to what they need charged up and when, as they do in a new scheme offered by Octopus Energy Group, a British provider. After that they let the system do as it wants—an approach the company says can, among other things, lower the cost of charging an electric vehicle (EV) by 75%. Such savings by consumers equate, at some point, with savings for the suppliers in terms of electricity they did not have to ship down congested transmission lines.

What people want from energy is simply "cold beer and hot showers"

An in-depth study carried out by America's Pacific Northwest National Laboratory puts numbers to some of the possibilities. It analysed the impact of using dynamic price signals to automatically incentivise and co-ordinate a variety of DERs on a theoretical grid the size of Texas. Operation stabilised, loads were lowered, household-power prices dropped by 10% to 17%. The need for transmission, distribution and generating infrastructure fell.

In Britain a new regime for distribution-system operators means that utilities will be able to solicit DERs via open and transparent "flexibility" markets. That should allow them to provide better services without having to add generating or transmission capacity. In Australia, Energy Web, a charity co-founded by the RMI, is working with the energy-market operator, a big distribution utility and several aggregators of distributed resources to develop a "transactive" energy market that allows customer-owned DERs to bid into the wholesale energy market.

The check on such things is not because of a lack of interest in greening; it is because of opposition from incumbents. This can be as marked in purportedly green countries as anywhere else. The Association of Energy Market Innovators, a European trade group, grouses that "Germany's regulatory framework for its smart meter roll-out...should by no means serve as a role model." Jesse Morris of Energy Web complains that, in California and Hawaii, utilities are allowed to "simply prevent—either directly or via prohibitively ▸▸

high interconnection fees—DERs from being added to the grid."

The commercial and industrial market for flexible demand is taking off too. Enel X, part of Enel, an Italian electricity giant, is one of the biggest aggregators of demand response, something its customers are coming to appreciate. Kimberly Clark, a big consumer-products firm, gave it authority over 5MW of load at one of its factories, allowing it to sell the grid "negawatts" at times of peak demand. With no capital investment and no big change in operations the company earned over $2m from the scheme.

This Technology Quarterly was written in a comfortably cooled and well-lit apartment in a high-rise owned by one of New York City's largest landlords. Unbeknown to your correspondent until recently, some of that landlord's buildings now have solar capacity as well as energy-storage systems managed by Enel X that provide the grid-system operator with demand response at peak load. Good for avoiding blackouts, good for the landlord's profits and all done without haranguing tenants to make fiddly green choices, just as it should be. ■

Energy storage

Beyond batteries

The deep decarbonisation of grids heavily reliant on renewables requires long-duration energy storage

MOST CLIMATE ACTION centres on getting rid of carbon dioxide. Energy Dome, an Italian startup, wants to put it to use. Its "CO_2 batteries" will store the gas under high pressure when electricity is plentiful; when electricity is needed the stored gas will be run through a turbine to generate some. The advantage of using CO_2 is that it can take on a dense sort-of-liquid form at room temperature; similar systems using other gases need low temperatures. The company has built a pilot plant in Sardinia and is moving up to a commercial scale. "I dream that our domes will become an icon of the energy transition," says Claudio Spadacini, its charismatic boss, "like windmills and solar panels."

Energy Dome is one of a promising crop of firms seeking to upend the field of long-duration energy storage, or LDES. Such technologies, which can provide large amounts of electricity for hours, days or weeks when called on, are important complements to intermittent renewables—especially in systems which aim to do without any fossil-fuel or nuclear power stations. "LDES allows you to go from 60-70% renewables on the grid to 100%," says Godart van Gendt of McKinsey, who works in the field.

But you need a lot of it. Storage systems are measured in two linked but distinct ways: the power they can deliver (expressed in a multiple of watts), and the amount of energy they can store (expressed in a multiple of watt-hours). To understand the difference, think of the simple technology which provides almost all the world's LDES needs: pumped-storage hydropower (PSH). When electricity is cheap and copious, water is pumped up into a high-level reservoir. When electricity is scarce the water is allowed to run back down to a lower level, spinning a turbine as it does so.

The power rating of the system is set by the size of the turbine and the difference in water levels between top and bottom; for the world's PSH systems the total number is about 165GW. The energy-storage capacity is set by the amount of water you can get into the top reservoir in the first place. For today's PSH systems that figure is around 9,000GWhrs, or 9TWhrs.

In a report for the LDES Council, an industry body, Mr van Gendt and colleagues modelled the most cost-effective path to a world with net-zero emissions by 2040. They found that the system needed to be able to deliver 1.5-2.5TW and store 85-140TWhrs. To put that in context, America's total electricity-generating capacity today is about 1.1TW; 140TWhrs is about 5% of the EU's annual electricity consumption. Huge numbers—but achievable with sufficient investment, the report argued.

Indeed, if everything could be done with pumped hydro, this might look quite promising, given the exponential growth that has often been seen in the technologies elsewhere in the energy transition. Global wind capacity has increased by a factor of four in the decade to 2020; solar capacity increased nearly 18-fold over the same period. That makes increasing PSH capacity by a similar amount in a couple of decades sound quite reasonable.

In practice, though, things are trickier. Wind and solar benefit from the increasing returns of mass-production and started off at a very low base; PSH systems are one-offs and many have already been built. The best sites for it have often already been taken; the best remaining sites are often far from where people need power. Project-development times for PSH are long, capital costs are high and local environmental objections common. The industry thinks it is on track for a 50% increase in capacity in the next decade. But a tenfold increase in two decades looks implausible.

What is more, storage is not needed just as a way of time-shifting energy from renewables. It is also needed to keep grids stable, and to keep energy near where it will be used, to avoid grid congestion or reliance on long-distance transmission. PSH can do the first of these but not the rest.

Alternatives that can meet all these goals might also grow much faster—possibly at solar or offshore-wind rates. But they have the problem of starting at a very low level. The Global Energy Storage Outlook published by BloombergNEF (BNEF), a research firm, last year saw non-PSH storage increase 20-fold by both measures over the coming decade. But it was still only 1TWh by 2030.

Lithium-ion batteries, the cost of which has crashed due to a mixture of innovation and economies of scale, have provided by far the greatest recent advances in "grid scale" electric storage. After a 90% decline in the cost of battery packs between 2010 and 2021, reckons Citi, a bank, America is now seeing more megawatts of capacity added to its grid in the form of batteries than in the form of natural-gas combined-cycle turbines. Enormous banks of such batteries already provide up to four hours of dispatchable power to California's grid operator on demand. When Californian utilities asked companies to come up with technologies for an eight-hour buffer the winning bids all used lithium.

But though the use of such systems is sure to increase a lot—BNEF expects them to make up most of the terawatt-hours it imagines the world having by 2030—the disadvantages of hitching a ▸▸

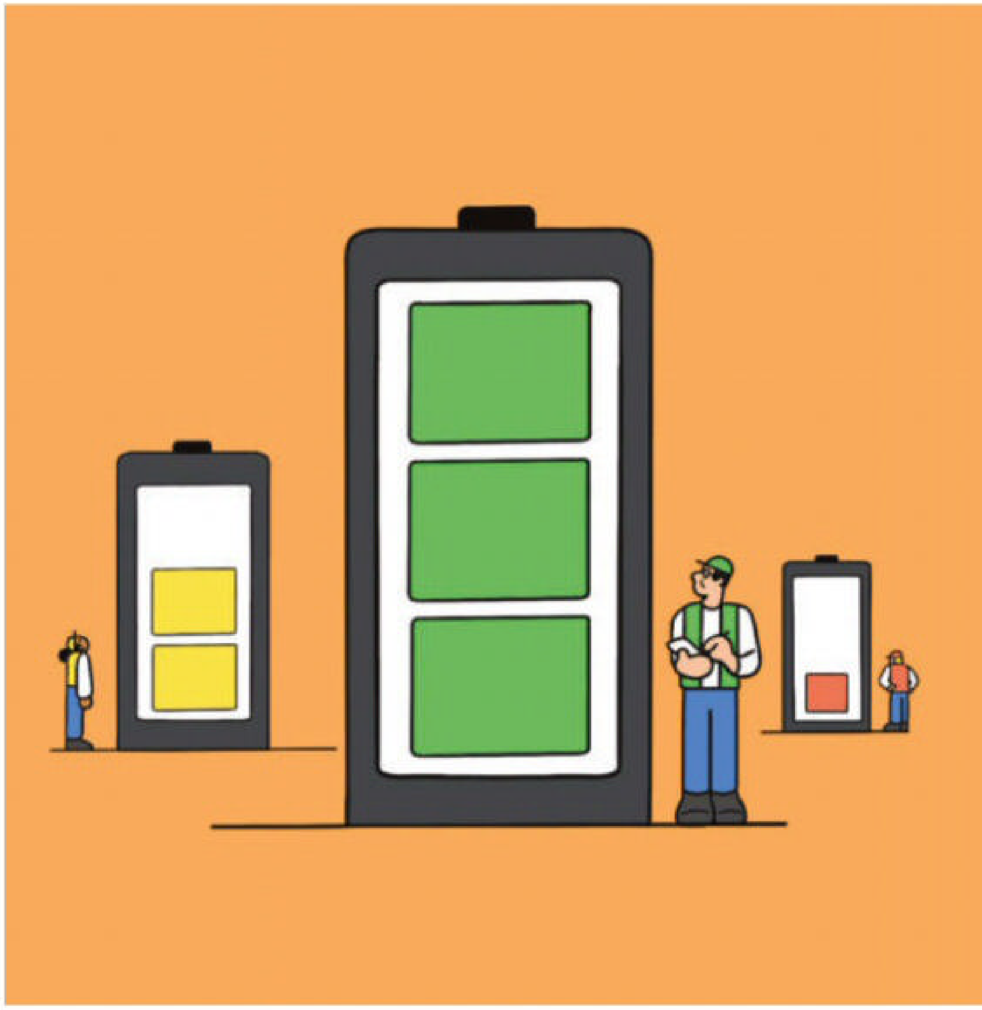
All charged up

Energy storage ● Chemical ● Electrochemical ● Mechanical ● Thermal

Selected storage technologies	Market readiness	Maximum size, MW	Average RTE*, %
● Power-to-hydrogen-to-power	Pilot	10-100	40-70
● Aqueous electrolyte flow battery	Pilot/commercial	10-100	50-80
● Hybrid flow battery	Commercial	>100	55-75
● Liquid CO_2	Pilot	10-500	70-80
● Novel pumped hydro	Commercial	10-100	50-80
● Latent heat	Commercial	10-100	20-50
● Sensible heat	Pilot	10-500	55-90

Source: LDES Council, McKinsey *Round-trip efficiency, power-to-power not including heat ride on the coat-tails of the electric-vehicle (EV) boom are becoming apparent. For one thing, there are a variety of constraints on lithium supply, and even with new mines opening up there are real worries that the booming EV industry will suck up most of their output. On top of that, the improvements in battery technology needed for EVs differ from those required for grid-scale storage. Cars need batteries that store energy in as small and light a form as possible and in a range of environments. Storage cares little for weight or volume.

Developments that excite EV-makers, such as batteries in which lithium is used as a solid metal, rather than as ions held in an electrolyte, offer little to storage people. The ability to sit unused for a long time, which storage people prize, is of only passing interest to carmakers. A recent study of emerging lithium-based technologies by IHS Markit, a research firm, concluded that "None of these systems can store the volumes of electricity required to deal with the supply and demand imbalances that are likely to arise in the future as renewable penetration rises." Only novel approaches to long-duration storage can hope to fill the breach.



That is the opportunity which Energy Dome and other innovators have in their sights. Their approaches can be divided into four groups: mechanical, electrochemical, thermal and chemical.

Mechanical storage is dominated by PSH, and probably always will be. But other options are available. Storing gas under pressure, as Energy Dome does, is one. Another is doing with big solid blocks what PSH does with water: lifting them up high into the air with cranes when energy is cheap, lowering them down with a pulley that acts like a generator when the need arises. The idea has a number of critics; but a Swiss-American startup in the area, Energy Vault, has attracted a lot of investment.

Voltage differences between various sorts of metals and chemicals are known as electrochemical storage. Electrochemical batteries have been used for centuries, but many researchers believe novel designs and materials offer new possibilities. Researchers at America's Lawrence Berkeley National Laboratory (LBNL), which did early work on the chemistry underlying lithium batteries, are using artificial intelligence to sift through hundreds of thousands of possible battery materials looking for new ideas. In what must be the geekiest proclamation ever made by a UN secretary-general, on May 16th António Guterres even called for a "global coalition on battery storage to fast-track innovation and deployment".

Batteries do not have to be packages that contain all the chemicals they make use of. Flow batteries store their chemicals in external tanks, pumping them through the battery as it charges and discharges. Bigger tanks let you store more energy. It is too bulky an approach to use for a laptop, or even a car. But that does not matter if they are to sit on the grid.

ESS, a firm in Oregon, makes a flow battery that uses widely available materials—iron and salt. When charging, the salts are converted to iron deposits on the electrode; when discharging, the iron dissolves and the stored chemical energy is converted to an electrical charge. Form Energy, one of whose founders led the energy-storage arm of Tesla, an EV-maker, also uses iron in a process it calls "reversible rust". Its washing-machine-sized devices inhale oxygen from the air when discharging to convert iron to rust; when charging, they apply a current to convert the rust back to iron and emit oxygen. The firm's claim to be able to store power for up to 100 hours will be tested at a pilot project next year.

Thermal storage is also hotting up. Antora heats up blocks of carbon to as much as 2,000°C. This stored energy can be used to heat steam or air in a pipe; the firm also claims that the glow from the toasty blocks can be directed at photovoltaic cells like those in solar panels to generate electricity. Rondo Energy uses battery bricks made of novel materials it heats to over 1,200°C. That stored energy is later delivered as heat directly, if industrial customers need it, or used to create steam that can turn a turbine. Malta, a firm in Massachusetts, is pioneering an electrothermal system that operates as a heat pump in charging mode, storing electricity as heat in molten salt, while in discharge mode it acts as a heat engine, using the stored heat to produce electricity.

> **"I dream that our domes will become an icon of the energy transition"**

Perhaps the most transformative technology is chemical storage, which uses electricity to make a chemical which can later be used in a generator or engine. The simplest option is to use renewable power to drive an electrolyser that splits water into oxygen and hydrogen, and storing the hydrogen. "Batteries are useful, but what about storage across seasons?" asks Robert Schlögl of the Max Planck Institute for Chemical Energy Conversion, a European research group. He argues that as generation of renewable energy in remote areas proliferates, more and more electricity will be stored in hydrogen for later use—or as a first step towards making more complex fuels such as synthetic diesel or ammonia.

And chemicals really are very storable. SNAM, an Italian pipeline operator with plans to spend up to €5bn on energy storage, says gas-storage sites can safely store hydrogen for long periods. Gasunie, a Dutch utility, is storing hydrogen in salt caverns near Groningen, home to Europe's biggest natural-gas field. Intermountain Power Agency, a coal-fired utility in Utah, has a salt cavern, too. It plans to fill it with renewable hydrogen that it can later burn in refurbished coal-fired stations to fill gaps in supply when renewable sources are offline.

America's Department of Energy (DOE) has just announced a $504m loan guarantee to boost Intermountain's efforts. Jigar Shah, whose loan office at the DOE controls some $40bn in funds earmarked for energy innovators, calls the project "the first-of-its-kind clean-hydrogen production and storage facility capable of providing long-term seasonal energy storage." It will not be the last. ■

Cleaning up natural gas

Low-hanging fruit

New technology makes it possible to monitor, manage and minimise the methane leaks which dog the natural-gas industry

More or less every day, several light aircraft operated by Kairos Aerospace take off from an airport in Odessa, Texas, right in the heart of America's Permian basin—and thus of its shale-oil and -gas industry. They fly low, at about 1,000 metres, their cameras scanning what passes beneath them. But they are not looking at the ground. They are looking at the air just above that ground. They are designed to detect the tell-tale infrared signature of methane as it escapes from leaks at wells, along pipelines or in storage facilities. Every day they find some. "We can image the plumes directly, tell you how big they are, and exactly where they are coming from," says Steve Deiker, the firm's co-founder.

Between October 2018 and January 2020, Kairos flew a systematic series of missions over the 36,000 square kilometres of the Permian that lie in New Mexico. It took multiple pictures of 90% of the 26,000 wells in the area and 15,000km of pipeline. In a paper published this March researchers from Stanford with access to that data estimated that the amount of methane being lost to the atmosphere was equivalent to just over 9% of the methane being produced. Roughly one tonne of methane was being lost for every nine tonnes that were not.

That is not just a waste. It is an assault on the climate. Methane absorbs some infra-red wavelengths very nicely. That makes the leaks spottable by Kairos's cameras; it also makes it a very powerful greenhouse gas. Over a 20-year period, a tonne of methane released into the atmosphere provides as much greenhouse warming as about 80 tonnes of CO_2. Burning nine tonnes of methane releases only about 25 tonnes of CO_2. If the companies in the Permian do lose one tonne of methane for every nine that they capture, those leaks warm the climate three times more, over the next 20 years, than burning the gas the companies actually sell.

Other methane-watchers find the Stanford figures to be surprisingly high. Adam Brandt, the leader of the study, says that because a very small number of sites with large leaks dominate the picture, you can only see what is really going on if, as his team did, you have very thorough coverage. Either way, there is no real doubt that leaks of methane substantially increase the amount of warming associated with using natural gas.

Russia is a particular worry. Though Europe's concerns about Russian gas are now largely strategic, there are good reasons for climate worry, too. Relying on Russian production, which is leaky and poorly maintained, means the life-cycle emissions for European gas are very high. Analysis by RMI, a think-tank, shows that methane leaks make Russian gas imported to Germany twice as damaging to the climate as the same amount of natural gas imported from America as LNG, and nearly three times as damaging as gas from Qatar shipped the same way.

In the Permian basin, if not in Russia, there are forces in play that can help to stop the leaks. Less methane is something governments want, it is something investors want and it is something which often pays its way: gas not lost to leaks is gas that can be sold. And companies like Kairos Aerospace allow all the would-be little-Dutch-boys to see where the best leaks to plug are to be found.

Norway produces huge amounts of natural gas with much lower greenhouse-gas emissions. Many governments elsewhere want to see their industries, and those which supply them, do the same. As Patrick Graichen, a senior climate official in Germany's economics ministry, puts it, "It is crucial that we tackle methane leakage through the entire value chain, from well to final consumer." The leakage rates must be low enough that emissions from gas remain well below those from coal. "It is not about incentives," he insists, "it is about hard regulation."

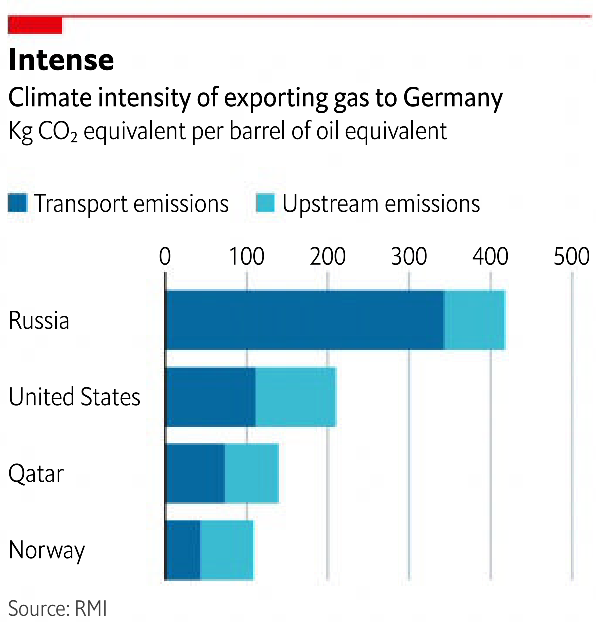
Some investors feel the same. There is hot debate, and in some quarters open scorn, about the fact that some fossil-fuel producers are assessed as meeting high environmental, sustainability and governance (ESG) standards. But they are, and taking their methane leaks seriously is one of the ways that they qualify. Fully 17% of America's gas production, and 4% of global gas production, is now certified to this end by MiQ, a not-for-profit platform. Georges Tijbosch, its boss, says the platform's assessments look at three factors: the firm's methane emissions, the technologies it uses and the policies and procedures in place for improvement.

In March the Oil and Gas Climate Initiative, which includes a dozen of the world's biggest energy firms, from ExxonMobil to Shell to Saudi Aramco, announced a goal of zero methane emissions from oil and gas operations by 2030. That will appeal to regulators and investors alike.

There is a market advantage here. Big firms can afford to clamp down on methane in a way firms less well endowed with capital and human resources cannot. That said, the expense is not likely to be crippling. According to a study by the IEA 40% of methane emissions from energy operations around the world could be eliminated cost effectively: the money spent plugging the leaks would be recouped through increased sales. And that study was based on the average natural gas price for the past five years. Apply the higher prices seen last year and almost everything needed to eliminate emissions could be implemented "at no net cost".

The only thing the leaks have going for them is that they have, in the past, been hard to spot. Major sources of unwanted gas can be burned in flares: on some nights the Permian basin seems studded with flame. But a lot of methane is vented during standard procedures or unwittingly lost to leaks. A decade ago, hand-held methane monitors were either so simple that they could not do continuous monitoring or so expensive they were impractical. Satellite monitoring was expensive, insensitive and low-resolution. Now, "Methane emissions are a problem that we have the tools to solve," says Stefan Bokaemper with the characteristic self-confidence of a technology entrepreneur. He is the boss of Kuva Systems which, like Kairos Aerospace, then sells data on methane leaks to the companies concerned: in Kuva's case the data gathered by ground-based sensors are delivered in the form of annotated video clips of the leaks that can lead to immediate action.

The first satellite capable of pinpointing methane leaks at specific installations was launched by GHGSat, a Canadian company, in 2016; it now has six in orbit and hopes to have ten up by 2023. The MethaneSAT system, developed by EDF, an American environmental group, and researchers at Harvard University, is scheduled to launch this year. Its spatial resolution is not quite as good as that offered by GHGSat, but it looks at larger chunks of the surface at a given time and can, under certain conditions, pick up lower levels of methane. Carbon Mapper, a consortium ▸▸



led by the state of California, Planet, a company which sells data from its Earth observation satellites and JPL, the institute responsible for most of NASA's planetary science, will launch two prototype satellites next year and hopes to fly a couple of dozen or so by the middle of the decade; they are intended to measure point sources not just of methane but also of CO_2.

Such schemes typically work together with airborne detectors. Bridger Photonics, a startup, uses helicopter-mounted lasers rather than ambient light to pick up methane's telltale spectral signature. Baker Hughes says its drones can detect and quantify methane emissions with flow rates as low as 0.12kg/hour (170 litres/hour). SeekOps has drones that sniff instead of seeing, measuring methane in the air they fly through with very high precision.

There is also a rush to come up with ground-based technologies for detecting methane, like Kuva's. Cheapish always-on sensors that report back regularly have advantages over drones and satellites that visit more rarely. Project Canary, which helps companies meet ESG commitments, offers a cloud-based service that monitors methane using rugged, ground-based monitors that report back 6,000 times a week.

All this wizardry would not be enough if the industry were still in denial. At least at the biggest firms it is not. Walking around Chevron's central tank battery at its GBG field in the Permian reveals an increasingly thoroughgoing approach to methane. The firm has completely changed how it designs and manages such kit. It has eliminated pneumatic controls that bleed natural gas, and converted them to air compressors. It has made modifications including redundancies so that there are zero routine tank-vent emissions and no flaring.

The firm's methane emissions at on-shore facilities in America are less than a fifth of the industry average. It has centralised processes and introduced accountability for emissions, even baking it into compensation. Chevron's Ryder Booth sums up the methane strategy this way: "Culture is the most important factor." ■

Burning natural gas

The long goodbye

Making natural gas emissions-free means dealing with its carbon content either before burning it or after

On a gravel road in La Porte, an industrial city to the south-east of Houston, a series of billboards tells an inspiring story. "Burn natural gas" says the first, "Generate electricity" the second. After that comes "Capture all emissions" and, finally, "Change the world". The outwardly unremarkable industrial facility at the end of this display of Burma-Shave Americana has big ambitions. Its owners see it as a step towards making natural gas a permanent part of zero-emission electric grids around the world.

The first two billboard injunctions are, in themselves, unproblematic. As long as methane losses in the journey from gas well to turbine are kept low, combined-cycle gas turbines (CCGTs) are the most efficient way of producing electricity from fossil fuels on a large scale; after passing the hot combustion gases through a primary turbine, they harvest the left-over heat to drive steam through a secondary turbine for an overall efficiency of about 60%. That means they produce on average only about 350kg of CO_2 per MWh of electricity. Coal-fired power stations can easily produce twice as much, and a bunch of other nasty pollution to boot.

There is, however, a world of difference between lower emissions and zero emissions. In 2019 the 6,300TWh of electricity that was provided by natural gas worldwide came at a cost of over 2bn tonnes of CO_2.

Hence billboard three: "Capture all emissions". In principle it is possible to scrub the CO_2 out of a CCGT's exhaust and stash it away—an approach called carbon capture and storage (CCS). Since the turn of the century CCS has been held up as a way in which coal and gas could go on being used to generate electricity without wrecking the climate, both by being retrofitted to existing plants and designed into new ones.

The degree to which this has failed to happen is quite spectacular. The IEA's Net-Zero Emissions scenario calls for CCS in electricity-generating plants to be capturing 430m tonnes of CO_2 a year by 2050. The only commercial power station in the world currently using the technology captures 1m tonnes a year. And it runs on coal. There is not a single operational CCGT fitted with CCS.

There are many reasons for this. Some in the industry point to a stubborn unwillingness by greens to see any sort of fossil-fuel use as a helpful part of climate action. Eye-rolling can-you-blame-us greens complain that the industry is following a "make me chaste—but not yet" strategy worthy of St Augustine. It talks about CCS to provide an illusion of future viability while doing nothing to make that future real.

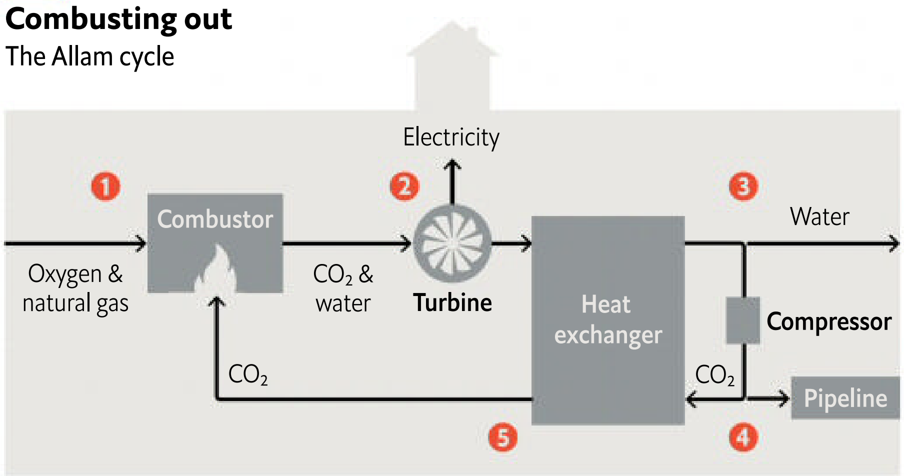
On top of this there are real technical problems. None of them are showstoppers but they are troublesome. And they are likely to reduce the efficiency of the power plants to which they are affixed. Adding CCS to a CCGT plant could increase the cost of its electricity by 50%, though that figure depends on the natural-gas price.

The installation at the end of the series of billboards in La Porte cannot on its own do anything about the politics of CCS. But it does aim to clear up the technical problems inherent in "Capture all emissions". Rather than add CCS equipment to existing gas-plant designs, the startup which built it, NET Power, has built a new sort of generator that is CCS-friendly from the get go. It uses an approach called the Allam cycle.

In an Allam-cycle plant the incoming air is stripped of everything but oxygen; that oxygen is then burned with natural gas in an atmosphere of pure, hot CO_2 (see diagram). The additional heat ▸▸

Combusting out

The Allam cycle



1 Natural gas is burned with oxygen in a combustor 2 The combustor expels a high-pressure mix of CO_2 and water, which drives a turbine to produce electricity 3 Water is removed and the gas is compressed 4 Excess CO_2 can be stored underground or used for industrial purposes 5 The remaining CO_2 is reheated and returned to the combustor, where the cycle begins again

Source: NET Power

from the combustion drives the stream of CO_2 through a turbine, producing power. The heat in the exhaust gas is removed in a heat exchanger and the combustion products—water and some extra CO_2—are taken out of the system. The same heat exchanger then heats the remaining CO_2 back up so it is ready to go through the system again.

It is an elegant idea, generating electricity almost as efficiently as a CCGT in a plant with a single turbine and providing a waste stream of pure CO_2, thus taking most of the CC out of CCS. As engineers know, elegant does not mean easy. It took many years of hard development work before, last November, the pilot plant in La Porte began delivering electricity to the Texas grid.

NET Power claims its commercial plants should cost no more to build or operate than today's CCGTs. Baker Hughes, an energy-services firm, Oxy Low Carbon Ventures, the climate-tech division of Occidental, an oil and gas company, and Constellation, a power utility, are now working with 8 Rivers, the innovative investment firm that incubated and nurtured NET Power's technology in order to take the technology further and increase the size of the plants from 50MW at the demonstration site to 300MW elsewhere.

Paul van Poecke, executive co-chairman of Tree Energy Solutions, a green hydrogen firm, is licensing the technology and plans to build several units in Europe: "Thanks to Texas, the technology is good to go, mature to scale up and be running by 2025 or 2026." Other global investors are looking to develop the technology at commercial scale in Britain and Canada.

This is all encouraging. But before the company gets to "Change the world" there are two substantial obstacles to overcome. One is that to replace an existing CCGT with an Allam plant will probably be even more expensive than fitting it with CCS. The other is that you need to have somewhere to put the CO_2 so handily captured. In Texas there is demand for CO_2 from companies like Occidental, which pump it down wells to flush out more oil. That market is not available everywhere.

A world in which the Allam cycle moves quickly into a lasting role is a world in which people are willing to write off existing generating plant and also one where there is stable, well-monitored underground storage capacity for billions of tonnes of CO_2.

Such a scenario is not inconceivable. The net-zero strategies countries started pursuing after the Paris agreement of 2015 do not imagine all greenhouse-gas emissions stopping completely. They see residual emissions cancelled out by "negative emissions" which draw down CO_2 that is already in the atmosphere. Some negative-emission technologies store the carbon they sequester chemically in biomass, soils or minerals. But some contenders need to bury it away underground in saline aquifers (which provide no drinking water) or played-out oil fields.

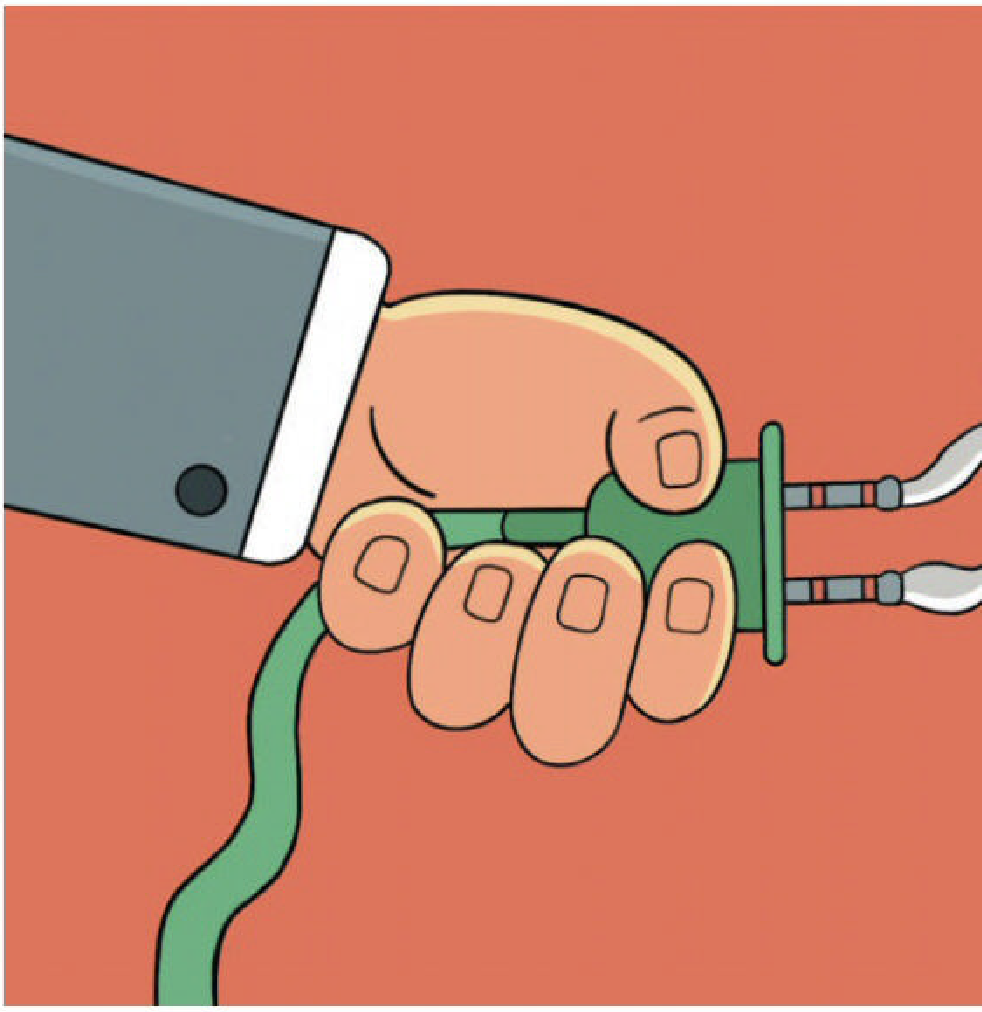
Bioenergy with CCS, or BECCS, burns biomass to drive turbines and generate electricity while using CCS to dispose of the CO_2 produced in the process. Because the carbon in the biomass came from the atmosphere—the biomass grew by means of photosynthesis—this reduces the atmospheric carbon-dioxide level. "Direct air capture" (DAC) uses huge banks of fans and chemical engineering to pull CO_2 out of the atmosphere. If either is used on a large scale—and it is unfortunately hard to imagine a world staying below the Paris agreement's 2°C limit if this does not happen—the world will need to find secure underground resting places for tens of billions of tonnes of CO_2. In such a world CO_2 from Allam-cycle power stations, or normal plants fitted with CCS, could be buried in a similar way. Indeed doing so would help to prove the storage capacity for later use.

The mainstream alternative to a world in which new infrastructure can continue to burn natural gas because it comes equipped with CCS is one in which existing gas infrastructure is first made as clean as possible and then sees increasing amounts of unnatural gas added to its fuel stock in the form of hydrogen created specially for the purpose.

The European Commission is taking a lead on cleaner infrastructure. As well as seeking to eliminate methane leakage, it wants to see investment only in new gas power plants that emit less than 270kg of CO_2 per MWh.

On replacing natural gas altogether things are a little sketchier. European politicians and companies are promising piously to "future-proof" all their gas-related infrastructure by making it ready for hydrogen and other "green gases" (such as methane produced from biomass). The commission's REPowerEU strategy, which foresees €210bn of investment by 2027, calls explicitly for "hydrogen-ready infrastructure."

Unfortunately, these policies are poorly defined. A knowledgeable European government official who specialises in hydrogen insists that the war in Ukraine will "speed up the global market for green gases and derivatives." Push him hard on future-proofing, though, and he throws up his hands: "At the moment it's at the lev-



el of political wishes, not technological details. It's not clear how it will work."

And it is not just the future-proofing that is open to question. So are the relative importance of different sources of hydrogen and the ways in which it might be shipped, and, particularly in Europe, the relative importance of energy security and climate security.

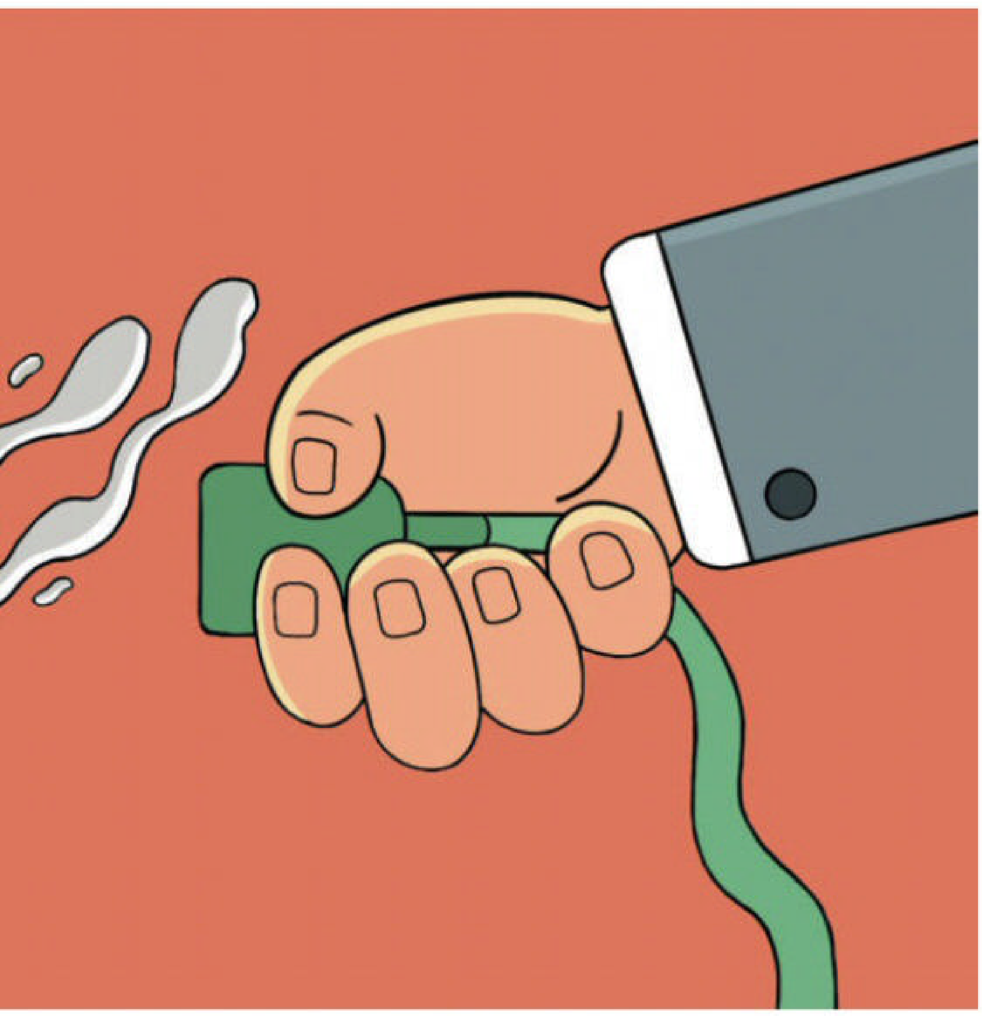
> "At the moment it's at the level of political wishes, not technological details"

For greens, the preferred form of hydrogen is made with renewable electricity and electrolysers, known as "green hydrogen". The REPowerEU plan says that "renewable hydrogen will be key to replacing natural gas". But this is an idea whose time has not yet come. Capacities are small, and costs are high, which makes green hydrogen a non-starter in terms of energy security. There is no plausible path leading to Russian gas being entirely replaced by green hydrogen in a decade.

The alternative is a two-stage greening, dependent on "blue hydrogen" made by reacting natural gas with steam, keeping the hydrogen thus produced and disposing of the concomitant CO_2 in the sort of underground dump used for DAC and CCS. A two-stage blue-hydrogen strategy for Europe would quickly replace Russian natural gas with imports from elsewhere, mostly in the form of LNG, and, over time, it would use more of that natural gas in the form of blue hydrogen. Thus it hopes to achieve both climate and energy security.

For a process dominated by economies of scale it makes sense to turn the natural gas into hydrogen close to where it is produced; there are far fewer producers of LNG than there are consumers of it. Making every LNG terminal have a blue-hydrogen plant with CCS on hand makes much less sense than having acceptable gas exporters like America, Australia and Qatar make the hydrogen and ship it over more or less ready to use.

The problem with this is that shipping hydrogen is hard. Like natural gas, it can be liquefied. But whereas liquefying natural gas only requires temperatures of -160°C, to liquefy hydrogen you need refrigeration systems capable of getting down to -253°C. That is an expensive proposition. Using current technologies the energy required is 30% of that in the hydrogen being liquefied. But it is doable, and the resultant liquid can be shipped in tankers like those used for LNG, though again specialist materials and designs are required. *Suiso Frontier*, built by Kawasaki Heavy Industries, recently sailed from Australia to Japan with the world's first cargo of liquefied hydrogen. South Korea's KSOE plans to have a similar vessel ready by 2025.



A leading alternative is to turn the hydrogen into ammonia. Like liquefying it, this is expensive. But it is a well understood technology. Liquid-hydrogen expertise is rare outside the space-launch business. Making ammonia from nitrogen and hydrogen is the basis of the fertiliser industry. And ammonia is liquid at temperatures as high as -33°C, which means it can be carried in fairly normal tankers. Once ashore, it can either be "cracked" back into hydrogen or used as is. Last October JERA, Japan's biggest power firm, started to experiment with burning ammonia at the site of the country's biggest coal-fired power plant. It plans to increase the concentration to 20% during the pilot, and ultimately to switch off coal and use only ammonia. Though ammonia is a less efficient fuel than hydrogen, using it directly saves the cost of cracking.

Thinking ahead

At the moment, Europe is not telling companies how to import hydrogen from overseas. But it is making it very clear that they should plan on doing so. Patrick Graichen of Germany's economics ministry says LNG-import terminals that are on land (as opposed to floating LNG "regas" ships, which can sail away when they are no longer needed) must be "hydrogen ready, or at least green-ammonia ready."

To encourage firms to make the extra investment in fuel flexibility, the government will grant LNG-import terminals only a "limited permit" that will expire in two decades, the implication being that getting a new permit will only be possible if you have the capacity to handle alternatives: "Either it's turned off in 2043, or from the very beginning you're already planning that conversion," says Mr Graichen.

Once the hydrogen comes ashore it needs to get to the plants that will burn it. Small amounts of hydrogen can be moved around through some existing pipelines simply by adding it to the natural gas they carry. To transport pure hydrogen, though, will often require significant retrofitting. Being truly hydrogen-ready means upgrading a system's steel, gaskets and valves and modifying aspects of its design. It could double the cost. Greenwashing strategies that claim systems are hydrogen-ready when they are not seem horribly plausible.

After transport comes use. Again, early on this should not be too hard. Tests in several countries have shown that modern CCGT plants can run blends of natural gas containing 20-30% hydrogen without problems. Above that, though, you start to need adjustments to fuel injectors, burners, combustion controls, process safety systems, valves and so on. Several CCGT manufacturers, including Mitsubishi and GE, are pushing ahead with efforts to commercialise proven turbine-technology for burning pure hydrogen, but they will take time to scale up and roll out.

The worry this all raises is that a European transition based on moving to hydrogen via LNG may provide energy security but falter well before it reaches its 100% hydrogen-in-end-use goal. "Europe is fully conscious of the risk of being locked in with LNG," insists Pierre-Etienne Franc, boss of Hy24, a European investment firm focused on clean-hydrogen infrastructure that has recently raised €1.5bn. But knowing the risks will not in itself make alternatives like green hydrogen come to market quicker. ■

Going beyond the grid

Heat, hope and hydrogen

Green gases can help tackle the hard-to-decarbonise industry

USING ELECTRICITY to do things currently done with fossil fuels means generating more of it. If all America's cars were EVs and Americans drove as far in them as they drive today, the country's power consumption would rise by 28%. If just two of Germany's largest industrial sites—the Ludwigshafen complex run by BASF, a chemicals goliath, and the Duisburg plant run by ThyssenKrupp, a steel giant—were to run on currents not hydrocarbons, the country's electricity consumption would be increased by 15% at a stroke, says Klaus Schmitz of Arthur D. Little, a consultancy.

That is a daunting prospect for developing countries which do not have the capacity to meet today's demand. It is less worrying for countries like America, Germany and Japan where new capacity is affordable and grids are getting more sophisticated. But it is still a huge challenge. And there are still difficult decisions to be made about what is electrified directly and what is electrified indirectly with green hydrogen.

The cost of making hydrogen from renewables is high. But it is also plunging. The falling cost of renewable energy itself is being amplified by improvements in the technologies of hydrogen manufacture—notably the electrolysers in which water molecules are torn apart to make hydrogen and oxygen. Electrolysers are ripe both for innovation and for economies of scale. They may well be the next technology to shoot down a precipitous cost curve in the way that solar cells and batteries have. Emma Champion of BloombergNEF, a research firm, predicts that by the end of this decade green hydrogen will be cost-competitive with hydrogen from fossil fuels, even if it is made without CCS.

It combines informed, technical imagination with the conservatism of good engineering

And it will keep going. Vinod Khosla, a venture capitalist with a long-standing interest in climate change, expects cheap renewables making cheapish hydrogen will lead to a booming market for the stuff. "If this path starts to work, our needs for electricity will grow hundreds of percent over our current forecasts for 2040, making solar even cheaper," he predicts.

Such hydrogen will not, though, be a one-for-one replacement for natural gas in all applications. In high-temperature turbines it makes sense. In domestic boilers it generally does not. Going from a natural-gas-fired boiler to a hydrogen-fired one may sound nice and likely to be minimally disruptive. But using electricity to make hydrogen to burn in a boiler is much less efficient than using it to run a heat pump.

Electric heat pumps are, in effect, air conditioners that run in reverse. The energy they use does not heat things up directly. Instead it moves heat from one place to another, and moving heat can be more effective than producing it. A heat pump that heats a house using warmth from the ground beneath it can produce 400W of heating for every 100W of electricity consumed. Retrofitting houses with heat pumps can be costly and inconvenient, and the workforce needed to do so at scale does not exist. But it still seems more sensible than burning hydrogen, a process which always releases less energy than making the hydrogen required in the first place. For living spaces, workspaces and industrial processes requiring "low grade" heat, which is to say temperatures below that of boiling water, heat pumps look like the way to go.

This is a tall order. In a scenario designed to limit warming to 1.5°C above the preindustrial level produced by IRENA, a UN body devoted to renewable energy, the number of industrial heat pumps will have to rise from fewer than 1m in 2019 to 35m in 2030 and 80m in 2050. In buildings, it calls for growth from 53m in 2019 to 142m in 2030 and 290m in 2050.

For high-grade heat, above 500°C, hydrogen probably has the edge. And it will have other niches, too. One of the reasons that the chemicals and steel industries are locked into fossil fuels is that they make use of their chemistry—the way the carbon and hydrogen inside them react with things—as well as the energy stored up in them. Making iron from iron ore and then steel from iron requires chemistry as well as heat, and the steel industry has grown up relying on fossil fuels for both.

At a factory in Toledo, Ohio, Cleveland-Cliffs, the biggest supplier to the American automobile industry, uses natural gas to remove the oxygen from iron ore, producing briquettes of direct-reduced iron (DRI). Hydrogen can do much the same job. Lourenco Goncalves, the firm's boss, says that replacing 30% of the natural gas with hydrogen would be easy if the plant had a reliable hydrogen source, and 70% could be achieved with limited modifications, slashing emissions by over 1m tonnes a year. Going hydrogen-only would be harder, but such plants are quite possible.

The DRI made in Toledo still goes into coal-fired blast furnaces. But it could be put into electric-arc furnaces (EAFs) which melt iron with electricity. The addition of some carbon to turn the iron to steel is still necessary; heat produced by fossil fuels is not. In the net-zero-emissions scenario published by the IEA in May around two-thirds of primary steel production in leading industrialised countries used the hydrogen DRI-EAF route by 2050. India's Tata Steel said last year that it would use this approach to green steel at a big plant in the Netherlands.

For a sense of the multifaceted, and integrated approach to energy infrastructure that climate action makes necessary and technology makes possible, come back to Berlin. Reuter West, one of the largest generators on the 50Hertz grid, is a large coal-fired plant operated there by Vattenfall, a Swedish firm. By 2030 the firm hopes to have it running on natural gas and be hydrogen-ready. The district-heating system which relies on the plant's hot water will be augmented with heat pumps. Hot water will be used for energy storage, too, in the form of a giant vacuum flask which can hold 56,000 tonnes of water at a couple of degrees below boiling.

Like all the paths forward in this report, the project is constrained by the history of what came before. It combines informed, perhaps idealistic, technical imagination with the kick-the-tyres conservatism of good engineering. It depends on the integration of technologies old and new to control immense flows of power. And it is a work in progress. If you want a mascot for the energy transition, you could do much worse. ■

ACKNOWLEDGMENTS A list of acknowledgments and sources is included in the online version of this Technology Quarterly

OFFER TO READERS Reprints of this TQ are available, with a minimum order of five copies. For academic institutions the minimum order is 50 and for companies 100. We also offer a customisation service. To order, contact Foster Printing Service: Tel: +1 866 879 9144; email: economist@fosterprinting.com

For information on reusing the articles featured in this TQ, or for copyright queries, contact The Economist Rights and Syndication Department: Tel: +44 (0)20 7576 8000; email: rights@economist.com

MORE TECHNOLOGY QUARTERLIES Previous TQs can be found at Economist.com/technology-quarterly

Graft in South Africa

The rot that spread

VREDE

As a landmark inquiry into corruption concludes, South Africans demand the prosecution of those implicated

To the new arrival at the Vrede Dairy, named after a town in the Free State that is not so much sleepy as catatonic, its iron gate is unremarkable. But to Ephraim Dlamini the structure is a symbol of what went wrong in one of the most notorious cases of "state capture": the era of looting in South Africa allegedly orchestrated by Jacob Zuma (pictured), the former president; his son, Duduzane; allies such as Ace Magashule, the former premier of the Free State province; and Ajay, Atul and Rajesh Gupta, three Indian-born brothers.

The provincial government, which funded the dairy, spun it as a scheme to help poor locals. In reality, it was taxpayers who were milked. They pumped in 280m rand (currently $17.6m), most of which seemingly ended up in Gupta-linked accounts. Procurement prices were vastly inflated: the gate, and accompanying security post, cost 2.6m rand. And the supposed beneficiaries were kept far away. "We weren't allowed to enter the farm," recalls Mr Dlamini. "And if you talked about it you were in the grave."

The Free State first funded the project in June 2012. A decade on—and four years after Cyril Ramaphosa replaced Mr Zuma as president—the province gave a 51% stake in the dairy to the "beneficiaries". Yet they are struggling. They lack capital, training, working machinery—and, crucially, cows to milk. Some fear they are being set up to fail by the province. "I think they're using us," says Loliwe Ngwenya, whose father was murdered in 2018, shortly after he made an official complaint about the project. "We're fighting but we're not getting anything." She notes that the alleged architects of the scheme, as well as whoever killed her father, remain at large.

→ Also in this section

49 Cyril Ramaphosa cowed

49 Israel's fallen government

50 Saudi Arabia's reputation

"The only thing we want is justice."

It is a sentiment echoing across the country. Many South Africans have placed hope in an official commission into state capture, chaired by Raymond Zondo, a judge and since April the country's chief justice. The commission published its final reports on June 22nd. These included its findings about the Vrede Dairy, which it deemed "a project of the Guptas". The commission asked the authorities to consider prosecuting, among others, Mr Magashule.

Taken as a whole, the reports document the astonishing scale of graft under the ruling African National Congress (ANC). Their thousands of pages mean that no reasonable South African can deny how close the country came to the abyss. Whether they pave the way for widespread prosecutions depends on a state whose enfeeblement the reports exhaustively reveal.

During Mr Zuma's reign acolytes of the president dismissed allegations of corruption as a plot by political opponents to derail their efforts to help the poor. Justice Zondo dismisses this notion. The Guptas, notes one report, identified Mr Zuma "at a very early stage as somebody whose character was such that they could use him against the people of South Africa". The former president, meanwhile, "would do anything that the Guptas wanted him to do". (The Guptas and Mr Zuma deny wrongdoing and say the allegations against them are politically motivated.)

That led to schemes that are now notorious. Allies of Mr Zuma would be appointed, allegedly at the behest of the Guptas, to powerful positions at state-owned enterprises (SOEs) or government departments. In return for bribes or cuts they would steer contracts to Gupta-linked firms. Institutions meant to crack down on graft were infiltrated to ease the looting. Blue-chip firms such as Bain & Company, KPMG, McKinsey and SAP were allegedly linked to various schemes. Bell Pottinger, a public-relations outfit, helped spin the lie that critics of Mr Zuma and the Guptas were agents of "white monopoly capital".

Take the money and run

The commission said that at South African Airways, Dudu Myeni, then the chair of the state-owned airline, acted with "corrupt intent" and was "unlawfully benefiting" from the help of the State Security Agency (SSA), a spy organisation, in crushing enemies. She has denied wrongdoing. At Transnet, the public freight operator, more than 40bn rand was diverted in a "Gupta racketeering enterprise", while staff lavished cash on luxury cars and properties.

A similar modus operandi was evident at Denel, an arms maker, and Eskom, the electricity utility, which was looted for about 15bn rand. The commission's findings show that Mr Magashule acted like a mini-Zuma. He allegedly steered public funds to Gupta-linked schemes, including the Vrede Dairy, which reportedly helped pay for a plush wedding for the Indian family. Mr Magashule has denied wrongdoing.

The details do not end with looting. As head of the South African Revenue Service (SARS), Tom Moyane, another Zuma appointee, "dismantled the elements of governance one by one", concludes the commission, "seizing control of SARS as if it was his to have". An attempt to bribe the then deputy minister of finance, Mcebisi Jonas, so that he would take the top job and become a Gupta lackey—the case that catalysed investigations into state capture that ultimately led to the commission—was deemed credible. So too was the report that the Guptas were behind the replacement of a respected finance minister, Nhlanhla Nene, with an inexperienced MP.

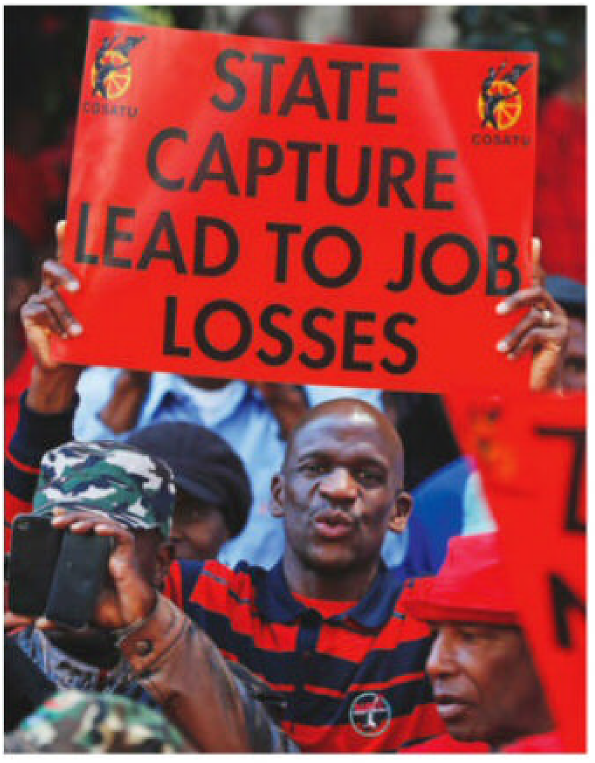
The SSA was the subject of an entire volume of one of the final reports. The agency was said to run partisan operations in support of elements of the ANC and withdrew vast amounts of cash without accounting for it. Justice Zondo also concluded that Mr Zuma encouraged the SSA not to investigate early concerns about the Guptas' influence. Had it done so, state capture might have been averted.

For all the focus on Mr Zuma and the Guptas, the reports show that corruption was widespread in the ANC. For instance Bosasa, a services firm, bribed on an "industrial scale" to win contracts. The commission concluded that "during this period the most dominant political faction—the ANC under President Zuma—permitted, supported and enabled corruption and state capture."

The Zondo reports have also indicated how government policies facilitated corruption. Black Economic Empowerment, a scheme to transfer wealth to black South Africans, was used as an excuse to give contracts to chums. It encouraged the outsourcing of work to firms even though the state was capable of doing the job. The ANC's policy of "cadre deployment", whereby unqualified comrades are given public jobs based on factional fealty, made the state less competent. Justice Zondo notes that such appointments are "unlawful and unconstitutional".

Mr Ramaphosa, who was deputy president under Mr Zuma, was in charge of this "deployment" for much of the period. He does not emerge unscathed from Justice Zondo's latest findings. In a deliciously legal turn of phrase, the judge notes that the current president's claims to have quietly and privately tried to stop graft "suffers from his inability to provide any further examples of resistance". Moreover, his ANC presidential campaign is criticised for "solicit[ing] donations from individuals suspected to be involved in corrupt activities."

The inquiry is thus a damning verdict on almost three decades of post-apartheid South Africa. Across nearly 5,500 pages it underlines how, having helped make the country a democracy, the ANC proceeded to debase it. It also offers recommendations to stop this from happening again. Justice Zondo calls for tighter rules on procurement; a statutory body to oversee the appointment of senior figures at SOEs; a permanent anti-corruption agency; and, so as to reduce the power of the party over the executive, a directly elected president. It is a blueprint that may prove useful in the years ahead, when the probable collapse of the ANC's national majority leads to a more fragmented politics.



Those who paid the price

For now, the big question is whether any of the alleged gangsters will end up behind bars. The commission urged the authorities to consider prosecuting dozens of people, including cabinet ministers past and present; MPs; executives of the state-owned enterprises; and Mr Zuma himself.

In recent weeks there have been signs that the wheels of justice are turning. In May the Hawks, a police unit, and the National Prosecuting Authority (NPA) arrested five executives accused of fraud at Transnet. In early June two of the Gupta brothers were arrested in Dubai; the NPA is working on their extradition.

The task ahead is huge. The Zondo commission may have been headed by a judge but it was not a court of law. Successfully prosecuting so many state-capture cases would be daunting for any criminal-justice institution. But under Mr Zuma the organisations meant to investigate crimes were captured, too. Shamila Batohi, who took over as head of the NPA in early 2019, has had to rebuild an institution that was deliberately sabotaged. Still, critics have long worried about the lack of prosecutions led by the NPA in conjunction with the Hawks and the Special Investigations Unit, a branch of the executive.

Jailhouse rock

Mr Ramaphosa has, unlike his predecessor, left these institutions largely alone to do their jobs. But senior figures in the NPA have lamented the lack of funding and qualified lawyers to go after complex crimes. It is hard to escape the conclusion that Mr Ramaphosa, who needs the ANC's blessing to run for re-election, could be doing more to ensure that perpetrators are brought to justice. The farmers in Vrede seem symbolic: notional beneficiaries of a new era but in reality cast adrift by an uncaring state and still without justice for those who wronged them.

In many ways the Zondo commission is laudable. Not every country is willing to air so much dirty laundry, so publicly. In its scope the inquiry has been compared to the Truth and Reconciliation Commission (TRC), which held post-apartheid hearings into human-rights abuses. Yet that likeness also hints at its shortcomings.

The TRC, though praised more fulsomely abroad than in South Africa, revealed many truths. But after it closed the government neglected its recommendations. In a similar fashion the Zondo commission has ensured that no one can deny the extent of corruption during the ANC's 28 years in power. Justice, like reconciliation, may, however, prove only partial. ■

South Africa

The longhorns and the law

JOHANNESBURG

The strange yet revealing case of cows, Cyril Ramaphosa and cash in a sofa

Cyril Ramaphosa loves Ankole cattle. "The graceful movement of these amazing creatures", he writes in "Cattle of the Ages", a book he co-wrote about the majestic cows, "speaks to the gentle whispers of the ancestors in the wind." In recent weeks, however, the animals have been less a source of joy than of controversy for the tycoon-turned-president.

On June 1st Arthur Fraser, an ex-head of the State Security Agency (SSA), an intelligence organisation, asked police to investigate Mr Ramaphosa about a series of events starting in 2020. In an affidavit Mr Fraser claims that thieves broke into Mr Ramaphosa's cattle farm that year and stole at least $4m in cash hidden in furniture. Mr Fraser alleges that Mr Ramaphosa asked the head of his presidential protection unit to investigate the robbery.

The presidential guards, says Mr Fraser, tracked down and illegally detained suspects, including one in Namibia, after Mr Ramaphosa asked the neighbouring country's president for help. All of this took place outside formal channels, claims Mr Fraser, and was thus against the law. That the president allegedly held a large sum of American dollars, which are subject to strict controls in South Africa, also points to money-laundering, he adds.

Mr Fraser is not a disinterested party. As a senior official at the SSA he ran a rogue unit that spent vast sums on political operations without authorisation, according to Jacques Pauw, an investigative journalist. (Mr Fraser denies wrongdoing and is suing Mr Pauw for defamation.) A report on the SSA released in 2019 said it was politicised and had become a "cash cow" for many inside and outside the agency. A judicial commission investigating graft under Jacob Zuma, Mr Ramaphosa's predecessor, released its final reports on June 22nd (see previous article). The volume on the SSA said that there were serious allegations of "massive abuse of the assets of the SSA" when Mr Fraser was in charge. The commission recommended that criminal prosecutors investigate Mr Fraser with a view to possibly bringing charges against him. Mr Fraser's attack on Mr Ramaphosa could be seen as a warning not to prosecute people implicated by a commission.

The allegations against Mr Ramaphosa may seem trivial compared with those against Mr Zuma. Nonetheless, they may help the pro-Zuma faction of the ruling African National Congress (ANC). (Last year Mr Zuma was jailed for defying a court order to testify to the commission. Mr Fraser, who was by then running the prisons service, released him on medical parole, a decision later deemed unlawful by a court.) Politicians allied to the former president wish to unseat, or at least weaken, Mr Ramaphosa ahead of elections due in 2024.

A bit of bovine bother

The president dismisses Mr Fraser's claims. He says much less than $4m was involved, the proceeds of sales of game. But questions remain. Was the cash properly accounted for? Did the presidential protection unit act appropriately? Mr Ramaphosa's enemies will also beef about his running a hobby farm when so many national problems require his attention. ■

Israeli politics

Once more unto the booths

JERUSALEM

Israel faces a fifth election in four years after its government collapses

A week after their first anniversary in office, the two leaders of Israel's unwieldy government announced jointly on June 20th that they had "exhausted all efforts to stabilise the coalition" and would be dissolving Israel's parliament, the Knesset. Israel is heading for its fifth general election in less than four years.

A series of inconclusive elections and a long period of political paralysis were supposed to have come to an end last June, when Naftali Bennett, an arch-nationalist, and Yair Lapid, the leader of Israel's largest centrist party, managed to yoke together eight disparate parties, including an independent Arab party—the first ever to participate in an Israeli government. This clunky coalition was able to confect a wafer-thin majority in the Knesset and was thereby able to end the reign of Binyamin Netanyahu after 12 years as prime minister.

For a short while things went fairly smoothly. The government passed a long-delayed budget. But Messrs Bennett and Lapid were soon struggling to keep their coalition of contradictions together. In April a religious-nationalist member of the Knesset defected to the opposition, depriving the government of its majority. "I am unable to lend a hand to damage the state of Israel and the Israeli people's Jewish character," she declared. Incapable of passing tricky legislation, the government finally fell after its Israeli-Arab members refused to renew a law governing Jewish settlements in the occupied West Bank. The opposition, led by Mr Netanyahu, supports the law in principle but voted against it to bring about the government's collapse.

Under the terms of the coalition agreement, Mr Bennett, the prime minister, (who recently told *The Economist* that he had "learned the value of compromise during the past year") will cede his job to Mr Lapid during the election campaign. Mr Lapid, in turn, will try to prolong his time as prime minister by preventing Mr Netanyahu from returning to power.

Mr Lapid can do little as caretaker of a government without a majority. The son of a former justice minister, he is steeped in politics and the media; he was a TV anchor as well as a poet and amateur boxer. Unlike Mr Bennett, he supports in principle an independent Palestinian state, albeit demilitarised. But that is not on the agenda.

The latest polls predict yet another stalemate. Mr Netanyahu failed four times in a row to secure an outright majority for his bloc of right-wing and religious parties, but held on as a caretaker prime minister through election after election. This time he clearly thinks he can do better by campaigning against the unlikely coalition he has just helped to bring down. He was quick to lambast the outgoing government for "relying on supporters of terror". In the coming campaign he is likely to denounce his opponents as "controlled by the Muslim Brotherhood".

Such absurd scaremongering may win votes, although it may also prompt Israeli-Arabs, who are more than a fifth of the population, to turn out to vote in greater numbers than usual. Many on the right see the inclusion of an Arab party in government as "an experiment" that has now failed. But given the daunting arithmetic of cobbling together a majority, it is hard to imagine that the centre and left will not turn to Arab parties again. Whatever the election result, the now-defunct coalition may well have changed Israeli politics for good. ■

Saudi Arabia

Princes, purses and putters

DUBAI

The kingdom still believes that wads of money can restore a reputation

It is a golf tour that would make a coddled Saudi bureaucrat happy. The work-week is short: 54 holes over three days, instead of the 72 over four days that is usual at other tournaments. A rolling start means play can finish within five hours. Those who play badly cannot fail to make the cut; even the worst collects $120,000. Take a World Bank report on the Gulf's laid-back, overpaid public sector, add caddies and caps, and you have the concept behind the Saudi-financed LIV tour. (LIV, by the way, is the Roman numeral for 54, an impossibly low score for one round.)

Golf is usually a polite game. But the Saudi-backed tour, which held its inaugural event near London on June 9th, has brought howls of vituperation. The PGA Tour, which runs the established circuit for top players, suspended 17 rebel players who took part in LIV's first event. Some golfers fear it will "fracture the game". Fans have railed against defectors taking exorbitant sums to join the new tour. For all the changes in Saudi Arabia over the past seven years, the kingdom is stuck on its old strategy of trying to buy its way out of a shoddy reputation.

Despite some far-fetched spin from politicians and LIV players, golf will not transform Saudi Arabia's post-oil economy. Nor will it provide much live entertainment for Saudis. Only one of its eight events will be played in the kingdom, on a course north of its commercial city, Jeddah. Organisers have struggled to find broadcasters for the LIV tournaments. In many places they can be watched only on streaming services, including one owned by the Saudi government.

For decades, when Westerners thought of the kingdom, they thought of religious austerity, a place where women could not drive and fun was outlawed. To his credit Muhammad bin Salman, the crown prince, has unbanned many kinds of fun. But his government has also jailed scores of activists; waged a ruinous war in Yemen; and allegedly ordered the murder of Jamal Khashoggi, a Saudi journalist.

Sport, in theory, is a way to change the subject. Saudi Arabia is not the first Gulf country to pour money into it. Qatar has spent an estimated $200bn to prepare for hosting the football World Cup in November. Buying Europe's top clubs is a favourite pastime of Gulf royals. The Saudis joined in last year when their main sovereign-wealth fund acquired Newcastle United, a middling British team.

The LIV tour is something else—not co-opting a beloved sport but attempting to usurp one. It may backfire. In the past few weeks even the most apolitical of golf fanatics sounded annoyed. Fans know sport is big business, but tend to bristle when this is rubbed in their faces: witness the furore that erupted last year over the European Super League, a short-lived effort to create a new closed-shop football league that might have raked in billions of euros.

Greenswashing

It does not help that some of the golfing rebels get tongue-tied when trying to explain themselves. Asked about Khashoggi's murder, Greg Norman, a retired Australian star golfer who is now LIV's CEO, replied: "We've all made mistakes." As if slicing a journalist into pieces is somehow akin to slicing a four-iron.

Some critics also grumble that two of the eight events in this year's LIV golf tour will be played on courses owned by Donald Trump. (The USPGA championship, a long-established tournament, was to have been held on his course in New Jersey this year, but the organisers terminated the contract after last year's Capitol riot.)

The Saudis have long used cash as a diplomatic tool. On June 22nd Prince Muhammad made his first visit to Turkey since the murder of Khashoggi, which took place at the kingdom's consulate in Istanbul. Recep Tayyip Erdogan, the Turkish president, was a fierce critic of the prince for several years. But his ardour for justice has cooled along with the Turkish economy.

The prince will hope to pull the same trick in July when Joe Biden arrives for his first visit as president. The Saudis may have little to offer on oil prices or sanctions against Russia, two of the president's priorities. But the prince and his ministers will probably announce billions of dollars of new investments in America, in everything from e-commerce to clean energy.

Can't buy you love

Money only goes so far, though. Saudi Arabia is a longtime Western partner but has little support outside political and business elites. A Gallup poll in March found that only 33% of Americans had a favourable view of it, seven points below Cuba, a country under American embargo for six decades. A survey in 2020 by YouGov found that only 14% of Britons liked the kingdom, putting it on a par with Belarus.

There are better ways to improve an image. One is to clean up your act. Saudi Arabia has eased up on repression over the past few years. It has also opened its doors to foreigners a bit wider, introducing tourist visas for the first time in 2019.

In December the kingdom hosted a dance-music festival in Riyadh, the capital, that drew big-name DJs like David Guetta. Hundreds of thousands of partygoers came from across the country. The event brought some good PR, a glimpse of a changing Saudi Arabia—and gave young Saudis a chance to let their hair down, often literally. It also cost a fraction of what the Saudis are pouring into their controversial golf venture. Princes and well-paid foreign consultants may prefer costly vanity projects. But the best way to change the reputation of the kingdom is surely to change the kingdom itself. ■

Illiberalism in Indonesia

Illusory extremists

DENPASAR

The government's campaign against Islamist radicals is really a campaign against its political opponents

Bureaucrats have a reputation for being boring. But not in Indonesia, whose civil service is full of dangerous radicals, according to the government itself. Officials regularly declare that a worryingly high share of public-sector workers are in fact Islamist extremists. Ministers and intelligence chiefs denounce the "radicalism" of bureaucrats and teachers, and newspapers run stories about suspected terrorists who double as local officials.

Such concerns stem, in part, from the ruling elite's attachment to religious pluralism. Fully 87% of Indonesia's 274m inhabitants are Muslim, making it the world's most populous Muslim country. But it is not a Muslim state: the official ideology emphasises pluralism. Western allies have long celebrated Indonesia for combining widespread piety with a commitment to liberal values.

Yet the attacks on the civil service also serve a less lofty purpose. The biggest source of opposition to President Joko Widodo, known as Jokowi, lies not in parliament, where his big-tent coalition includes all parties bar two, but among grassroots Islamist organisations. Their popularity has ballooned over the past two decades as many Muslims, emboldened by the freedoms afforded them by the end of the long dictatorship of Suharto in 1998, have embraced a more conservative strain of the faith.

Politicians began to fret in 2016 when such Islamists emerged as a political force during big demonstrations in Jakarta, the capital. Hundreds of thousands took to the streets to decry supposedly blasphemous remarks by Basuki Tjahaja Purnama, the city's governor, who was Christian and a close ally of Jokowi. His bid for re-election faltered. Since Jokowi's first campaign for president in 2014, his opponents have encouraged fundamentalist vigilantes and protest groups such as the Islamic Defenders Front (FPI), who accuse the president of not being "Muslim enough".

In an echo of Suharto, Jokowi has responded with repression. In 2020 he banned the FPI; six of its supporters were killed in a shoot-out with police that year. He also targeted the public sector. In 2019 he formed a task force to remove extremists from its ranks. The members of the force were drawn from ministries and intelligence agencies, but the government encouraged members of the public to alert it to the extremist views of civil servants via a dedicated website. It also began screening civil-service applicants to assess their religious beliefs. Government agencies now hold seminars designed to instil loyalty to the state in their employees. The security services have delivered lists of members of staff who supposedly hold extremist views to administrators at public universities and the bosses of state-owned firms. Those named are warned that their views will hurt their careers.

The lists suggest that state agencies are conducting extensive surveillance of the public sector, writes Gregory Fealy of Australian National University. Tjahjo Kumolo, the minister of civil-service reform, has warned civil servants that the government ▸▸

→ Also in this section

52 A big catch in the Mekong

53 Afghanistan is hit by an earthquake

53 Central Asian migrant labour

54 Banyan: What BTS leave behind

can detect their "digital footprint". The government justifies such intrusions by claiming that Muslim extremism is "penetrating deep into the organs of state, resulting in the capture of whole sections of the bureaucracy", Mr Fealy writes.

Concerns about radicalism have some merit. Indonesia has a recent history of violent extremism, with terrorist attacks on tourist sites killing scores of people in the early 2000s. Large minorities of civil servants support radical Islamism. In 2017 Alvara research centre, an Indonesian pollster, found that one in five civil servants and one in ten state-enterprise workers wanted Indonesia to become a Muslim theocracy. A survey conducted a year later found that nearly 60% of Muslim schoolteachers are intolerant of other religions.

Yet the government's claim of state capture by extremists is overblown. "There is no evidence to suggest the systemic prevalence of terrorism or violent extremism within the civil service," says Sana Jaffrey of the Institute for Policy Analysis of Conflict, an Indonesian think-tank. In its first two years the government's anti-extremism campaign officially sanctioned a mere 38 civil servants, according to A'an Suryana, a researcher at the ISEAS Yusof Ishak Institute, a think-tank in Singapore. That is a minute percentage of the country's 4.3m public employees.

This is despite the fact that the government is using a broad definition of "radicalism". Making remarks that "insult" the government, or sharing what the task force deems to be "fake news" on social media can be enough to attract its attention. The nebulous criteria, in turn, make it easy to sideline opponents by accusing them of being extremists.

In September 57 employees of the Anti-Corruption Commission experienced this first-hand when they were sacked on the pretext of having failed a civil-service exam. The commission had doggedly rooted out corruption within the highest echelons of Indonesian politics, making powerful enemies. After the officials' dismissal, celebrities on social media with ties to the government put it about that they were members of the Taliban. One of the former officials who got the boot, Giri Suprapdiono, says he and his colleagues were in fact dismissed because they refused to kowtow to the government. But many members of the public, he says, believed the claims that they were "radical". That is absurd, he argues: some of those who lost their jobs were not even Muslim.

The government is "blurring the line between having views that are critical of the government, having Islamist views, and just being called a terrorist", says Ms Jaffrey. Many conservative Muslims now feel they must be "very careful" when expressing themselves online, says Muhammad Kholid, the spokesperson of the Prosperous Justice Party, a Muslim opposition party. Thousands are subject to discrimination on the basis of their religious and political views, reckons Mr Fealy.

Jokowi hopes that by repressing conservative Muslims, he will prompt them to moderate their views and thereby protect the country's pluralism. Since the killings of the six FPI supporters in 2020, Islamist agitation has died down. But the peace that Jokowi has bought may not last. His tactics are likely to anger Muslims and drive extremists underground. On June 7th the police announced the arrest of the leaders of Khilafatul Muslimin, an Islamist group which taught students at its 31 schools that Indonesia ought to be a caliphate. It would be better for them, and Indonesia's democracy, if they were taught the value of pluralism. Too bad that their president is not leading by example. ■

Conservation in South-East Asia

A giant stingray in the Mekong

The discovery of the world's largest freshwater fish spells hope for the river

IT TOOK A dozen men to load Boramy, a giant stingray, onto the scales. At just under 300kg, she is the biggest freshwater fish ever weighed. She was caught by a Cambodian fisherman on the Mekong, South-East Asia's longest river, on June 13th. She was the fourth giant stingray recorded in the area in the past few months. She swam away tagged.

The discovery of such a large fish has cheered conservationists. The Mekong river, which starts in the Tibetan plateau and snakes through China, Myanmar, Laos, Thailand, Cambodia and Vietnam, feeding some 66m people along the way, is home to more species of huge freshwater fish than any other in the world. But they are suffering. In the past 50 years the population of giant fish has dropped by 94%.

Dams are part of the problem. Over 140 of them have been built on the Mekong and its tributaries to feed the region's growing demand for electricity. Dozens more are under construction. Dams alter the amount and quality of water and nutrients in the river. They also block fish from migrating.

Changing weather patterns do not help. The wet season is shorter than it used to be and tends to start later, says Courtney Weatherby of the Stimson Centre, a think-tank. Between 2019 and 2021, the water level in the Mekong was the lowest since records began 60 years ago. Poor dam management, climate change and El Niño, a weather pattern that affects rainfall in the region, are all thought to contribute to the problem.

That Boramy is both massive and alive shows that pockets of the river remain resilient and worth protecting. Her discovery also points to improving relations between fishermen and conservationists. Her captor could have sold her as food. Instead he called Wonders of the Mekong, a local conservation group, which paid him some $600 to keep Boramy alive so that she could be tagged and released. Villagers along the river are also paid modestly to maintain the acoustic receivers that pick up signals from the group's tags.

Conservationists hope that by tracking Boramy, they will learn which parts of the river to protect, including breeding and birthing spots. But big fish may yet lose out to big hydropower. A new dam is being proposed just upstream of where Boramy was found.

Afghanistan

Another disaster

ISLAMABAD

A devastated country is hit by a deadly earthquake

AFGHANS WERE already being tormented by hunger, poverty and the aftermath of war when, in the early hours of June 22nd, disaster struck once more. A 5.9-magnitude earthquake centred in the south-eastern province of Khost, on the border with Pakistan, destroyed homes and triggered landslides in Khost and neighbouring Paktika as people slept. When dawn broke, pictures showed villages reduced to rubble or demolished by torrents of shifting earth. Residents sifted through piles of crumbled masonry and began digging graves.

The speed with which the reported death toll rose, even in an area with few communication links, is a sign of how deadly the tremor may have been. Within hours the state news agency had put the number of victims at over 1,000, with a further 1,500 injured. Those figures were expected to rise further, making the quake the country's deadliest in recent decades. "People are digging grave after grave," said Mohammad Amin Huzaifa, head of Paktika's information and culture department. "It is raining also, and all houses are destroyed. People are still trapped under the rubble," he added.

The earthquake has hit a country in crisis. Drought, war and covid-19 had already left most Afghans destitute. When the Taliban took power last summer, foreign aid stopped overnight. Sanctions against its leadership halted bank transfers and paralysed commerce. Aid agencies have spent the past six months trying to save millions of people from starvation while ensuring their money does not flow into the Taliban's coffers.

The remote areas hit by the earthquake, home to poor settlements on steep slopes prone to landslides, are particularly ill-equipped to cope. Even before the Taliban returned to power, foreign aid often failed to reach far-flung places like Khost and Paktika. The south-east's role as a heartland for the Taliban's feared Haqqani faction meant that for years it was the site of fighting rather than economic development. A lack of money and materials has meant that many homes in the region are badly built. And although the fighting stopped once the Taliban took over, poverty has increased.

The disaster will test the Taliban's capacity to govern. The former insurgents have taken over a state. But foreign officials in Kabul who meet them say that they struggle to run it. Taliban administrators have expressed shock at the size of the governing apparatus they have taken on. Many appear to be feeling their way around it, without much sense of what to do. "We don't have anything resembling governance here; we have a few ministries that do their own thing," says one foreign official. Big jobs in the administration are allocated by loyalty and seniority rather than competence. Technocrats have been replaced by fighters and clerics.

The Taliban have published a budget, and claim that Afghanistan is economically self-sufficient. But victims of the earthquake have yet to receive much help. Emergency and disaster-management teams are handicapped by a lack of airworthy planes and helicopters. Aware of their own limitations, the Taliban have called for foreign assistance. Charities and UN agencies that have been feeding Afghans and running hospitals have swung into action. But for many of those whose homes have been obliterated, help will come too late. ■

The morning after

Labour migration in Central Asia

From Moscow with money

BATKEN

Despite sanctions, Russia remains an important source of remittances

DANIYAR ABDYRAKHMANOV, a 37-year-old from Jany-Jer, a village in the Batken region in southern Kyrgyzstan, has spent half his life toiling in warehouses and at construction sites in Russia. Two of his three brothers still work there. His wife, a schoolteacher, hails from a neighbouring village. But they met in Moscow, where she worked as a shop assistant. When their son was two years old, they left him with his grandparents and went back to Russia to earn money.

Mr Abdyrakhmanov's story is typical. In Batken in the Fergana Valley, close to Kyrgyzstan's borders with Tajikistan and Uzbekistan, it is rare to find a family without at least one member working in Russia. Mr Abdyrakhmanov had no desire to leave the fertile and scenic region of his birth. But working in Moscow he made three times the average wage back home, where opportunities are mostly limited to growing rice, apricots and walnuts.

Remittances were worth about a third of GDP in Kyrgyzstan and Tajikistan in 2021, according to the World Bank, making them some of the world's most remittance-dependent countries. Money sent back from Russia, which is relatively cheap and easy to reach and has a familiar language, is a crucial lifeline. Last year some 82% of remittances to Kyrgyzstan came from Russia; for Tajikistan, the figure was 76%.

Without remittances, the number of poor Kyrgyz would rise substantially, reckons the government. In Batken, the country's poorest region, where 35% of people already subsist on just over $1 a day, the share might rise to 50%. Labour migration is so central to these countries' economies that even the pandemic barely disrupted it. Though some migrants came home in 2020, they left again as soon as they could. Remittances to Kyrgyzstan rose between 2019 and 2021.

But Russia's invasion of Ukraine may cut that lifeline. The World Bank predicts that Kyrgyzstan's economy will shrink by 5% this year. One big reason is that it expects remittances to fall by nearly a third as migrants lose their jobs in Russia's sanctions-hit economy. The fall of the rouble ▸▸

Award: Leo Mirani, *The Economist*'s Asia editor, has won the annual Award for Excellence in Arts and Culture reporting from the Society of Publishers in Asia. Mr Mirani was honoured for a feature on India's touring cinemas that was published in December 2021.

earlier this year also temporarily reduced the value of the money they sent home, though the currency has since recovered. Remittances to Tajikistan will drop by more than a fifth, the World Bank predicts; GDP will shrink by 2%. The share of Tajik households who cannot afford enough nutritious and healthy food is likely to rise from 20% to 36% as a result.

The experience of Mr Abdyrakhmanov's family suggests that life for migrants in Russia is already getting tougher: one of his brothers lost his job and is heading home. But so far, there has been no mass exodus. Migrants who still have their jobs say they are planning to stay put for now.

Fears of an exodus from Russia have sped up the efforts of Central Asian governments to try to diversify their sources of remittances. They have been pushing migrants to seek work in richer countries that offer higher salaries and better labour rights. Government-funded training centres in Uzbekistan have begun teaching Japanese and Korean to would-be migrants. Tajik and Kyrgyz labourers have begun picking fruit and vegetables in Britain, which has emerged as an unlikely destination for Central Asian migrants because of post-Brexit labour shortages.

Nonetheless, most migrants are still heading to Russia, sanctions notwithstanding. A worried-looking man who recently dropped into a government-run support centre for would-be migrants in Osh, Kyrgyzstan's second city, is typical. He asked staff to check if his name was on Russia's migration blacklist, which bans labourers who break the country's employment rules. When they told him that he was in the clear, he left the office with a wide smile on his face. ■

Banyan Exit stage left

After years of selling the idea of personal growth, will BTS try the real thing?

One pre-pandemic estimate put the annual economic impact of BTS, a South Korean boyband, at $3.7bn a year, making them the most valuable pop act ever. Wherever they go, the seven members sprinkle gold dust on clothing, cosmetics, tourism and food. Ahead of their first tour since the pandemic, stadium concerts in Seoul, Los Angeles and Las Vegas sold out in minutes.

The band also has a fan base of unprecedented reach and engagement. To ignore BTS, as E. Tammy Kim writes in the *New Yorker*, is "to risk missing something bigger than Beatlemania". The commitment of BTS fans, known as ARMYs (the acronym stands for "Adorable Representative MC for Youth"), shows an intensity that goes well beyond confessing "biases" for favourite members. They translate BTS's interviews, songs and social-media posts into countless languages and organise to boost the band's streaming numbers. Their devotion to textual analysis of social and other media is "astonishing", writes Ms Kim.

Equally notable is their activism in opposing movements they deem to run counter to BTS's values. In 2020 big numbers of ARMYs registered but did not show up for a rally Donald Trump, then America's president, was holding in Oklahoma, leaving empty seats that made Mr Trump look unloved. (In the Philippines this year they were less successful in an attempt to support opponents of Ferdinand "Bongbong" Marcos, son of a heinous dictator.)

So it came as a shock when BTS released a video last week in which they announced that they would stop performing together. Gathered around a table laden with food and wine, band members took turns to rue the band's high-pressure work and the constant demand for new music. One member, RM, said he didn't "know what kind of group we were any more". He added that he felt as if he was "trapped and couldn't get out"—years as a K-pop idol had constrained his personal growth. The band said they would take a break and pursue individual careers.

The effect was instant. The share price of the band's production company slumped by over a quarter and has yet to recover, despite reassurances that the break is temporary (looming national service for some members may be a factor in the break-up). ARMYs feel bereft, for BTS has a different image from other K-pop acts. Their faces and clothes are as flawless as those of other idols, but a confessional streak has long been part of their shtick. They admit to frailties and insecurities—but also emphasise self-belief.

The combination, more than anything, strengthened the bond with young fans struggling to forge an identity for themselves. In South Korea, it appealed to youngsters coping with the pressures of a hyper-competitive education system, dwindling job prospects and rigid social expectations. Many families, for example, still demand that their kids zip up their emotions. Abroad, BTS won hearts and minds by embracing causes such as Black Lives Matter, and appearing at the UN to call for children to be better protected from violence. They also helped shift macho norms, at least a little. With their androgynous looks and confessional approach, Hyeouk Chris Hahm, a professor at Boston University, says they have "reimagined the Asian male".

With so much emotional capital invested, it is little wonder that their fans are mourning. But as BTS leave the stage, they also leave behind contradictions. For all the solace they provide from rigid social expectations, they are the product of an industry that contractually regulates the minutiae of its stars' lives, including banning them from having romantic relationships. Even the most competitive Korean employers in other industries do not demand that.

Likewise, BTS may have embraced popular progressive causes abroad, but they have not done the same in their own conservative country. Efforts to introduce laws to protect people from discrimination on the grounds of race, sex, nationality or sexual orientation or to improve the rights of gay people, which are close to the hearts of many of their fans, would no doubt have benefited from their support. And for all their emphasis on self-care, they have done little to encourage other-care in their fans' online conduct. ARMYs can be some of the worst social-media bullies.

Carefully calibrating displays of vulnerability and avoiding controversial causes has been a big part of BTS's success. Maybe breaking up will in time let its individual stars break character.

Mental health

The thought police

China's mental-health crisis is getting worse. Covid lockdowns and constant surveillance probably do not help

It is no surprise that demand for psychotherapy is increasing in China. Take the residents of Shanghai, who recently suffered through months of lockdown. Now they are free to move about, but still constantly tested for covid-19, with a positive result landing them in an isolation centre. If the virus is not causing enough anguish, there is also the struggling economy. China's youth-unemployment rate has shot up to 18.4%. Don't complain too much, though, lest the state take notice. Censorship, surveillance and oppression, on the rise ahead of a Communist Party congress later this year, add to the anxiety.

China's collective mental health seemed to be declining even before the pandemic. In Shanghai the suicide rate has been rising since 2009. Covid has not helped. Suicides in Wuhan, the city where the virus was first identified, were 79% higher in the first quarter of 2020 (when it was under lockdown) than in the same period a year earlier. When Shanghai entered lockdown in April, a survey of residents found that more than 40% were at risk of depression. Searches in Shanghai for "psychological counselling" on Baidu, a search engine, rose by 253% that month.

China has come a long way since the Mao era, when psychology was outlawed and sufferers of mental illness were accused of lacking revolutionary zeal. In recent years the government has passed laws promoting mental health and set itself related goals, such as treating more people who are depressed. But the government itself is a big part of the problem. It is not just that lockdowns and oppression lead to anxiety and depression. The party is also trying to use psychotherapy to mould compliant, socially conservative citizens.

In some cases there are echoes of the past. Dissidents, for example, have been committed to psychiatric hospitals against their will. In 2018 Dong Yaoqiong streamed video of herself splashing ink on a poster of President Xi Jinping while accusing the party of "thought control". Uniformed men then took her away and (with no hint of irony) stuck her in a psychiatric clinic. Last year Li Tiantian voiced support online for a teacher in Shanghai who had been dismissed. The police reportedly forced their way into Ms Li's home and took her to a psychiatric hospital, too (the state said her committal was voluntary).

Often the state's tactics are more subtle. After an earthquake in Sichuan province in 2008, therapists were ordered to guide parents away from complaining about the poorly constructed schools that had collapsed on their children. In an effort to promote social stability, therapists are employed by courts to convince people seeking divorce to stay married. Guidance counsellors in schools have received awards for steering adolescent boys away from homosexuality, which is out of step with the party's conservative values.

"If I am not careful, I can easily become their instrument of control," a therapist for the police told Li Zhang, who has written a book about the politics of psychotherapy called "Anxious China". The therapist said she worried about having to file reports to senior police officers about her conversations with patients.

Legitimate therapists are in a tough spot. Until 2017 the requirements for certification as a psychological counsellor were minimal. Quacks, profiteers and those ▶▶

→ Also in this section

56 A new aircraft-carrier

58 Sparring over the Taiwan Strait

58 An iconic restaurant sinks

— Chaguan is away

with little experience benefited. China has since scrapped that system, but not replaced it with a new certification process. "No wonder a lot of ordinary people don't trust therapists," says Ms Zhang.

Even therapists who work outside government settings feel pressure to promote "positive energy", one of Mr Xi's favourite terms. Before the pandemic he ordered the media to push inspirational stories. That effort has gone into overdrive since covid arrived. During the lockdown in Wuhan, officials suggested that residents be taught to give thanks to Mr Xi and the party for their management of the virus. During the lockdown in Shanghai, videos of children thanking health workers in song went viral. Meanwhile, online complaints about health workers breaking into people's homes and killing pets were censored.

Therapists describe this as a kind of gaslighting, in which the state tries to make suffering citizens doubt their own feelings. An extreme case came in May, when a journalist for *Wenhui Daily*, a state-run newspaper, died. She had written stories praising the fight against covid in Shanghai right up until her death, which was reported as a heart attack. Some close to her think it was suicide. It is not uncommon for people's anger at irrational government policies to turn to helplessness, say therapists. "What can you do? You're angry and it's useless," says one in Shanghai. "So you drop that and go to the next stage, which is sorrow." Chinese activists have long had a term for this: *zhengzhixing yiyu* (political depression). Now ordinary people are experiencing it, too. ■

Aircraft-carriers

Catapulting forward

What to make of a big new ship

THE AIRCRAFT-CARRIER has long been a symbol of military might. Admiral William Halsey, who commanded an early American one and led Allied forces in the South Pacific during the second world war, described it in 1942 as the best way to "get to the other fellow with everything you have, as fast as you can, and to dump it on him." That has held true for most of the eight decades since, during which carriers played a key role in conflicts from Korea to Libya. They remain critical to ensuring American military dominance in Asia as friction with China intensifies, especially over Taiwan (see next story).

So the launch on June 17th of the *Fujian*, China's third carrier and its second home-made one, was an unambiguous public demonstration of its ambitions to project power, as America does, far from its shores. At roughly 318 metres long and 80,000 tonnes, the *Fujian* outstrips Britain's new carrier, HMS *Queen Elizabeth*, and is surpassed only by America's supercarriers (see chart). It also puts China's carrier fleet ahead of Britain's as the second biggest after America's, which boasts 11.

Power projectors

Selected aircraft-carriers

Sources: International Institute for Strategic Studies; CSIS; national sources

*Forecast †Incl. helicopters

Yet the *Fujian*'s most significant feature was hidden from view on its launch from Shanghai's Jiangnan shipyard. Hoardings concealed the parts of its deck that will house an electromagnetic catapult for launching aircraft. That will allow heavier fighter jets (carrying more fuel and weapons), as well as surveillance planes and smaller drones, to fly from the *Fujian*. It can thus undertake more ambitious missions than China's other two carriers, which entered service in 2012 and 2019, but have so far exercised only in Asian waters.

The *Fujian*'s catapult represents a technological leap—and a gamble. The only operational carrier with an electromagnetic version is America's newest one, the USS *Gerald R. Ford*, which has yet to be deployed, partly due to problems with the catapult. America's other carriers use steam-powered catapults, which are reliable but also bulkier, less powerful and hard to calibrate for different planes. China's two operational carriers, meanwhile, use an upward-curved ramp, or "ski jump", which works only for fighter jets with a high thrust-to-weight ratio, impeding the use of heavier weapons, like bombs. Both ships carry the J-15 fighter, an unlicensed copy of Russia's Su-33. They also carry helicopters to monitor their surroundings as longer-range fixed-wing aircraft cannot use the ski jump. That limits their ability to provide air cover for a larger naval taskforce. "Without catapult-capable carriers, China's ambition to operate task groups globally is a risky undertaking, especially in times of conflict," says Ridzwan Rahmat of Janes, a defence-intelligence firm.

The *Fujian* is designed to change that. Once sea trials are complete, it will probably start operating with upgraded J-15 models that include nose gear designed for the catapult, better radar and heavier weapons, including bombs and guided missiles. Later they will probably be joined by a new stealth fighter, the J-35. That plane could be ready for use in the latter half of the decade, says Henry Boyd of the International Institute for Strategic Studies, a think-tank in London. He projects a similar time frame for the KJ-600, a new fixed-wing "early warning and control" aircraft to coordinate fighter operations and detect incoming threats. Andreas Rupprecht, an author of books on Chinese military aviation, describes that as "the force multiplier" allowing the *Fujian*'s air wing to operate similarly to those on America's carriers, which often involve a combination of F/A-18 fighters, stealthy F-35s and Hawkeye early-warning and control aircraft.

Even then, China will be far from parity with America. The *Fujian* is conventionally powered, whereas American carriers are nuclear-driven, giving them greater speed and endurance. Plus America has decades of experience operating carriers. It will take at least two years to complete the *Fujian*, and probably more to perfect using its catapult. Even if, as some suspect, China is already building a nuclear-powered carrier and plans to have four by 2035, that would still leave it lagging America. Yet such comparisons can mislead. China's carriers are not designed for direct confrontation with America, naval experts say. In a war over Taiwan or in the seas around China (the likeliest conflicts involving China and America) ballistic and sea-skimming missiles would quickly destroy any big ships.

China is more likely to use its carriers against less powerful countries—much as America has since the cold war. Think, perhaps, of a confrontation with Vietnam over disputed islands or an intervention in Africa to protect Chinese interests. In the missile era, it is unrealistic to imagine a clash like the battle of Midway in 1942, which involved three American carriers and four Japanese ones, says Sam Roggeveen of the Lowy Institute, a think-tank in Sydney. "I don't read China's carrier ambitions as being a direct challenge to American naval power," he says. "I really view it as a gambit to build a navy that will be useful when the Americans are far less powerful and when China has more space to coerce and punish smaller countries." ■

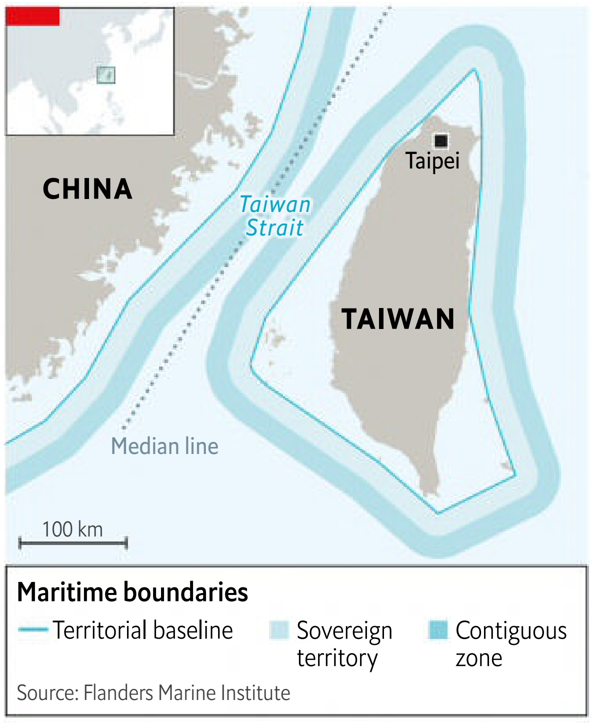
The Taiwan Strait

Whose is it?

America and China spar over military use of a strategic waterway

To chinese nationalists, keen to see America pushed from their country's backyard, the words of a foreign-ministry official have brought hope. Describing the Taiwan Strait as international waters is a "false claim", the spokesman said on June 13th. China, he insisted, has "sovereignty, sovereign rights and jurisdiction" over the waterway. His words were aimed at America, which calls it international waters and often angers China by sailing warships through it. Soon "the dragon will fight the tiger" in the strait, a Chinese academic warned in an online article.

The strait is an important thoroughfare for commercial shipping as well as foreign naval vessels. The latter are mainly American, but in recent years—as a gesture of support—some American allies have also occasionally sailed their warships through. The Chinese spokesman was responding to a report by Bloomberg, a news agency, that Chinese military officers, during meetings in recent months with American counterparts, have repeatedly asserted that there are no international waters there. It said this had caused concern among senior American officials.



At least in public, China's argument does not appear to have changed. It does not explicitly say that all waters in the strait are its sovereign territory. The words "sovereignty, sovereign rights and jurisdiction" refer to the various types of control to which it claims a right in different parts of the strait, which varies in width from 70 to 220 nautical miles.

China gives these areas the same names, and specifies their width, as other countries do under the UN Convention on the Law of the Sea, or UNCLOS (which China has ratified and America has not). It counts the area between its "territorial baseline" and a parallel line 12 nautical miles seaward as sovereign territory (see map). It claims the next 12 nautical miles beyond that as a "contiguous zone" where it has broad law-enforcement rights. That zone, and a band of sea beyond that, form the country's "exclusive economic zone", or EEZ. If there were space (which there is not in the Taiwan Strait), this could stretch to 200 nautical miles from the baseline.

Like most other countries, America treats EEZs as the high seas, accepting only a few restrictions such as on rights to fishing and the extraction of minerals. China has a more sweeping view of its rights. It objects to any intelligence-gathering or exercises by military vessels or aircraft in its EEZ. It also demands that foreign military vessels passing through the first 12-nautical-mile band (exercising "innocent passage", as UNCLOS calls it) get permission first. America refuses to comply.

China's public statements often use language that blurs the distinction between sovereign waters and the EEZ. That may be intentional. It would clearly like others to believe it can veto any military passage through the strait. It regards transits by Western powers as expressions of solidarity with Taiwan, which China claims as its territory. In a commentary in the *Global Times*, a nationalist tabloid in Beijing, the newspaper's former editor said all of America's transits were "blatant declarations of support for the Taiwan authorities and muscle-flexing against the mainland" as well as "infringements against China's sovereign rights"—implying that those rights extend far beyond the economic realm in the EEZ.

America would be right to worry. Tensions are simmering in the region. On June 21st Taiwan scrambled jets after 29 Chinese military aircraft entered its air-defence zone. In recent years Taiwan has often reported such forays. In May it said a Chinese attack helicopter had crossed the "median line" in the strait, the first such incursion across that informal military boundary since 2020. The probes appear to be aimed in part at showing displeasure with American gestures of support for Taiwan.

China's nationalists bray for their country to get tougher. "When a friend comes, there is good wine, and when a jackal comes, there is a shotgun to greet it," thundered an editorial in the *Global Times*. "Here is our advice to those foreign warships which want to make provocations in the Taiwan Straits: Look out!" China's government may not be so explicit in its public language, but its frustrations are clear. ■

The metaphor still holds water

The iconic Jumbo Floating Restaurant had sat in Hong Kong's Aberdeen harbour for 46 years. Built in the style of an imperial palace, it attracted locals, tourists and celebrities. But it was losing money when it closed in 2020. On June 14th it was towed away. Wherever it was heading, it never made it: the vessel sank on June 18th. Some saw a metaphor in its demise. China's Communist Party has undermined Hong Kong's democratic institutions in recent years. Jumbo represented a more hopeful era, now gone.

Global instability

From inflation to insurrection

ALMATY, COLOMBO, ISTANBUL, KAMPALA, LIMA AND TUNIS

Costly food and energy are fostering widespread unrest in emerging markets

"MONEY NO LONGER had any value in Istanbul," laments the narrator of "My Name is Red", a novel by Orhan Pamuk set in the 16th century. "[B]akeries that once sold large...loaves of bread for one silver coin now baked loaves half the size for the same price." The royal mint was slyly reducing the amount of silver in each coin. When the Janissaries (an elite military force) found that their wages had been debased, "they rioted, besieging Our Sultan's palace as if it were an enemy fortress."

Galloping inflation afflicts Turkey again today. Officially it is 73%, but everyone suspects it is higher. Mr Pamuk, a Nobel laureate for literature, says he has "never seen such a dramatic rise in prices". He makes no predictions about what the political consequences might be. To criticise Turkey's modern sultan, Recep Tayyip Erdogan, would be risky. But from his book-strewn flat overlooking the Bosporus, Mr Pamuk observes that his compatriots are reacting with "shock, surprise and anger".

A visit to a street market suggests the novelist is right. A vine-leaf seller gripes that he has had to treble his prices since last year. "People used to buy 5kg at a time and put them away for winter. Now they can only afford 300g." A grandfather complains that his pension has been so eroded that he has not eaten meat this year.

"The government is responsible, who else?" he says. He voted for Mr Erdogan's party at the most recent election, in 2019, but will not do so again. "The solution is to change the government," says the vine-leaf seller. "I want to leave the country," says his younger brother. "I'll clean toilets in Europe if I have to."

All around the world, inflation is crushing living standards, stoking fury and fostering turmoil. Vladimir Putin's invasion of Ukraine has sent prices of food and fuel soaring. Many governments would like to cushion the blow. But, having borrowed heavily during the pandemic and with interest rates rising, many are unable to do so. All this is aggravating pre-existing tensions in many countries and making unrest more likely, says Steve Killelea of the Institute for Economics and Peace (IEP), an Australian think-tank.

The strongest predictor of future instability is past instability, finds a forthcoming paper by Sandile Hlatshwayo and Chris Redl of the IMF. Historically, the probability that a country will experience severe social unrest in a given month is only 1%, but this quadruples if it has suffered it within the previous six months and doubles if a neighbouring country has experienced it, they calculate. Protesters are more likely to surge onto the streets if they think others will join them.

This is bad news, since unrest has been building for years. The IEP calculates that 84 countries have become less peaceful since 2008; only 77 have improved. Its measure of violent protests is up by 50% over the same period. Using a different method—counting mentions in the media of words associated with unrest across 130 countries—the IMF estimated in May that social turmoil was near its highest level since the pandemic began.

The Economist has built a statistical model to assess the relationship between food- and fuel-price inflation and unrest. We used data from ACLED, a global research project, on "unrest events" (ie, mass protests, political violence and riots) since 1997. We found that rises in food and fuel prices were a strong portent of political instability, even when controlling for demography and changes in GDP.

We also found cause for alarm about the coming months. Expenditure on imports of food and fuel is set to increase, especially in poor countries (see chart 1). Poor countries' debts have also risen (see chart 2). The average low-income country has a public-debt-to-GDP ratio of 69.9%, estimates the IMF. This, too, is set to increase, and to overtake the (unweighted) average for rich countries this year. Since poor countries typically have to pay much higher interest rates, many of their debts look unsustainable. The IMF says 41 countries, home to 7% of the world's population, are in or at high risk of "debt distress". Some, such as Laos, are on the brink of default. Our model suggests that many countries will see a doubling of the number of "unrest events" in the coming year (see map).

Places that were precarious before may be tipped over the edge. In Turkey, for example, the disruption of food and fuel imports from Ukraine and Russia adds to the damage already being caused by barmy monetary policy. Mr Erdogan believes that high interest rates cause inflation, rather than curbing it. So he has ordered rates cut even as prices have raged out of control.

To defend the Turkish lira, Mr Erdogan has since the end of 2021 urged people to put their money into special depreciation-proof accounts. The state promises to make up the difference if these deposits lose value against the dollar, as they have been doing. The lira has already fallen by almost 25% this year. No wonder that over 960bn lira ($55bn, or 7% of GDP) has been stashed in the accounts in six months, creating a vast liability for the government.

"It's the dynamite under the system," says Garo Paylan, an opposition MP. It will probably explode before the next election, which is a year away. Mr Erdogan is expected to lose unless he does something drastic, so he might do something drastic. He could start a new war in Syria against the PKK (a Kurdish group the government calls terrorists) or ban his strongest opponents from politics, speculates Behlul Ozkan of Marmara University. In short, the economic crisis could lead Turkey to eject an erratic strongman who has ruled for nearly two decades—or the strongman could throttle what is left of Turkish democracy. Tranquillity seems the least likely scenario.

In country after country, the global economic storm has exacerbated underlying troubles. Take Pakistan, where squeezed living standards help explain why in April parliament ousted the prime minister, Imran Khan, with a nod from the army. He has since led mass rallies to get his job back. In India riots erupted over a plan to reduce the number of jobs for life in the army. (When times are hard, people particularly crave job security.)

Sri Lanka gives a taste of how quickly things can spiral out of control. President Gotabaya Rajapaksa banned agrochemicals last year and told farmers to go organic instead. Harvests plunged. Six months later he lifted the ban but, by then, thanks to other daft policies, there was too little hard currency to import enough chemical fertiliser. The next harvest is predicted to be miserable. Sri Lanka needs food and fuel, but cannot afford to import them.

On May 9th protesters clashed with a pro-government rally. They pushed buses into lakes or set them on fire. They attacked government supporters with poles; your correspondent also saw some wielding hockey sticks. They burned the homes of politicians and smashed up a museum dedicated to the Rajapaksa family. Troops dispersed protesters who burst into the prime minister's residence. The president tried to calm the crowds by pushing out the prime minister (his brother).

But Sri Lankans are still furious. Shop shelves are bare, even for basics, and people queue for hours for petrol. Schools and government offices are temporarily closed. The government has defaulted on its debts. IMF officials arrived in Colombo, the capital, on June 20th to discuss a bail-out.

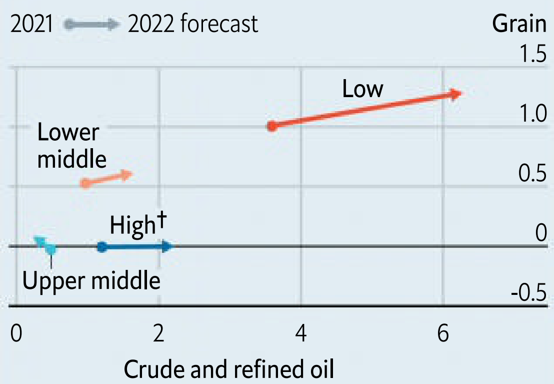
Foreseeing red

No one can be sure which country or region will explode next. Mr Killelea frets about the Sahel, which has seen five coups in the past two years. Others point to Kazakhstan, where the government called in Russian troops to help suppress civil unrest in January, or Kyrgyzstan, which relies on wheat and remittances from Russia and has ousted three presidents since 2005.

Emptying the pockets of the poor 1

Net imports as % of GDP

By country income group*



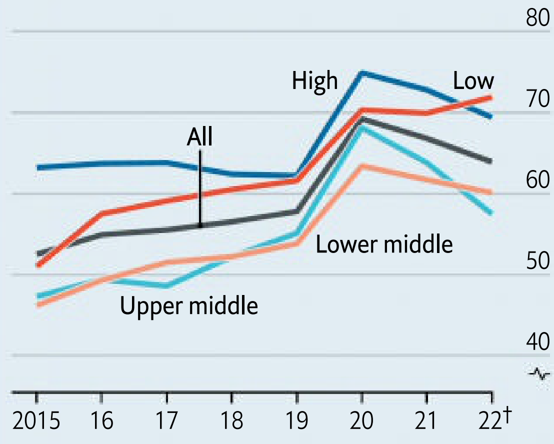
*Unweighted average †Excludes Kuwait and UAE

Sources: Gro Consulting; IMF; EIA; Atlas of Economic Complexity; *The Economist*

The load gets heavier 2

General government gross debt as % of GDP

By country income group*



Sources: IMF; World Bank *Unweighted average †Forecast

One country with nearly all the harbingers of havoc is Tunisia. It has a history of unrest. Almost 12 years ago a Tunisian fruit-seller, Muhammad Bouazizi, set fire to himself after police kept shaking him down. His death set off the Arab spring, a wave of protests that swept the Middle East and toppled four presidents. Tunisia's democratic revolution initially went well. But last year the president, Kais Saied, assumed autocratic powers. Falling living standards have turned the country into a powder keg once more.

Half the population is under 30, and a third of young men are unemployed. In slums around Tunis, the capital, they loiter on street corners, smoking and bellyaching. "Young people here have nothing to lose. They'll join a riot just for a chance to steal phones and rob shops," says Muhammad, a 23-year-old selling pot in the street.

"I'm always angry, from the beginning of the day to the end," says Meher el Horchem, who works in a café in Goubellat, a small town. Business is down 70-80% in recent months, he reckons: "No one can afford to go out." He waves a 20-dinar ($6.40) note in the air. It is his day's wages. "You walk into a shop with this and you come out with nothing," he complains.

He is in his 30s and lives with his parents. "Of course I want to be married. Everyone does," he says. But he cannot afford to on his inflation-sapped wages. "I can't have a life," he fumes, adding: "All the youth are angry at the system. I'm hoping to God it won't lead to a civil war."

So far, it has not. But a general strike on June 16th stopped buses and trains. The government is trying to make a deal with the IMF, but a big union objects to its conditions, which include cutting the public-sector wage bill. President Saied is trying to buttress his own power: on July 25th Tunisians will vote on a new constitution, the text of which he has not yet shown them.

Ordinary Tunisians yearn for calories, not constitutional reform. But policies intended to satisfy their hunger have per-verse consequences. Like many countries, Tunisia fixes the price of a staple food (in this case, bread). Bread subsidies cost more as wheat prices rise; this is one reason why the government needs an IMF bail-out.

Farmers, meanwhile, must sell their grain to the state for a low, fixed price. This discourages production. In a field near Goubellat a group of labourers share lunch. "The earth in this country is good," says Neji Maroui, their manager. There is plenty of spare land. If they could earn a market rate for their wheat, they would plant more of it, he says. But they receive less than a fifth of the world price, so they don't.

Inflation stimulates corruption, argues Youssef Cherif of the Columbia Global Centre in Tunis. In poor countries, each civil servant typically supports a large extended family. Grocery bills have gone up. Wages have not kept pace. "That creates an incentive to demand more bribes."

That, in turn, makes unrest more likely. As graft intensifies, the chances of another frustrated victim like Muhammad Bouazizi staging a spectacular protest somewhere must surely increase. In Goubellat Rafika Trabelsi boils with rage as she slices potatoes. She wanted to expand her roadside kiosk and sell a wider range of drinks and snacks. But local officials refused her permission and bulldozed her tiny extension. Other people got permits because they paid bribes, she says.

Though Mr Putin is responsible for a big chunk of global inflation, people tend to blame their own governments. In Peru Pedro Castillo won power last year with the slogan "no more poor people in a rich country". Covid-19 made that harder—it has been deadlier in Peru than almost any other country, according to *The Economist*'s excess-deaths tracker. And just as the economy was recovering, Mr Putin's war choked off its supply of fertiliser. Peru had relied on Russia for 70% of its imports of urea, the most commonly used sort. Now farmers struggle to get hold of the stuff, and they are livid.

In April they blocked roads to protest against inflation. Toll booths were burned; shops were looted. Mr Castillo panicked and tried to impose a fresh pandemic-style lockdown on Lima, the capital. Critics howled "autocrat". He relented.

The president's approval rating is now around 20%. "We thought he was like us," says Gricelda Huaman, a mother of three in a shantytown outside Lima, but, "he's forgotten us." She often skips meals so her children have more. She sometimes can't afford pills for lupus, an autoimmune disease. Without them, she cannot walk.

Unless Peru secures more fertiliser, the next harvest could be drastically reduced, says Eduardo Zegarra of GRADE, a local think-tank. Mr Castillo has been distributing guano, a traditional fertiliser that Peru once produced in large quantities. He recently told farmers that "only the lazy" would go hungry. They are unimpressed. "If we don't see concrete actions in favour of farmers soon, he'll have us on the streets," says Arnulfo Adrianzén, who grows rice. Peru has had five presidents in the past five years. It may not be long before another puts on the increasingly uncomfortable sash of office.

Some regimes will keep a lid on unrest through force. No one expects protests to get out of hand in China, for example. In Turkmenistan, where food shortages have long been rife because of a mismanaged economy, anyone who buys more than their allocation of bread faces 15 days in jail. Egyptians are wary of speaking up. The last mass protests, in 2013, ended when the regime massacred perhaps 1,000 people.

In Uganda, President Yoweri Museveni has told his people to eat cassava if there is no bread. An opposition leader has urged them to take to the streets. Kizza Besigye, a former presidential candidate, led protests during the previous big inflationary spike, in 2011. This time the state is taking no chances. Dr Besigye has been locked up.

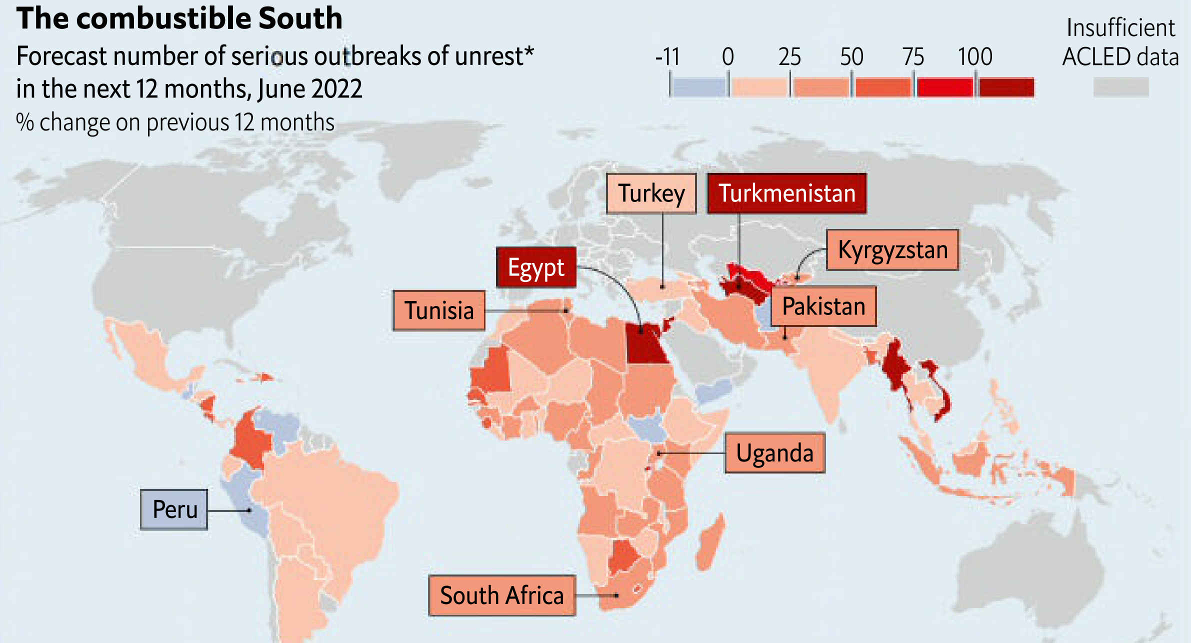
Protests in Uganda are unlikely to succeed. The state, like Egypt's, has no compunction about shooting demonstrators. Also, many Ugandans live hand-to-mouth, which makes protest difficult to sustain: if people don't work, they don't eat. Still, frustration is rising. Ugandans spend 43% of their income on food, so price rises hurt.

Authoritarian regimes such as Uganda's face a dilemma. To crush dissent they must divert ever more resources to the security forces and patronage, reducing their capacity to respond to economic shocks. Dr Besigye says "the repressive apparatus" in Uganda is stronger than ever. But by squandering so much money on the army, he adds, Mr Museveni has "intensified the conditions for discontent".

The combustible South

Forecast number of serious outbreaks of unrest* in the next 12 months, June 2022

% change on previous 12 months



*Includes explosions, violence against civilians, non-violent protests and riots

Sources: Gro Consulting; IMF; World Bank; EIA; Atlas of Economic Complexity; ACLED; *The Economist*

Uproar to downturn

Global unrest could hobble growth. Investors get skittish when mobs burn down factories or overthrow governments. A working paper by Metodij Hadzi-Vaskov and Luca Ricci of the IMF and Samuel Pienknagura of the World Bank finds that big outbreaks of unrest are on average followed by a percentage-point reduction in GDP, relative to the previous baseline, a year and a half later. This could in theory be because, say, a previous policy of fiscal austerity led both to popular anger and to lower growth. But the authors find that the link holds true regardless of whether the unrest is preceded by fiscal austerity or low growth. They conclude that unrest does indeed hurt economies.

They also find that unrest motivated by socioeconomic factors (such as inflation) is associated with more severe contractions than unrest sparked by political factors (such as a disputed ballot). When the unrest has both political and socioeconomic motivations, the damage to GDP is worst of all. A good example was the rioting that rocked South Africa in 2021, when covid-19 was causing economic hardship and a rogue ex-president was urging his supporters to protest against his being put on trial for corruption. In the quarter when the looting occurred, GDP shrank by 1.5%.

A final and intriguing finding is that although unrest typically causes stockmarkets to fall, this effect has historically been negligible in countries with more open and democratic institutions. The implication is that societies cope better with turmoil when they have good institutions and the rule of law.

The thing protesters around the world so often demand—cleaner, better government—is exactly what their countries need. But it takes time, and stability, to build. The short term will be turbulent. ■

Big tech and health care

Doctor Google will see you now

Alphabet wants to shake up a seemingly undisruptable multi-trillion-dollar industry

Rich countries pour heart-stopping amounts of money into health care. Advanced economies typically spend about 10% of GDP on keeping their citizens in good nick, a share that is rising as populations age. America's labyrinthine health-industrial complex consumes 17% of GDP, equivalent to $3.6trn a year. The American system's heft and inertia, perpetuated by the drugmakers, pharmacies, insurers, hospitals and others that benefit from it, have long protected it from disruption. Its size and stodginess also explain why it is being covetously eyed by big tech. Few other industries offer a potential market large enough to move the needle for the trillion-dollar technology titans.

America's five tech behemoths have spent billions on various health-care bets. Some of their earlier health-related investments are starting to pay off. Amazon runs an online pharmacy and its telemedicine services reach just about everywhere in America that its packages do, which is to say most of it. Apple's smartwatch keeps accruing new health features, most recently a drug-tracking one. Meta scrapped its own smartwatch plans earlier this year but offers fitness-related fun through its Oculus virtual-reality goggles. Microsoft keeps expanding its list of health-related cloud-computing offerings (as is Amazon, through AWS, its cloud unit).

Yet it is Alphabet, Google's corporate parent, whose health-care ambitions are the most vaulting. Between 2019 and 2021 Alphabet's venture-capital arms, Google Ventures and Gradient Ventures, and its private-equity unit, CapitalG, made about 100 deals, a quarter of Alphabet's combined total, in life sciences and health care. So far this year it has injected $1.7bn into futuristic health ideas, according to CB Insights, a data provider, leaving its fellow tech giants, which have invested around $100m all told, in the dust (see chart on next page). Alphabet is the fifth-highest-ranking business in the Nature Index, which measures the impact of scientific papers, in the area of life sciences, behind four giant drugmakers and 20 spots ahead of Microsoft, the only other tech giant in the running. The company has hired former health regulators to help it navigate America's health-care bureaucracy.

Alphabet's approach to innovation—throw lots of money at lots of projects—has served it well in some other businesses beyond its core search engine. It has given rise to clever products, from Gmail and Google Docs to the Android mobile operating system and Google Maps, which support people's digital lives. Alphabet thinks that some of its health offerings will become as central to their physical existence. Is that an accurate prognosis?

Alphabet has dabbled in health care since 2008, when Google (as it was then known) introduced a service that allowed users to compile their health records in one place. That project was wound up in 2012, resurfaced in 2018 as Google Health, which included Google's other health ventures, and was again dismantled last year. Today Alphabet's health adventures can be divided into four broad categories. These are, in rough order of ambition: wearables, ▸▸

→ Also in this section

64 Disrupting the drug market

65 Communist Party v fun

66 Why everyone wants Arm

67 Bartleby: Pity the managers

68 Schumpeter: EY's split personality

health records, health-related artificial intelligence (AI) and the ultimate challenge of extending human longevity.

Google threw itself into the wearables business in 2019 with the $2.1bn acquisition of Fitbit. That firm's popular fitness tracker has been counting steps and other exertions on around 100m wrists. It has come a long way since the Nintendo Wii motion-detecting game console that inspired Fitbit's founders. A new feature—a sensor which monitors changes in the heart rate for irregularities that can lead to strokes and heart failure—has just been been approved by America's Food and Drug Administraton (FDA). Google is also trying to boost the health-care potential of its other devices. To help it along, it has enlisted Bakul Patel, a former official tasked with creating the regulatory classification of "software as a medical device" at the FDA.

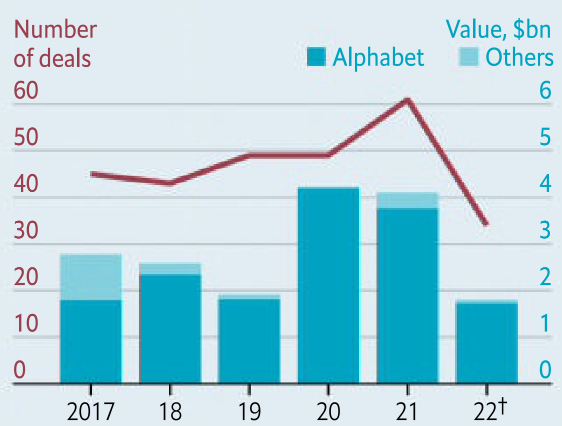
The FDA's stamp of approval for the Fitbit sensor is a big deal. It should make it easier to get a similar thumbs-up for Google's higher-end Pixel Watch, which uses a lot of the same technology and is due out this autumn, as well as other gadgets. For example, the camera on its Pixel phones can be used to detect respiration and heart rates by tracking the subtle colour difference brought about by the fact that blood with fresh oxygen in it is slightly brighter. Google's Nest smart-thermostat-turned-home-assistant can listen to snoring to assess your sleep.

As significant, if not more, is that Google considered the regulatory go-ahead worth getting. It signals that the company intends its products to be more than fun consumer gadgets, actually able to influence the practice of medicine.

Google is also giving health records another whirl. The new initiative, called Care Studio, is aimed at doctors rather than patients. Google's earlier efforts in this area were derailed in part by hospitals' sluggishness in digitising their patient information. That problem has mostly gone away but another has emerged, says Karen DeSalvo, Google's health chief—the inability of different providers' records to talk to each other. Dr DeSalvo has been vocal about the need for greater interoperability since her days in the Obama administration, where she was in charge of co-ordinating American health-information technology. Until that happens, Care Studio is meant to act as both translator and repository (which is, naturally, searchable).

Health cheques

Big-tech firms*, disclosed venture-capital investments in health care



*Alphabet, Amazon, Apple, Meta and Microsoft; includes partners †To June 20th

Source: CB Insights

Place your Alpha bets

Alphabet's AI projects are also beginning to produce results. Starting in 2016 DeepMind, a British firm bought by Google in 2014, used data from Britain's National Health Service (NHS) to create diagnostic tools, in one case training an AI algorithm to detect retinal diseases. (DeepMind's co-founder sits on the board of *The Economist*'s parent company.) It made headlines last year with AlphaFold, a groundbreaking piece of software that can predict the structure of proteins, which is responsible for many of the complex molecules' characteristics. Alphabet has also launched another subsidiary, Isomorphic Labs, which will be run by DeepMind's boss and use machine learning to build on AlphaFold to accelerate (and cheapen) drug discovery.

The most out-there part of Alphabet's health portfolio is an effort to slow the ageing process—or stop it altogether. The idea is that ageing should be viewed not as an immutable aspect of life but as a condition that can be managed and treated, or a problem that can be solved with the right technology. To that end, one of Alphabet's life-sciences subsidiaries, Calico, is looking into age-related diseases. Last year its $2.5bn partnership with firms including AbbVie, a big drug firm, was extended until 2030. Another Alphabet subsidiary, Verily, is working with L'Oréal, a French beauty giant, to better understand how ageing affects the biology of the skin—and in the process create better skincare.

Inspiring stuff, to be sure. But obstacles remain. Some are technical. The NHS data proved hard for DeepMind's AI to digest. The firm's AI assistant for doctors, called Streams, is being discontinued. Still, given the strides being made in machine learning, it may be only a matter of time before something like Streams is resuscitated.

Other hurdles may be harder to overcome. Trustbusters are increasingly wary of letting through deals that might be seen as stifling nascent rivals. In Europe competition authorities have forbidden Fitbit (but not the Pixel watch) from favouring Google's own phones and operating system, or from using user data to sell advertising. Governments also fret about privacy breaches, which are more sensitive still when it comes to medical information. Last month plaintiffs filed a class-action lawsuit against DeepMind for misuse of NHS patient data. DeepMind has not made a public statement on the case.

Last, good ideas are not the same things as a good business. The wearables market is highly competitive. So, increasingly, is the one for electronic health records. Google's reputation for technical brilliance has not exactly made Care Studio into an overnight success; the system is reportedly used by just 200 or so clinicians. Verily, which besides solving ageing also offers various diagnostics, signed $50m-worth of contracts for covid-19 testing during the pandemic, a tidy sum but chump change next to Alphabet's total annual revenues of nearly $260bn. DeepMind as a whole reportedly turned a profit for the first time in 2020 (seemingly from selling services back to the rest of Alphabet) but it gives away its flagship health product, AlphaFold, for nothing. Calico could be years away from generating real revenues, let alone profits.

These are open-ended wagers that a company of Alphabet's size can absorb with relative ease. In the next decade the challenge will be to show they can graduate from being experiments and vanity projects to something transformative for the firm—and for Americans' health. ■

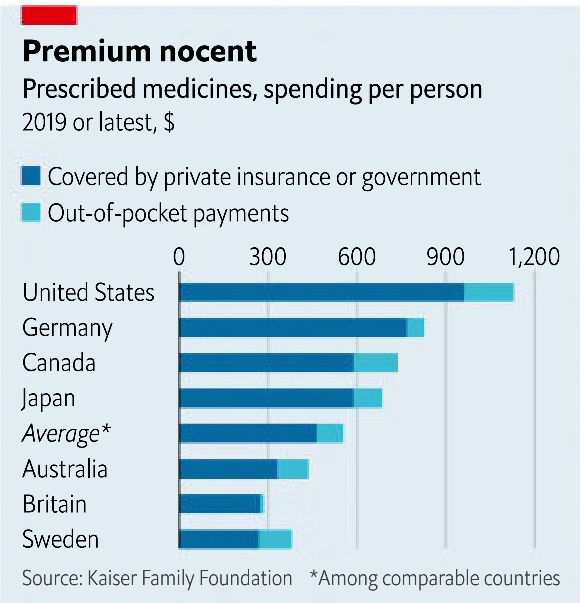
Health care

New pharm hands

Entrepreneurs want to shake up America's overpriced drug market

If there is one thing guaranteed to get Americans to stand to attention it is cheap Viagra. On June 2nd a firm owned by Mark Cuban, a billionaire investor (as well as a judge on "Shark Tank", a TV show for budding entrepreneurs, and the owner of an NBA basketball team), caused a stir by reducing the price of the blue pill—whose patent expired two years ago—from several dollars a pop to 11 cents. It was one of 87 drugs that the Mark Cuban Cost Plus Drug Company added to its growing assortment of cheap off-patent medicines. A new study finds that Mr Cuban's prices might have saved Medicare, a federal health scheme for the elderly, $3.6bn on $9.6bn-worth of drugs it had bought in 2020.

Drugs in America are notoriously dear. In 2019 spending on prescription medicines came to $1,126 per citizen, twice the figure in other rich counties (see chart on next page). Critics like Mr Cuban seek to shake things up. He intends to offer thousands of cheaper drugs by the end of the year. His company buys these directly from manufacturers and sells them to con-



sumers at cost, plus a 15% mark-up and a $3 pharmacy fee. The idea is to make drugs affordable to the 31m Americans who lack health insurance and the many more whose policies make them pay hefty fees for prescriptions. Patients have thanked him on social media for slashing the cost of drugs to treat conditions ranging from heartburn to cancer.

Mr Cuban is not the only one to have lost patience with America's current setup. CivicaScript, from Lehi, Utah, is also trying to bring down the price of generics. In March it said it would manufacture a generic insulin at no more than $30 a vial, down from $300 for today's branded versions. At the innovative, patented end of the market, meanwhile, EQRX and Checkpoint Therapeutics are developing new cancer and immunology drugs with the explicit intention of undercutting expensive existing therapies from big pharma.

Competing on price seems like an obvious thing to try in America's overpriced drug market. A lack of such competition suggests that obstacles get in the way.

Some of these are practical. Certain off-patent drugs take years to copy, manufacture, test and win regulatory approval. Insulin, a complicated biological molecule, is one of them. Having borne the expense of copying and certifying its insulin, CivicaScript may find that the incumbents, which have long since recouped their development costs, simply lower the price of their branded products to undercut it instead. Ned McCoy, CivicaScript's boss, insists this would make him happy; the firm's goal, he says, is to bring about change in the market. The firm is set up as a public-benefit corporation that is not seeking profits but rather a "positive impact on society". But it cannot do that if it goes out of business.

In the American market for patented medicines, the drug's inventor has a great deal of pricing power, which has driven prices higher. Developing new therapies is a costly gauntlet of research, clinical trials and regulatory hurdles. All too often it ends in failure. Risks can be reduced by picking well-understood diseases. Nevertheless, to succeed in the long run, EQRX will need to make up with volume what it forgoes on margins, observes Daniel Chancellor of Informa Pharma Intelligence, a research firm. The same applies to others who choose this model, like Checkpoint. Britain's government has indicated that it would make large-scale purchases from EQRX's pipeline of cancer drugs if those gain regulatory approval. Though this will not help American patients in the near term, it is good news for the company if it helps scale up production.

The final wrinkle is that any medicine-seller who undercuts incumbents becomes a target for acquisition by them. It is easy to imagine a pharma giant launching a takeover bid for the firm, and if successful simply jacking up prices to what the market will bear—which in America is a lot more than what EQRX wants to charge. After buying a biotech startup that had developed a hepatitis drug in 2011, one big drugmaker, Gilead, charged much more for the treatment than its target had planned.

On June 13th Goldman Sachs, an investment bank, noted that the market was undervaluing the drugs being developed by EQRX. On the topic of being acquired, EQRX's boss, Melanie Nallicheri, remarks cryptically that the firm has put thought into how "not to let that happen", but declines to give details. Mr Cuban shares the sentiment: "I don't have a reason to sell…I can afford to absorb the losses that come from starting the company." CivicaScript, too, has made itself an unattractive investment by ceding control over a lot of what it can do to a second non-profit sister company, Civica. The poison pill, it seems, has a place in the pharma business. ■

A ballsy move by Cuban

The internet in China

NetUnease

SHANGHAI

The Communist Party's crackdown on the fun industry continues

In China's world of video-game warcraft the phrase *chong ta* describes the storming of a castle before you are equipped with the right weapons and armour. More recently the term has been used to refer to an equally foolhardy and even more treacherous act: posting risky comments or content on Chinese social media knowing full well that this will incur the wrath of censors, or even higher-level officials.

NetEase, a Chinese games developer, is familiar enough with the first meaning. *Chong ta* is, after all, a staple of "Diablo Immortal", a hugely popular role-playing game set in medieval times. The firm was due to release the Chinese version of the game, developed together with Activision Blizzard, an American gaming giant, on June 23rd. On June 19th it delayed the roll-out, supposedly to further optimise the new version, prompting a 10% slide in its share price. Rumours swirled that *chong ta*'s second interpretation played a role.

In late May the firm's official "Diablo Immortal" account on Weibo, China's Twitter-like service, posted a controversial question: "How has the bear not stepped down yet?" The cryptic message was widely interpreted as a reference to Xi Jinping, China's president, who has often been likened online to Winnie the Pooh (apparently because he resembles the podgy bear's Disneyfied depiction). The Weibo account was banned in June, shortly before the game's scheduled release. Many Chinese netizens immediately spied *chong ta*.

It wouldn't be the first time inopportune online content has cost a Chinese tech company dearly. Last year Wang Xing, founder of Meituan, a delivery super-app, posted on Weibo a 1,000-year-old Tang dynasty poem. After certain internet users construed the verse as an affront to Mr Xi, investors fearful of state reprisal dumped Meituan stock. The firm's share price fell by 14% over two days, erasing about $26bn in market value.

On June 3rd a live-streamed broadcast of Li Jiaqi, an online influencer known to his millions of fans as Lipstick King, was suddenly cut off after he was presented with a piece of cake shaped like a tank. He has not appeared on his show since—a blow to Taobao, the e-commerce platform on which he plies his trade (as well as to international make-up brands), ahead of a big Chinese shopping holiday. Mr Li's disappearance is widely assumed to be linked ▸▸

to the anniversary of the Tiananmen Square protests, in whose bloody suppression tanks played a role. The vehicles' likenesses are thus scrubbed from the internet around the anniversary, lest they remind anyone of what happened that day in 1989.

In recent months Chinese authorities have been signalling that their two-year crackdown on the consumer internet—which at its worst lopped some $2trn off the market value of Chinese tech firms, compared with late 2019—was easing. This month, for example, regulators even approved a new batch of games. The Diablo debacle and the Lipstick King's predicament imply that any respite may be short-lived and selective. So do new rules requiring internet platforms to review user comments before they are posted, a draft of which was unveiled on June 17th.

It is unclear if either NetEase's alleged Pooh, Mr Wang's poem or Mr Li's pudding was in fact a defiant act of *chong ta*. Mr Li's turreted, cookie-wheeled ice-cream cake certainly does not smack of premeditated subversion; the Lipstick King had not previously shown a dissident streak and it is hard to imagine him wilfully sacrificing a lucrative gig. Mr Wang's sin may well have been to fail to consider all the possible interpretations of his post. Whether or not the managers of NetEase's Weibo accounts knew what they were getting into, their plight—and that of Messrs Li and Wang—suggests that divining censors' thought processes is becoming an ever bigger part of doing business in China. ■

Looking at NetEase, the party sees red

Chipmaking

Why everyone wants Arm

The British chip designer behind the smartphone revolution looks destined to stay small

Tech giants, governments, trustbusters, investors: all eyes are on the much-anticipated stockmarket listing of Arm. Despite the recent rout in tech stocks, SoftBank, the Japanese group that paid $32bn for the British chip designer in 2016, still plans to refloat its shares by next March. On May 30th Cristiano Amon, boss of Qualcomm, an American chipmaker, told the *Financial Times* he would like to create a consortium with rivals like Intel or Samsung, either to buy a controlling stake in Arm or to purchase it outright—as Nvidia, another American firm, tried to do in 2020 in an abortive $40bn deal. Some British politicians argue that Arm is so critical that the government should take a controlling "golden share". On June 14th it was reported that, perhaps in response, SoftBank was considering a secondary listing in London alongside the primary one in New York.

Look at Arm's finances and the interest seems puzzling. Its sales rose by 35% last year to $2.7bn—not bad, but peanuts next to the giants of chip design. Its valuation, as implied by the Nvidia deal, has risen by a quarter in six years. In the same period Qualcomm's market capitalisation is up by half and Nvidia's has risen 13-fold, recent market carnage notwithstanding.

There are two explanations of the mismatch between Arm's size and the covetousness it elicits. The first is the ubiquity of its products. Spun out of the wreckage of Acorn Computers, a British maker of desktops, in 1990, Arm has grown to the point where nearly all big tech firms use its designs. Most modern phones contain at least one chip built atop its technology. That makes it a keystone in the $500bn chip industry. Arm's second selling point is its potential. After years of trying, its designs are making inroads into lucrative markets such as personal computers and data centres. They could also power everything from cars to light bulbs as more everyday objects become computers.

Start with the ubiquity. Unlike firms such as Intel, which sells chips that it both designs and manufactures, Arm trades only in intellectual property (IP). For a fee, anyone can license one of its off-the-shelf designs, tweak it if necessary, and sell the resulting chip. Besides licensing revenue, Arm takes a small royalty from every sale of a chip built with its technology. In 2021 licensing revenues accounted for a bit over $1bn, while royalties brought in $1.5bn.

Removing the need to design a chip—a complicated, highly specialised job—has made Arm's off-the-shelf designs popular, especially as chips have become more and more complicated. New Street Research, a firm of analysts, reckons Arm has a 99% share of the $25bn market for smartphone chips. Its products are widely used in everything from drones and washing machines to smart watches and cars. Arm says it has sold just under 2,000 licences since its founding (see chart). More than 225bn chips based on its designs have been shipped. It hopes to hit 1trn by 2035.

The firm's long customer list explains the backlash against Nvidia's proposed buy-out. Simon Segars, who stepped down as Arm's boss this year, used to describe the firm as the neutral "Switzerland of the tech industry". Other chipmakers feared that giving a rival control of it would undermine this neutrality, explains Geoff Blaber of CCS Insight, a research firm. So did trustbusters in big markets, whose concerns derailed the deal. Few were reassured when Jensen Huang, Nvidia's CEO, insisted that he had no plans to use Arm to stymie rivals.

Arm's ability to attract so many customers points to another explanation for the mismatch between its importance and its finances. A big reason why Arm's technology triumphed over rival chip architectures was low prices. New Street reckons that Arm earns royalties of just $1.50 from the sale of a high-end smartphone, for which a consumer may fork out $1,000 or more. Cheaper gadgets might earn it a few cents.

The firm has raised its royalty rates over time, notes Pierre Ferragu of New Street, often when a new version of its designs is released. According to one insider, SoftBank wanted to increase them further. But, he says, the plan caused friction with Arm's bosses, who worried this would irk existing customers. It could also jeopardise Arm's effort to conquer new markets. ▸▸

In 2020 Apple, which has long used Arm chips in iPhones, began replacing Intel silicon in its laptops and desktops with Arm-based designs. Although Apple is not as big in this area as it is in smartphones, it was a vote of confidence for Arm in what had been foreign territory.

Arm has also increasingly been competing in the high-margin business of servers, the high-spec machines found in data centres. That market has for decades been dominated by Intel, but in recent years Arm has scored notable victories. Amazon Web Services, the e-commerce giant's cloud division, now uses lots of Arm-derived "Graviton" chips. Ampere, an American firm that sells data-centre chips, also bases its products on Arm's designs, as do several makers of specialised processors for tasks such as managing networks. TrendForce, another research firm, predicts that Arm processors could account for 22% of installed server chips by 2025.

Under SoftBank's ownership Arm has put lots of money into research and development, says Mr Blaber. That will help it maintain its technological edge. It is nevertheless limited in how much it can charge for its products by the emergence of a new challenger: RISC-V. This is a novel chip architecture that lacks royalties and licence fees entirely. In 2020 Renesas, an Arm licensee, announced it would use RISC-V for a new generation of products. Intel, Qualcomm and Samsung, among others, are also eyeing the technology. Whatever Arm's fate, then—as a public company, a state-controlled one or the ward of a consortium of chip-industry heavyweights—its future will therefore probably resemble its past: vital but, by Silicon Valley standards, a minnow. ■

Bartleby Pity the managers

Don't overdo the sympathy, but the job is both necessary and demanding

Management is not a heroic calling. There is no Marvel character called "Captain Slide Deck". Books and television shows set in offices are more likely to be comedic than admiring. When dramas depict the workplace, managers are almost always covering up some kind of chemical spill. Horrible bosses loom large in reality as well as in the popular imagination: if people leave their jobs, they often do so to escape bad managers. And any praise for decent bosses is tempered by the fact that they are usually paid more than the people they manage: they should be good.

A world without managers is a nice idea. But teams need leaders, irrespective of the quality of the people in charge. Someone has to take decisions, even if they are bad ones, to prevent the corporate machine gumming up with endless discussions. That is true even of flatter organisations. In a paper published in 2021, researchers described an experiment in which a number of different teams took part in an escape-room challenge. Some randomly selected groups were asked to choose a leader before the task began; the rest were not. The teams with leaders did much better: 63% of them completed the challenge within an hour, compared with only 44% of those in the control group.

The difference between good bosses and bad ones is striking. In one paper published in 2012, a trio of academics looked at the output of workers in a large services company who frequently switched between different supervisors. They found that the gap in output between the best and worst bosses was equivalent to adding an extra person to a nine-member team. Even the average boss enhanced their team's productivity by enough to justify their higher salary.

Managers are needed, but they do not have it easy. The job is structurally difficult. Most managers have to meet the expectations, sometimes unreasonable, of people below them and above them. The blurring of work-life boundaries as a result of the covid-19 pandemic seems to have made life tougher for them. Gallup, a pollster, found that in 2021 managers suffered higher levels of self-reported burnout than workers, and that the gap between these groups had widened considerably over the previous year.

They are subject to conflicting demands. They are meant to care about members of their teams and be ready to get rid of them. They are supposed to give people agency while making sure that things are done in the way the organisation wants. The concept of the "servant leader" is utter nonsense. (What next? The weepy psychopath? The serf dictator?) It is also a reflection of the different directions in which bosses are pulled.

Many of those in positions of power don't want to be managing at all. True, some of them have found their way into management because of thrusting ambition. But others have wound up there because it is the only route available to more pay and greater influence. Hence another screwed-up office character: the "reluctant leader".

Managers are also handling the most baffling material on Earth: people. A study conducted by researchers in Germany found that handing out monetary bonuses for good attendance to apprentices in retail stores led to sharp rises in absenteeism (paying for behaviour that was previously considered normal seems to have made people feel licensed to bunk off). Another piece of research, by academics at IESE Business School and the Poole College of Management, found that empowering employees could lead to more unethical behaviour if workers felt under greater pressure to perform. The law of unintended consequences runs through the workplace.

Managers are allegedly human, too, and also susceptible to bias. Bosses who take steps to encourage employees to contribute their ideas are doing the right thing by their organisations and by their teams. But according to research by Hyunsun Park of the University of Maryland and her co-authors, the more they solicit input, the less likely they are to reward people for speaking up. Instead, they credit themselves for creating the right kind of environment. Laudable, no. Natural, yes.

It is true that managers do not save lives or nurture young minds. Even the best ones spout jargon and cause unholy amounts of irritation. The worst ones make life a misery. But the job that managers do is almost always necessary, often unpopular, sometimes done reluctantly and pretty difficult to boot. Every so often that is worth remembering.

Schumpeter | Bean-counters v lion-tamers

In EY's split, fortune may favour the dull

In a Monty Python sketch from 1969, the middle-aged Mr Anchovy, played by Michael Palin, wants to give up what he calls the desperately dull world of chartered accountancy in order to become a lion-tamer. His "vocational guidance counsellor", aka John Cleese, suggests he consider an interim career path—banking, say—while he works towards lion-taming. "No, no, no, no, no," Mr Anchovy interrupts. "I don't want to wait. At nine o'clock tomorrow I want to be in there, taming."

Echoes of Mr Anchovy's yearnings can be heard in the haste with which EY, one of the Big Four accounting firms, is considering spinning off its fast-growing consultancy practice from the unfashionable audit side of the business. Not only is it a bold move by the standards of book-keeping firms—to the point, says Michael Izza of the Institute of Chartered Accountants in England and Wales, that EY's three rivals, Deloitte, PWC and KPMG, will be considering their next steps in light of its decision. There is also a hint of Pythonesque farce about it. Such is the excitement that details of a proposed initial public offering (IPO) in 2023 were leaked to the *Wall Street Journal,* which published them on June 20th. They included the size of the potential bonanza for some of the firm's 13,000 partners—something EY's bean-counters of old would much rather have kept under their bowler hats.

The firm insists no final decision has been made. Yet a split would make sense. Regulators worry that consulting services generate conflicts of interest for firms also carrying out statutory audits. After a string of accounting scandals in recent years they are urging the auditors to stand on their own two feet. As for an IPO, that is bound to set consultants' hearts racing. But like Mr Anchovy, they should think twice before they leap into the lion's den. In the long run, audit may well be the more prudent bet.

Make no mistake, the advisory practice is the red-blooded side of the business. It accounted for two-thirds of EY's $40bn in revenues last year. Unshackling much of the tax, consulting, strategy and transactions work from audit would give the consulting arm more room for manoeuvre and free it from a partnership model that smothers quick decision-making. The new advisory firm could raise capital more easily to invest in technology, as well as developing trendy outsourcing businesses such as fully running multinationals' tax affairs. It could bolster its fortunes by offloading niche businesses. (Not that it needs to wait for an IPO to do that: last year PWC sold one that handles global companies' foreign postings to a private-equity firm for $2.2bn, its biggest divestment in nearly two decades.)

There is an even more enticing precedent. Accenture, which was spun off from Arthur Andersen and then went public a year before the accounting firm collapsed in 2002, has soared in value to $190bn. EY's consulting arm would not be worth close to that. However, the leaked documents, based on recent market conditions, suggest it could raise $10bn by selling a 15% stake. The partners who join it would receive 70% of the shares (the remaining 15% would be for lowlier staff).

It is not all upside for the consultants, though. The split would involve a cash payout from the spun-off company to partners remaining in the rump EY, and would cover potential claims against the firm for problems such as those at Wirecard, a failed German payments company, and NMC Health, a collapsed British hospital chain, both of which EY audited. To make the payment, the new firm would reportedly borrow $17bn—a large sum considering that publicly traded rivals like Accenture and TCS have low debts.

Those are not the only competitors, either. Barriers to entry in consulting are low. Big tech firms such as Microsoft and data-miners such as Palantir may try to muscle into the space. The EY brand may have raised the stature of the consultancy practice, but it will probably be floated with a new name. Like some other consultants, it could fall victim to delusions of grandeur.

That is why, despite being the pedestrian side of the business, audit could be a dark horse. Its shortcomings are well known: lack of trust, conflicts of interest, low pay compared with other professional services, the risk that AI-powered "audit bots" will crawl over its business model. Yet it has some advantages.

For one thing, it remains an entrenched oligopoly. The Big Four audit 99% of firms in the S&P 500 index. Moreover, structural changes are afoot that could benefit it. The first is regulatory. As the Big Four auditors are forced to become more independent, they are raising fees. As pressure mounts to improve audit quality, they will charge more for it. The second change is to their scope. The firms are expecting a lot of new work as regulators force companies to disclose more about their climate impact. Much of this will have to be checked and approved by auditors. One senior accountant talks excitedly about hiring "thousands of eco-warriors".

If history is any guide, the windfall from the split may favour the auditors, too. Though the partners remaining on the audit side would receive lower payouts than those departing with the consultancy, cash in hand is precious, especially in times of volatile markets. The last time EY split off its consultancy, selling it to Capgemini, a French firm, in 2000, the partners who received cash, not shares, did better. And after that the auditors simply rebuilt the consulting side of the business. Even now they plan to retain elements of advisory work, such as parts of the tax practice. These could again be reconstructed into something bigger.

Ants in the pants

Those with long memories, such as the older partners, will know all this. Many of the more junior ones may find themselves lured by the eat-what-you-kill excitement of consultancy. But if they ignore history, they should not ignore comedy. Mr Anchovy never did become a lion-tamer. What he thought was a lion was instead an anteater. Shown a photo of a real lion, he passed out. ■

Property in America

Move fast and break things

WASHINGTON, DC

Can the Fed pull off a controlled slowdown of the housing market?

ESTATE AGENTS are known for their sunny disposition. Lindsay Garcia, a realtor in Miami, is no exception. She talks about the city's warm climate and low taxes, both of which have lured a wave of footloose outsiders. For much of the past two years agents enjoyed a bonanza. Buyers fought to outbid each other, waived property inspections and bought units sight unseen; many paid well over the asking price. Then mortgage rates began to climb this year, cooling the frenzy a little. Only houses that were newly renovated or ready to be moved into straight away received multiple offers, Ms Garcia says. Now a fresh spike in mortgage rates seems to have slammed the brakes on altogether.

On June 15th the Federal Reserve raised interest rates by 0.75 percentage points. Figures released a day later revealed that the benchmark 30-year fixed mortgage rate had hit 5.78%, an increase of more than half a percentage point over the week before. By June 17th, two of Ms Garcia's colleagues had been rung up by buyers abruptly calling off deals because they could no longer afford them.

The plight of the would-be buyers illustrates just how swift and brutal the rise in interest rates has been, and how immediate its impact is on interest-sensitive sectors such as housing. In January mortgage rates were around 3%, only a little above their all-time low of 2.67%, reached during the pandemic. They have nearly doubled since (see chart on next page); only in the 1980s was there a comparably rapid rise in interest rates. The increase has made houses even more unaffordable. In January a buyer with a deposit of $100,000 looking to spend $3,000 a month on housing could afford a home worth $815,000. Now they can afford one worth just $600,000.

The prospect of a turn in the property market's fortunes naturally calls to mind America's housing crisis of 2007-09. But there are important differences between the two situations. Rising interest rates in the late 2000s revealed just how imprudent mortgage lending had been. By contrast, the median FICO score—a measure of creditworthiness—for mortgages today is about 48 points higher than the pre-financial-crisis level of around 700. Household balance-sheets are robust, bolstered by pandemic stimulus, and in aggregate there has been far less borrowing for house purchases than in the early 2000s. The total value of mortgage debt is around 65% of household income, compared with nearly 100% in 2007.

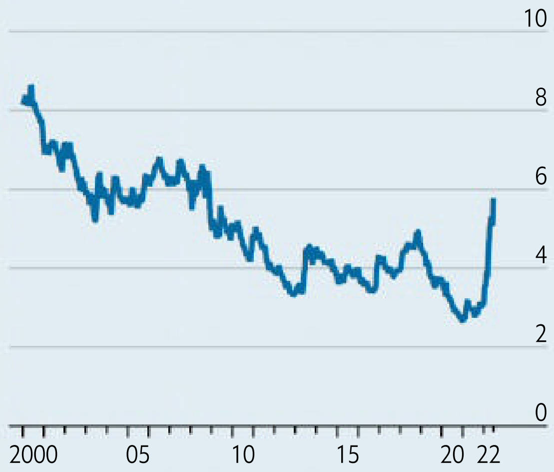
Though it is possible that pockets of dodgy debt lurk in the shadows today, it seems less probable that rising rates will uncover systemic weaknesses in lending ▸▸

→ Also in this section

70 Europe's doom loop 2.0
71 Italy's debt dynamics
72 Carnage in the cryptosphere
72 Fintech fizzles
73 Buttonwood: Buying the dip
74 The inflation exceptions
74 Investors v the BoJ
75 Is natural gas green?
76 Free exchange: Inflation expectations

You can't afford me

United States, 30-year fixed mortgage rate, %



Source: Freddie Mac

standards that could set off a vicious cycle of falling prices and foreclosures. Instead the problem of 2022 is house-price growth itself. "The type of acceleration in house prices that we've seen over the past two years is unprecedented," says Enrique Martínez-García of the Dallas Fed. By the first quarter of the year the increase in American house prices over the previous two years, at 37%, was the fastest on record.

That rapid growth is a problem for the Fed, argues Mr Martínez-García, because it feeds into rents, which in turn contribute to headline inflation. According to Redfin, a property platform, asking rents in May were 15% higher than in the same month last year. As new leases are signed, these will eventually add to consumer-price inflation. Indeed, rising housing costs already accounted for 40% of the monthly increase in the consumer-price index in May. "Cooling the housing market is almost a precondition to being able to tame inflation," says Mr Martínez-García. A housing slowdown, then, will this time be engineered, rather than uncovered.

The best possible outcome is that the Fed manages to slow the property market by enough to bring inflation under control, without overdoing it. The events of the early 1980s, when interest rates last climbed so quickly, illustrate what such a controlled slowdown might look like. Inflation soared to well above 10%, Paul Volcker had just been appointed chairman of the Fed, and the federal funds rate was briefly raised to an all-time high of about 20%. Property prices did fall sharply—but only in real terms. From 1979 to 1982 real house prices fell by nearly a fifth, even as prices in nominal terms rose by a tenth. More notably, housing transactions fell off a cliff. Existing-home sales peaked at 4m in 1978; four years later, only 2m homes were sold.

Higher interest rates this time are indeed likely to hit transaction volumes first. That the initial consequence will be a fall in property sales, rather than a rise in financial distress among homeowners, can be partly explained by a quirk in the America's mortgage market.

In most countries borrowers are offered fixed interest rates for only two to five years; when that period ends, the rate floats in line with the central bank's policy rate. But the existence of America's government-sponsored housing agencies, most notably Fannie Mae and Freddie Mac, which were set up to incentivise home ownership, means that the vast majority of American mortgages are on a 30-year fixed rate. That makes would-be sellers increasingly reluctant to move and give up their cheap mortgages when rates go up. Buyers, meanwhile, can no longer afford the kind of house they want. Daryl Fairweather of Redfin therefore expects the market to go into a "cold period" of scant activity for the rest of the year.

Things could easily get more complicated than they did in the 1980s, though, if the Fed is unable to act with enough precision to stabilise the market without causing prices to crash. The fact that housing has been so frothy makes the task harder. What has been remarkable about the past couple of years of price growth is that it has been so difficult to square with any of the "usual explanations", such as millennial household formation or supply constraints, says Mr Martínez-García. Once those explanations have been ruled out, all that is left is "expectations", such as the fear of missing out on ever being able to buy a house. Cooling a hot property market by just enough to quell inflation is one thing. Deflating a bubble without popping it is another. ■

The euro zone

Thrown for a loop

BERLIN

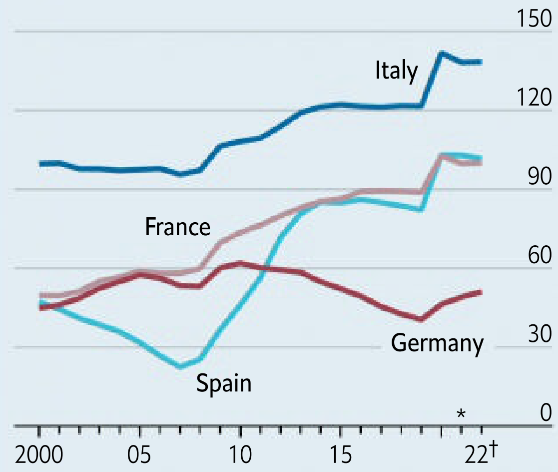
Is the notorious doom loop between banks and sovereigns still to be feared?

THOSE OLD enough to remember the euro zone's economic crisis of a decade ago may have felt a shiver of *déjà vu* on June 15th, when the European Central Bank (ECB) called an emergency meeting to discuss the widening spreads between member countries' government-bond yields. It is nearly exactly a decade ago that, as yields soared, Mario Draghi, then the president of the ECB, promised to do whatever it took to preserve the single currency.

In both instances, bond spreads began to narrow after the central bank intervened. Today the ECB is considering an "anti-fragmentation" tool to lower spreads, say by buying the bonds of weaker countries (provided they meet certain conditions). Nonetheless, worries that the currency union might start to look shaky remain in the air. The fiscal position of Italy in particular, which last year had net public debt in the region of 140% of GDP, is preoccupying investors. Should interest rates rise much more, financial markets might start to doubt its ability to pay its debts (see box on next page).

Can they afford it? 1

General government net debt as % of GDP



Source: IMF *Estimate for Italy and Spain †Forecast

One dangerous feature of the previous crisis was the infamous "doom loop" that connected banks and sovereigns. Crudely put, euro-area banks were loaded up with home sovereign debt. When fears of sovereign default intensified, banks' balance-sheets crumbled, which then required them to be propped up by an already wobbly state. As banks cut lending, the real economy weakened, further worsening the public finances. How much of a worry is this doom loop today? A consideration of the various links in the chain suggests it is less fearsome—but that the monster has not been slain.

Start with banks' exposure to their home sovereigns. After the global financial crisis in 2007-09, banks in southern European countries started to buy large amounts of bonds issued by their home government (which banking regulators consider to be risk-free, meaning that banks do not need to fund their holdings of them with capital). Spanish lenders increased their holdings of national government bonds from around 2% of total assets in 2009 to more than 9% by 2015; Italian banks increased their holdings of home sovereign debt from 4% to nearly 11% over the same period.

Banks in most big euro-area countries have since reduced their exposures to their home sovereign. Strikingly, the boss of one of the bloc's big lenders says that it no longer has any exposure to any euro-area sovereign debt. But Italian banks are the big exception. They remain just as exposed to their government's debt as they were a decade ago. In Italy, at least, this part of the doom loop is alive and kicking.

What about governments' exposure to collapsing banks? Severing this bit of the feedback loop has certainly been an important aim of policymakers. The EU's banking union—which sought to set up a system of common supervision, resolution and deposit insurance—was born nearly a decade ago. The idea was to make banks more European, and rescuing them less of a national affair. The problem, however, is that the task is only half done.

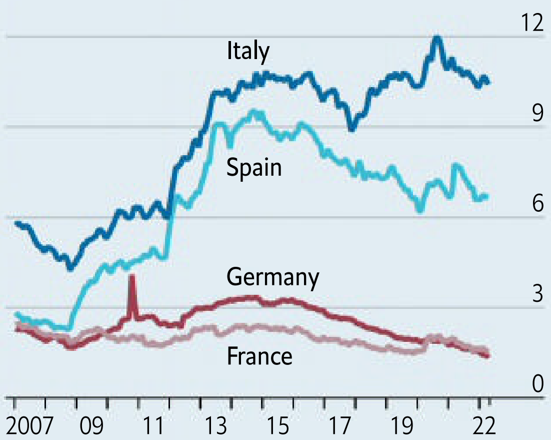
The ECB has been in charge of supervising banks since 2014. That, together with regulatory changes that have forced banks to fund lending with more capital, have made it more likely that troubled lenders can be restructured, meaning that sovereigns are less exposed to the risks stemming from collapsing banks than they used to be. But the European resolution of banks remains incomplete, and common deposit insurance has not been set up at all. All told, "the safety-net for banks and deposits remains predominantly national, and the exposure of banks to sovereigns has not been solved," concludes Nicolas Veron of Bruegel, a think-tank in Brussels.

If governments' sensitivity to failing banks is somewhat lower than it used to be, what about the economy's exposure to zombie lenders? Europe remains largely bank-based, with capital markets playing a minor role in financing firms. It helps at least that banks are less stuffed with non-performing loans than they used to be, and are in better shape overall. But a hit to a national banking system could still impair its ability to lend to firms and households, unless they find other sources of finance.

In 2015 the European Commission launched a plan to bolster Europe's capital markets. But little progress has been made. Most indicators that measure the size of capital markets, and the degree to which they are integrated, have moved sideways. The main problem, say observers, is that national politicians have not fully committed themselves to the difficult work of harmonising rules across countries.

Home bias 2

Banks' domestic sovereign-debt exposure as % of total assets



Source: European Central Bank

Regulation aside, there have been two big improvements within the euro zone that will help weaken the doom loop. The first is on fiscal policy. Without transfers between member states, a national economy will always suffer when its government is forced to cut spending. A sovereign under financial stress may have to cut benefits or raise taxes precisely when the economy is weak. That in turn lowers tax revenues, worsening the fiscal position. From the start of the euro area's crisis in 2010 until about 2014, countries painfully shrank their deficits, hurting economic growth. It was only when interest rates came down and austerity was eased that the economy began to recover.

The covid-19 pandemic has led to more fiscal integration. The EU's recovery fund, financed by commonly issued debt, will spend about €750bn ($790bn) over the next five years, with more money going to support investment in the weakest economies. Such a mechanism of fiscal transfers, if repeated, could make the sovereign-to-economy loop less severe in the future. The second big improvement is political. Few politicians are agitating for their countries to leave the euro, which in turn means investors are not getting jittery about euro exit and debt default.

About a decade ago, policymakers in the euro zone started off with bold plans to eliminate the doom loop. Some of those have come to fruition. But the overall picture is mixed. With a recession looming and interest rates rising, that might not be good enough. ■

Italian debt

Whenever it breaks

How inflation and rising interest rates might affect Italy's finances

BEFORE THE pandemic it was a cause for excitement among economists that the real interest rate governments paid on their debts had fallen below the rate of economic growth in most rich countries, allowing governments to spend more freely and worry less about running up debts. But central banks' battle with inflation today threatens to turn that relationship on its head, making the fiscal position of indebted governments more perilous.

When interest rates are below growth rates, governments can run primary budget deficits (that is, deficits before interest payments are taken into account) without the debt-to-GDP ratio necessarily rising. But when rates exceed economic growth, primary surpluses are the only way to keep indebtedness stable. The higher the starting debt, the more belt-tightening needed.

Fortunately, inflation reduces the real interest rate, and so most countries will gain a fiscal windfall this year. Some of their debt, in other words, will be inflated away. But if central banks successfully bring inflation down, and if high interest rates endure, things could get more painful. The picture looks especially worrying in Italy. The euro zone's third-largest economy had net public debt worth nearly 140% of GDP last year. Its government currently pays about 3.5% to borrow for ten years.

Precisely where Italy's indebtedness and borrowing costs will settle after the energy crisis is uncertain. Our table shows a range of combinations for debt and financing costs, and what they would imply for the country's budget were growth to match the average IMF forecast during 2022-27, and were inflation to fall to the European Central Bank's target of 2%. In reality, the average tenor of outstanding Italian debt is nearly eight years, so it would take time for its average financing cost to rise to the levels shown on the right-hand side of the table.

In search of stability

Government budget primary surplus required for stable debt ratio, as % of GDP*

Debt as % of GDP ↓	Average financing cost, %					
	2.5	3.0	3.5	4.0	4.5	5.0
135	-0.9	-0.2	0.5	1.2	1.8	2.5
140	-0.9	-0.2	0.5	1.2	1.9	2.6
145	-0.9	-0.2	0.5	1.3	2.0	2.7
150	-1.0	-0.2	0.6	1.3	2.1	2.8
155	-1.0	-0.2	0.6	1.3	2.1	2.9

Source: *The Economist*

*Assumes 3.1% nominal economic growth

At financing costs of 3% or below, Italy can run small primary deficits and still outgrow its debt. (The table also shows one weird effect of growth exceeding interest rates: that debt stability is easier to achieve when starting debts are higher.) As interest rates rise, however, stability requires primary surpluses of 2% or more. The only time Italy has run so tight a budget since the global financial crisis was in 2012, at the height of European austerity.

Crypto carnage

Blockchain reaction

Three mechanisms for crypto contagion

This year's Juneteenth holiday in America gave crypto buffs little time to reflect or rejoice. On June 18th bitcoin reached a low of $17,600—its first tumble below $20,000 since 2020—before recovering a little the next day. The sell-off sparked over $1bn in liquidations, as traders who had borrowed money to make big bets failed to post more collateral.

Overall, bitcoin is about 70% below its peak in November; ether, another cryptocurrency, is down by around 80%. As prices have fallen, cracks have appeared in the crypto infrastructure. Babel Finance and Celsius, two crypto lenders, have paused withdrawals after struggling to meet redemptions; their rivals have trimmed their balance-sheets, causing a credit crunch. Third Arrow, a crypto hedge fund, has failed to meet margin calls, and Hoo, an exchange, has halted transactions.

The risk of a fresh downward spiral remains. Traders that were not wiped out have managed to post more collateral with decentralised-finance (DeFi) lenders; the level at which margin calls are triggered briefly dipped. But data from Parsec Finance, an app, suggest that the threshold has risen again to nearly $900 a coin for ether, from $700 on June 20th (at the time of writing, the price of ether was $1,100). Recent events have also shown how three weaknesses in crypto can amplify trouble: fuzzy valuations, incestuous relationships and the lack of a liquidity backstop.

Start with valuations. Some of the most commonly traded crypto tokens are complex products such as derivatives and "tokens" issued by DeFi platforms, for which there are no established valuation models. The lack of an anchor means trust in pricing can vanish in a jiffy; the effect is magnified on weekends, when trading volumes are thinner. Problems in parts of the crypto market can end up rippling outwards, not least to bitcoin, the benchmark for the entire universe.

A second channel of contagion comes from the high degree of interconnectedness between DeFi platforms. This is partly the result of intensifying competition. The amount of money invested in DeFi, after a period of explosive growth, has fallen over the past year. As crypto lenders have vied to attract a shrinking pile of dollars, they have promised ever-higher yields to depositors, which, in turn, has led them to invest users' funds in riskier projects—typically other lending and yield-generating platforms. When the price of one asset falls, the effects cascade through the system.

Celsius is a case in point. In December it claimed to have $24bn in crypto assets under management, which it had lured by offering yields to depositors of as much as 18%. To achieve those returns, it made loans to marketmakers, hedge funds and DeFi projects. When prices sank, however, so did the value of those assets. Some, such as the $400m Celsius held in "staked ether", a derivative, proved illiquid. That left the firm unable to meet growing demand for withdrawals. When Celsius eventually froze funds on June 14th, bitcoin sank by 25%, partly on fears of contagion.

These goings-on revealed a third weakness: the lack of a liquidity backstop to prevent a free-fall in asset prices. In mainstream finance, regulators provide a safety-net. But no institution exists to mop up stressed crypto assets of systemic importance (at least to the crypto system), such as stablecoins, or to bail out important firms. Deposits with crypto lenders are not insured. In conventional finance, such fail-safes reduce the risk of panic-selling when prices tumble.

Were bitcoin to drop below $15,000, liquidations could accelerate so much that posting enough collateral or raising funds to stop the fall may become hard, say Monsur Hussain and Alastair Sewell of Fitch, a rating agency. But it would probably take a trigger for that to happen: a huge hack at an exchange, say, or a big economic surprise. And time seems to be on crypto's side. Crypto platforms, and the risks they take with their assets, may soon come under regulatory scrutiny. Some stablecoins are trying to build sounder reserves: Tether, the issuer of the world's largest such coin, has said it plans to replace its holdings of commercial paper with safer Treasuries. Some of the makings of a frosty crypto winter, though, are still in place. ■

Fintech fizzles

The devil to pay

AMSTERDAM

After a golden decade, fintech faces its first true test

Europe's annual Money 20/20 conference is where the rock stars of fintech come to cut deals and court investors. The shindig this month, the first proper extravaganza since 2020, had the added buzz of a long-awaited reunion, enhanced by DJs and brass bands. "Money 20/20 is back in full technicolour," trumpeted Tracey Davies, the master of ceremonies.

The tone, however, was out of sync with the mood outside the room. Rising interest rates and the threat of an economic slowdown are hanging over the industry. Many listed fintechs have seen their market capitalisation crash by more than 75% since July 2021; private firms are being forced into "down rounds" that value them at less than their previous worth. In recent weeks a sorry cast of multi-billion-dollar fintechs, from Klarna, a "buy now, pay later" (BNPL) firm, to Wealthsimple, a trading app, have announced layoffs. In total, fintechs have sacked about 5,500 employees since May 1st, according to Layoffs.fyi, a website, compared with none last year.

The woes are in stark contrast to the exuberance of 2021, which was fuelled by the surge in digital finance and investors' hunt for returns. Last year financial startups raised $132bn, more than twice their haul in 2020; fully 150 of them reached a valuation of $1bn or more. Now backers are wary—especially "non-traditional" venture capitalists, such as sovereign-wealth and pension funds, that piled in late in the cycle. Some VC investors are pulling out of deals after they are signed.

For many insiders, the downturn serves to clear froth from the market. "There was a lot of greed," notes Vidya Peters of Marqeta, a debit-card firm. The thinking is that the current turmoil will be limited to a correction in valuations, and that the secular trends that have propelled fintech so far remain in place. "Very little has changed," says Rana Yared of Balderton Capital, a VC firm. Recent declines, she points out, have pushed back many valuations only to the levels of early 2020.

Yet the funding crunch could inflict real damage. Olivier Guillaumond of ING, a Dutch bank that also invests in fintech, says he is advising firms in his portfolio to raise debt rather than equity, to avoid diluting valuations. But that means more borrowing just as rates are rising. VCs are also asking startups to hoard more cash to guard against shocks. The boss of one "neobank" says he is planning to cut his marketing budget by 75%. That, however, could compromise the growth on which valuations have tended to be premised.

Worse still, business models are exposed to a souring economic environment. Many fintechs rely on the securitisation of loan and credit-card portfolios, or wholesale funding from banks, to fuel their credit operations, leaving them vulnerable to rising interest rates. Declining household incomes and reduced consumer spending could spell higher default rates and lower fees for payments firms.

The tide is turning in other ways. Some firms had sought to exploit loopholes that helped them avoid some of the regulatory burdens faced by banks; many of these are now being closed up. Others have seen their products commoditised as rivals have swarmed in. BNPL has been hit by both problems. This month Apple said it would launch a BNPL service in America.

Large fintechs with ample cash are responding to the crunch by diversifying faster. Wise, which provides cheap cross-border payments, has launched a stock-trading platform and business-accounting tools. Stripe, a payments giant that raised $600m last year, has branched out into business loans and card issuance. John Collison, its president, says the firm is considering expanding the services it offers.

Banks and credit-card giants, meanwhile, are on the lookout for bargains as startup valuations tumble. The very first session of Money 20/20 saw the boss of Visa Europe waxing lyrical about becoming a "network of networks". Mastercard had sponsored one of the stages at the conference. The incumbents, in other words, are crashing the party. ■

Buttonwood After the fall

What a key valuation measure says about buying the dip

Everyone knows, or thinks they know, the advice of Warren Buffett to investors: that "they should try to be fearful when others are greedy, and greedy when others are fearful." After share prices in America plunged firmly into bear-market territory (defined as a fall of 20%-plus from a recent peak) in June, some will be starting to wonder whether there is enough fear in the air to warrant their being greedy.

How attractively are shares now priced? One approach is to use the equity risk premium as a guide. A rough-and-ready version of it suggests that it is not obviously a time for would-be Buffetts to swoop in. Equities are not (yet) priced at fearful levels. An opportunity for greed may yet arise. But the circumstances will be such that only the steeliest of investors can take advantage.

Start with some definitions. Stocks are riskier than bonds. Owning shares should come with a higher reward for bearing the additional uncertainty about returns. This reward is the equity risk premium. Historically the premium has been handsome, particularly in America. Between 1900 and 2021 the excess real return of stocks over bonds in America was 4.7% a year, on average, according to the Credit Suisse *Global Investment Returns Yearbook*, compiled by Elroy Dimson, Paul Marsh and Mike Staunton, three academics.

That is nice to know. But what investors care about is prospective returns. Yields to redemption are the obvious measure of the expected returns on bonds. The higher the yield, the greater the expected return. By a similar logic, the earnings yield (ie, the inverse of the share-price-to-earnings ratio) is a decent guide to expected return on equities. The gap between the earnings yield and long-term bond yields provides a forward-looking measure of the equity risk premium for long-horizon investors. The higher this premium, the keener investors should be to buy stocks over bonds.

The chart shows a crude measure of the equity risk premium: the excess of the earnings yield on the S&P 500 index of shares over the yield on ten-year inflation-protected Treasuries. The latter yield is a gauge of long-term real interest rates and so is a proxy for prospective risk-free returns for a long-term investor. The risk premium varies over time, because people's risk appetite varies with the circumstances. During the dotcom boom of the late 1990s, for instance, the equity risk premium was negative. Another salient feature is the severe spikes in the premium during periods of extreme stress, such as during the Great Recession in 2008-09 and the euro-zone crisis in 2011-12.

The current reading is broadly in line with the average over the past two decades. It is also little changed from the start of the year. A couple of implications follow from this. First, the bear market has been largely warranted by the sharp rise in expected interest rates now embedded in real bond yields. Share prices have fallen, but the equity risk premium has been broadly constant. You might say that not much has changed with regard to the attractiveness of American shares. That would not be quite right. It would be truer to say that equity prices are now based on more realistic expectations of future interest rates.

A second implication is that equity investors are not especially fearful—or, at least, their worst fears are not reflected in share prices. For now recession is a forecast. It is not yet a reality. History suggests that in recessions American share prices fall even more sharply than they have this year. Panic usually sets in. And a panic is often a good buying opportunity. Should such an opportunity arise again, though, do not imagine that it would be easy to take advantage of. It takes nerve to buy when markets are plunging. You can always convince yourself that an even better opportunity is around the corner. Delay always seems advisable. And delay often ends up meaning not making a decision at all. The opportunity is missed.

Readers may sense a familiar conclusion coming: that market timing is a snare. In this regard, it is worth thinking about Mr Buffett's quote in full. It is only "if they [investors] insist on trying to time their participation in equities", he said, that they should try to be greedy when others are fearful. Mr Buffett was cautioning against a "start-and-stop" approach to the stockmarket, which often leads to investors missing out on returns. There are worse times to buy stocks than after a big fall. But for most temperaments, buying and holding for the long haul is usually the best policy.

Risky business
United States, equity risk premium*
Percentage points

*Gap between S&P 500 earnings yield and real ten-year Treasury yield
Source: Refinitiv Datastream

Asian exceptionalism (1)

Islands of price stability

HONG KONG

Inflation is not high everywhere

FACED WITH public uproar about the cost of living, policymakers like to point out that rising prices are a global phenomenon. "Every country in the world is getting a big bite and piece of this inflation," said President Joe Biden on June 10th, after America reported its biggest bite since 1981 (consumer prices rose by 8.6% in May, compared with a year earlier).

It is true that the cost of fuel, fertiliser and grains rose everywhere after Russia invaded Ukraine in February. But not everywhere has its mouth full of inflation. Of the 42 big economies featured in the indicators page of *The Economist*, eight still have inflation below 4%. Six of those eight are in East or South-East Asia (see chart). The region also includes some smaller oases of price stability, such as Vietnam (where inflation was 2.9% in the year to May) and Macau (1.1% in the year to April).

What accounts for this Eastern exceptionalism? Japan has long suffered from too-low inflation, although rising commodity prices have pushed the headline rate a little higher (see next story). Elsewhere, part of the explanation lies in the spread of two diseases. An outbreak of African swine fever from 2018 to 2021 devastated the pig population in China, where as many as 200m pigs were culled, according to some estimates. This dramatically increased the price of pork, a staple food in East Asia. The price has subsequently fallen back sharply. In mainland China, for example, the price of pork fell by more than 21% in the year to May. This helped offset inflationary pressures elsewhere in the economy. (It also helps that East Asia, unlike other parts of the world, eats more rice than wheat. The price of rice has risen by 8% since Russia invaded Ukraine, whereas wheat prices have increased by 17%.)

The other anti-inflationary disease in the region is covid-19. Many parts of Asia turned to living with the virus more slowly and reluctantly than in the West. Indonesia, for example, did not entirely abandon quarantine for international arrivals until March 22nd. In Malaysia, travel and movement did not return to normal until early May, a full month after the country entered its official "transition to endemic" phase, according to an index of social restrictions developed by Goldman Sachs, a bank. Taiwan remains cautious even now. Its success in keeping covid at bay in the past has left its population with little natural immunity and less of the West's fatalism about the disease.

China, of course, continues to impose stringent restrictions on people's movement and gathering wherever infections appear. The recent lockdowns in Shanghai and elsewhere hampered both the economy's ability to supply goods and its consumers' willingness to buy them. This twin disruption to supply and demand could in theory move prices either way. But the damage to consumer spending seems to be more severe and persistent. In May, the second month of Shanghai's lockdown, retail sales fell by almost 10% (in real terms) compared with a year earlier, even as industrial production rose by 0.7%.

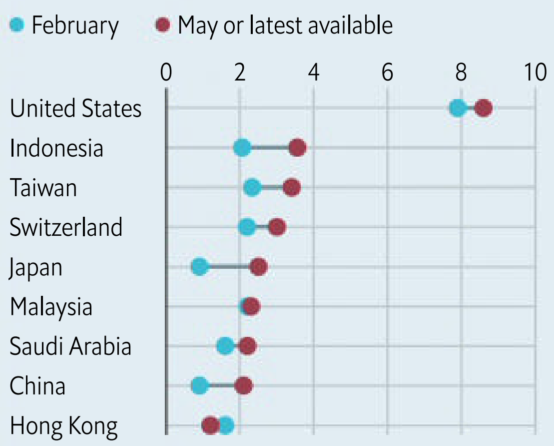
Limits on cross-border travel have been devastating to the economies of Hong Kong and especially Macau, which relies on visitors from the mainland to fill its casinos. Indeed, Macau's GDP in the first three months of this year was less than half the size it reached in the same months of 2019. In that context, inflation of 1% does not seem so miraculously low. Indeed, it is a wonder that prices are rising at all. ■

Land of the slowly rising price

There's no Asian in inflation

Consumer prices, 2022

% increase on a year earlier



Source: Refinitiv Datastream

Asian exceptionalism (2)

The BoJ v the markets

Investors test the Bank of Japan's promise to keep yields low

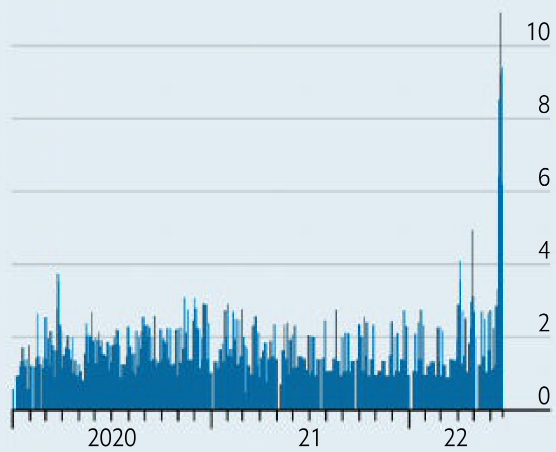
THIRTY YEARS ago, Britain's snap decision to withdraw from the European Exchange Rate Mechanism made George Soros, a hedge-fund titan, more than $1bn from his short positions against sterling. Hedge funds may not be the financial giants they were in 1992, but some speculators still aspire to "break the bank", to borrow the phrase used to describe Mr Soros's bet. This time, it is not the Bank of England but the Bank of Japan that the would-be bank-breakers have their eyes on.

The BOJ stands out like a sore thumb in the world of monetary policy. While the Federal Reserve, the European Central Bank and the Bank of England are rushing to combat inflation by reversing asset-purchase schemes and raising interest rates, the BOJ is sticking to its guns. After a meeting on June 17th it left its policy of "yield-curve control", intended to keep yields on ten-year Japanese government bonds at around 0%, firmly in place. As the gulf between Japanese and rising American bond yields has widened, the yen has plunged: by 15% this year so far, to its lowest level against the dollar since the late 1990s.

The BOJ adopted yield-curve control in 2016 as a way to maintain monetary stimulus, while slowing down the frenetic purchases of Japanese government bonds that it had been undertaking since 2013 to boost inflation. For most of the time its yield cap has been in place, the mere promise to buy more bonds if anyone tested its resolve was enough to keep a lid on yields. More recently, however, that commitment has itself been tested. In the five days to June 20th the central bank was forced to buy ▸▸

The BoJ binge

Bank of Japan government-bond purchases*, yen trn



Source: Haver Analytics *Weekly rolling average government bonds worth ¥10.9trn ($81bn) as it sought to suppress yields. By contrast, between 2015 and 2021 it never bought more than ¥4trn in a five-day period.

Some investors are betting that the BOJ will eventually be forced to alter, or even abandon, its target. BlueBay Asset Management, an investment firm with more than $127bn in assets as of September 2021, is short-selling Japanese government debt. Mark Dowding, the firm's chief investment officer, has called the central bank's position "untenable". Volatility in the typically calm Japanese government-bond market has surged to its highest level in more than a decade.

The investors betting against the BOJ might be taking hope from moments when central banks abandoned similar commitments. Late last year the Reserve Bank of Australia's yield-curve control policy, which targeted three-year Australian government bonds, collapsed spectacularly as yields surged and the central bank failed to defend its target. The Swiss National Bank insisted it would not break its currency peg to the euro in the months leading up to January 2015, before doing precisely that.

So far, however, neither Japan's economy nor the central bank's internal dynamics hint that a change in policy is coming. Inflation has risen, but not exploded as in other parts of the world; consumer prices rose by 2.5% in the year to April, compared with 8.3% in America. Excluding fresh food and energy, Japanese prices are still up by less than 1% year-on-year, and wages by less than 2%. There is little sign of domestically generated price growth.

The weak yen, meanwhile, has a mixed effect. It drives up imported inflation and magnifies the effect of rising dollar-denominated oil prices. But after many years in which Japan's price level has barely budged, a shallow increase does not seem an urgent threat. Even with all these external shocks, inflation is barely above the central bank's target of 2%. Rapid moves in the currency make planning difficult for businesses, but a weaker exchange rate benefits many exporters of manufactured goods, as well as the holders of Japan's ¥1.2 quadrillion in overseas assets, which have gone up in yen terms.

Nor does the mood within the BOJ so far hint at a coming change in policy. The central bank still has several monetary doves in its roosts. Kataoka Goushi was the sole board member to vote against holding policy unchanged in June, but because he wanted even more stimulus, not less. In early June Wakatabe Masazumi, the bank's deputy governor, said that monetary easing should be pursued to maintain wage growth. And Kuroda Haruhiko, the governor of the BOJ, is a longtime advocate of monetary stimulus to revive Japan's sluggish economic growth.

Mr Kuroda is now into the final year of his term. His replacement may well be Amamiya Masayoshi, another deputy governor, who is so entrenched in the institution that he is known as "Mr BOJ". Mr Amamiya has sometimes been seen as more hawkish than Mr Kuroda. But in his most recent comments on monetary policy, in mid-May, he spoke in favour of continuing current policy without reservations. Barring a change to the domestic picture, or a groundswell of hawkish sentiment within the BOJ, investors expecting a U-turn are likely to be disappointed. ■

Green finance

A natural question

The rights and wrongs of investing in natural-gas projects

CAN NATURAL gas ever be a "green" investment? Burning any fossil fuel inevitably makes the planet warmer. Yet switching power stations to gas from more carbon-intensive coal has helped countries cut their total emissions in the past. Environmentalists counter that global temperatures have risen so much that all fossil-fuel use needs to be ended as quickly as possible if the world is to meet the targets laid out in the Paris agreement to limit global warming to "well below 2°C".

European institutions cannot agree on the question among themselves. The European Commission's proposal for a "green taxonomy", a classification scheme that aims to guide sustainability-minded investors, says the fuel can count as green provided it acts as a "bridge" to more renewable sources. The European Investment Bank (EIB), the EU's state-backed lender, by contrast, has virtually ruled out investing in natural gas as inconsistent with its climate commitments.

The EIB is not alone. Multilateral development banks (MDBs) that channel money from rich countries towards worthy projects, such as the World Bank and the Asian Development Bank, have in general turned away from financing natural gas. In 2018 they signed a joint statement saying they would align their lending with the Paris goals, giving them limited scope to invest in the fuel.

Few MDBs lent as much to gas projects as the EIB did before it said in 2019 that it would start phasing out such investment. Researchers at Boston University calculate that the EIB provided more than half of the $63.7bn invested by MDBs in natural gas between 2008 and 2021, mostly for transmission and storage. (That is a tiny fraction of the total amount invested in energy worldwide, but MDBs argue they help catalyse private investment.)

The return of coal provides the case for restarting spending on gas. Eager to move away from imported gas from Russia, on June 19th the German government announced it was restarting some previously mothballed coal power plants. Investing more in Europe's gas infrastructure—such as pipelines, terminals for liquefied natural gas (LNG) imports and storage facilities—could alleviate a shortage of natural gas and keep the continent from having to switch on such plants. At present, bottlenecks prevent LNG imports moving from the continent's terminals, which are mostly in the west, to the eastern and central European countries that need to swiftly wean themselves off piped Russian gas.

What does the tension between the commission's vision of "green" and the EIB's thinking mean for increasing investment in gas? Some think the implications are limited. If there is indeed a business case for gas in Europe, then the private sector could simply finance it, says Sonia Dunlop of E3G, a think-tank. Scarce public money should be used elsewhere.

But the disagreement over the question of investing in gas hints at a deeper problem. Whether it is deemed green or not, gas is an increasingly unattractive investment, the high prices for the fuel after Russia's invasion of Ukraine notwithstanding. Both private and MDB investors worry that gas infrastructure could end up "stranded" as regulatory changes or technological improvements render them unprofitable. MDBs that lend to poor countries are worried that such investments might leave taxpayers saddled with debts for worthless assets. Even the commission's taxonomy classes the fuel as "green" only until 2030. And as long as everyone agrees that gas is dirty in the long term, there is little incentive to invest today. ■

Free exchange | Into a void

Why inflation expectations could be hard to bring down. The first in a series on the central-bank pivot

CONSUMER PRICES across the rich world are rising by more than 9% year on year, the highest rate since the 1980s. Worryingly, there is growing evidence that the public is starting to expect consistently high inflation. Figures suggesting that Americans' medium-term expectations of inflation had risen helped set off the market turmoil in early June, which culminated in the Federal Reserve raising interest rates by three-quarters of a percentage point. Central banks urgently need to convince people that they are serious about getting inflation down. But a range of evidence suggests that changing the public's mind could be extraordinarily difficult.

The difference in views of expert and lay groups has become gaping. Bernardo Candia, Olivier Coibion and Yuriy Gorodnichenko, three economists, look at the inflation expectations of four groups in America. Those of professional forecasters and financial markets remain close to the Fed's target of 2%. But consumers' beliefs increasingly do not. They expect prices to rise by more than 5% over the next year. Firms, exposed to surging commodity, wage and other input costs, expect higher inflation still.

Expectations are rising outside America, too. A dataset put together by the Cleveland Fed, Morning Consult, a consultancy, and Raphael Schoenle of Brandeis University gauges public inflation expectations in various places. In May 2021 respondents in the median rich country thought inflation over the next year would be 2.3%. Now they expect a rate of 4.2%.

Central banks face a problem in getting these expectations down again. This is because few people, aside from investors and financial journalists, pay much notice to what they say. A new paper by Alan Blinder of Princeton University and colleagues puts it more drily: "Households and firms have a low desire to be informed about monetary policy." A survey in 2014 found that only a quarter of Americans could pick out Janet Yellen as the then-chairwoman of the Fed, from a list of four. Two-fifths of Americans believe that the Fed's inflation target exceeds 10%. Small wonder that the impact of its policy announcements on inflation expectations is "muted", according to a recent study by Fiorella De Fiore of the Bank for International Settlements, and colleagues.

Nor are Americans alone. In the late 2000s researchers at the Bank of Italy assessed whether people knew what inflation was. Many had only a fuzzy understanding—with half of respondents confusing price changes with price levels. In recent years Japan has implemented forceful monetary easing in order to boost inflation. But in 2021 more than 40% of Japanese people had "never heard" of the plan, according to an official survey.

In the years before the pandemic, public apathy to monetary policy did not much matter. Inflation was low and stable. Now it matters a lot. Spiralling expectations could become embedded in wages and prices, pushing headline inflation higher still. Central bankers' conventional toolkits may do little to bring them down. Even the effect of raising interest rates is not totally clear: twice as many Americans believe that higher rates raise inflation than reduce it, according to a recent *The Economist*/YouGov poll.

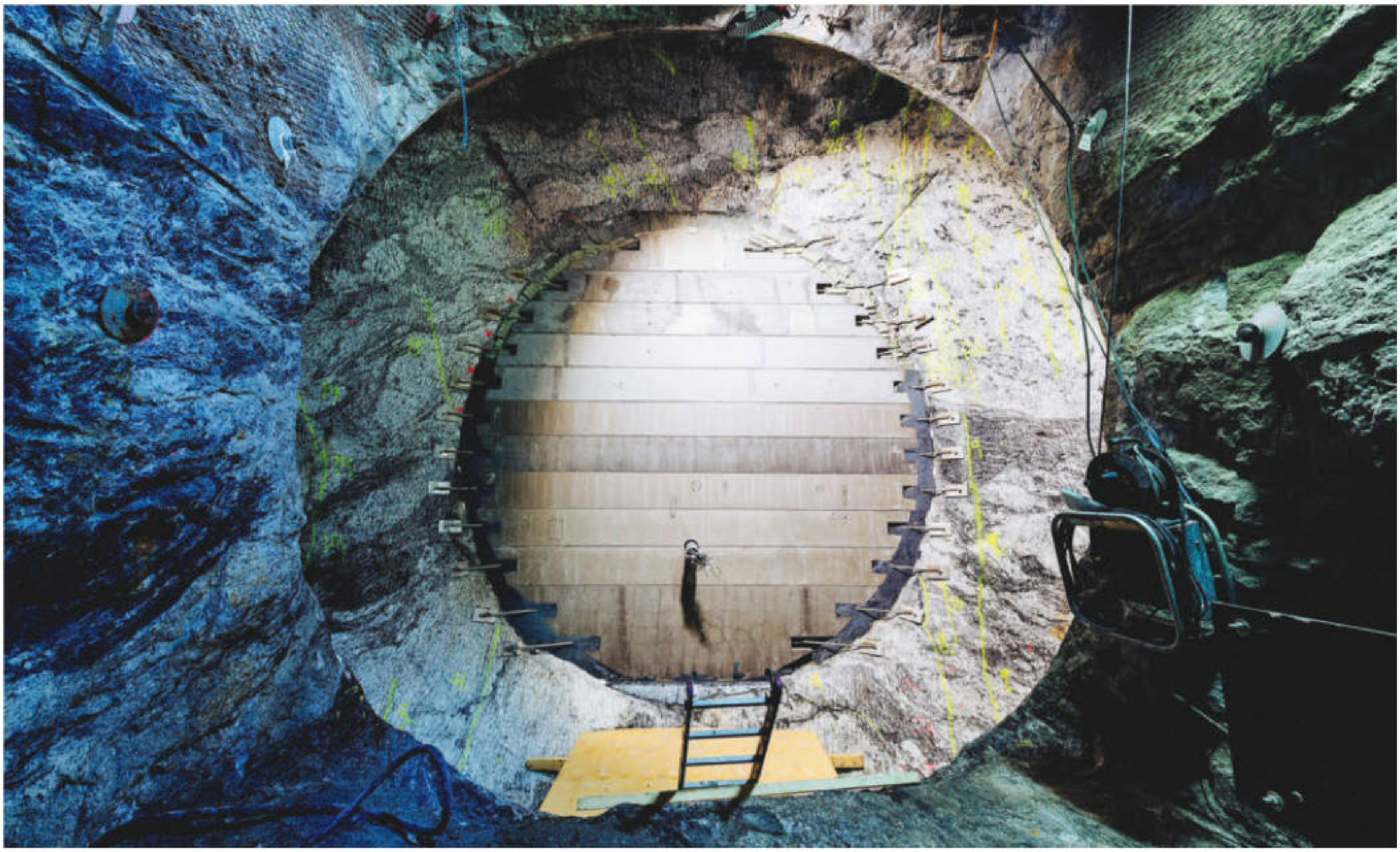
What more can be done? History points to several options. One is to make drastic or unexpected announcements. This could involve raising interest rates outside of scheduled meetings—a decision taken by India's central bank in May. The European Central Bank (ECB) has used this trick in pursuit of another goal: keeping down government-bond spreads, which would otherwise threaten a debt crisis. In 2012 Mario Draghi, then the head of the bank, made an impromptu promise to do "whatever it takes" to save the euro. According to research by Michael Ehrmann of the ECB and Alena Wabitsch of Oxford University, the words generated high traffic on Twitter among non-experts, suggesting they had cut through. The genius of the statement, other research suggests, was that it focused on the end ("preserve the euro") rather than the means ("buying bonds"), which is easier for the public to understand. The ECB has tried to repeat the trick more recently, such as by calling an emergency meeting to address widening spreads.

Others have played the long game. Paul Volcker, the Fed's chairman from 1979 to 1987, cultivated a reputation as what economists call an inflation "nutter": someone willing to tolerate high unemployment to defeat the beast. The public eventually got the message. A recent paper by Jonathon Hazell of the London School of Economics and others argues that post-Volcker "shifts in beliefs about the long-run monetary regime" proved more important than any other factor in conquering inflation before covid-19. Andrew Bailey, the head of the Bank of England, has been trying to embrace his inner Volcker, such as by giving Britons the impression that he cares more about inflation than he does their wages.

Public enemy number one

Another solution is for politicians to get involved. This has potential drawbacks, because they often advocate crackpot anti-inflation schemes such as price controls. Still, they might be able to help. After all, 37% of Americans believe that the president has "a lot" of control over inflation, compared with 34% for the Fed. Jimmy Carter's appointment of Volcker in 1979 showed that he was serious about getting inflation down. In Britain, Margaret Thatcher and her henchmen talked tough on price stability; their willingness to slash government budgets probably backed up those words, by cooling the economy. Today in America, President Joe Biden says that "fighting inflation" is his "top economic priority" (though he shows less inclination to tighten fiscal policy).

Public apathy towards central banking may be a backhanded compliment to the policymakers of the 1980s and 1990s. No one needed to care about inflation when it was low. Today's policymakers are constrained by that very success. To get inflation expectations back down, then, they may need to try everything in their power to get people to sit up and listen. ■



Nuclear waste

Oubliette

OLKILUOTO

Finland completes the first underground warren for storing spent nuclear fuel

NEARLY HALF a kilometre underground, in the Precambrian bedrock of Olkiluoto, an island off the south-western coast of Finland, a rough-hewn gallery a few metres wide and similarly high runs dead-straight through the granite. Underfoot, the floor is a bit muddy, though mostly rocky. Overhead, steel meshing stops any fragments that might have been loosened by the drilling falling onto people's heads. Neither hard-hat-mounted torches nor the headlights of an electric van can reach far enough into the stygian darkness to pick out the gallery's end, some 350 metres away in the distance.

Within a few years, this gallery, part of the Onkalo spent nuclear fuel repository, should be a resting place for batches of waste from Finland's two nuclear power stations to be sealed off permanently from the world. It was completed this month, the last of five almost identical tunnels that run parallel to each other, connected by a main access gallery (see diagram on following page). If all goes well, a warren of roughly 100 more will be excavated as needed over the coming century. As new galleries open, old ones will be backfilled with clay and sealed with concrete, entombing their radioactive contents.

Cold storage for hot waste

Deep geological disposal of this sort is widely held to be the safest way to deal with the more than 260,000 tonnes of spent nuclear fuel which has accumulated in 33 countries since the first nuclear-power plants began churning out electricity in the mid-1950s, and the still larger tonnage that may be generated in the future. Spent fuel is a high-level nuclear waste. That means it is both physically hot (because of the energy released by radioactive decay) and metaphorically so—producing radiation of such intensity that it will kill a human being in short order. Yet unlike the most radioactive substances of all, which necessarily have short half-lives, spent fuel will remain hot for hundreds of thousands of years—as long, in fact, as *Homo sapiens* has walked Earth—before its radioactivity returns to roughly the same level as that of the ore it came from.

At the moment, the vast majority of spent fuel is kept underwater in cooling pools, often within or near the power plants that generated it. The rest is in dry store. Wet or dry, these facilities are all intended as temporary depots—way-stations on the path to permanent disposal while companies and governments wrestle with the headache of where to put the stuff permanently (or conveniently turn a blind eye to a problem which they hope will not become a crisis on their watch).

And so Finland stands, for now, as the only country to have built a complete deep geological storage facility. It is just down the road from Olkiluoto's nuclear-power plant, which generates 21% of the country's electricity. Operations are expected to begin in 2024 or 2025, according to Janne Mokka, chief executive of Posiva, the company behind Onkalo. Posiva applied for its operational licence in December 2021. A trial run is expected next year. Sweden is ▸▸

→ Also in this section

78 Unblocking Fallopian tubes

79 Doubts about Sputnik V

79 The biggest bacterium yet

80 A mastodon's biography

just a few years behind, with its own repository at Forsmark, directly across the water from Olkiluoto. Both use similar designs.

The basic principle of deep geological storage is to put a multiplicity of physical barriers and a great deal of stability between the waste and human beings. Spent fuel rods are first left to cool for a few decades before they are sealed into metallic capsules of a composition that depends on the repository's geochemistry. The idea is to use something which will not corrode—at least not faster than the radioactive material within it decays.

In both Onkalo and Forsmark the water pervading the granite's tiny fissures is free of dissolved oxygen. Copper, corrodible by oxygen but otherwise stable, can thus be used for containment. The cooled fuel rods are packed into cast-iron vessels sheathed in cylindrical copper capsules eight metres tall and 1.05 metres wide. Argon, an inert gas, is injected between the two metals and the copper welded shut by remotely operated machinery. The capsule is then cleaned and transported to a lift that lowers it 430 metres, to a place where the rocks are unperturbed by human activity, climate change or the kinds of fracturing that an ice age might impose.

All this happens inside a remotely operated assembly line on top of the lift shaft. Onkalo's encapsulation building was finished at the end of May and its rooms are now being kitted out with robots that will manipulate the waste.

When the capsules are at the bottom of the shaft, a fleet of remotely operated vehicles will ferry them through a network of underground tunnels to whichever gallery is in the process of being filled. Once there, each will be lowered into a hole in the floor that has been lined with bentonite, an absorbent clay commonly used in cat litter. This will help to keep the copper dry. Gaps that remain will be filled with further bentonite and the hole sealed off. In Onkalo, the floor of each 350-metre gallery can accommodate 30 evenly spaced capsules, together holding 65 tonnes of spent fuel. Once full, galleries will be backfilled with yet more bentonite before their entrances are sealed with a reinforced-concrete cap. *Et voilà*. Goodnight, sleep tight.

Nor will any unwitting adventurer easily blunder across the place in future to wake the sleeping horror lying beneath. In 100 years' time, Posiva will fill the whole site in, remove all traces of buildings from the surface and hand responsibility over to the Finnish government. The thinking is that leaving no trace or indication of what lies below is preferable to signposting the repository for the curious to investigate.

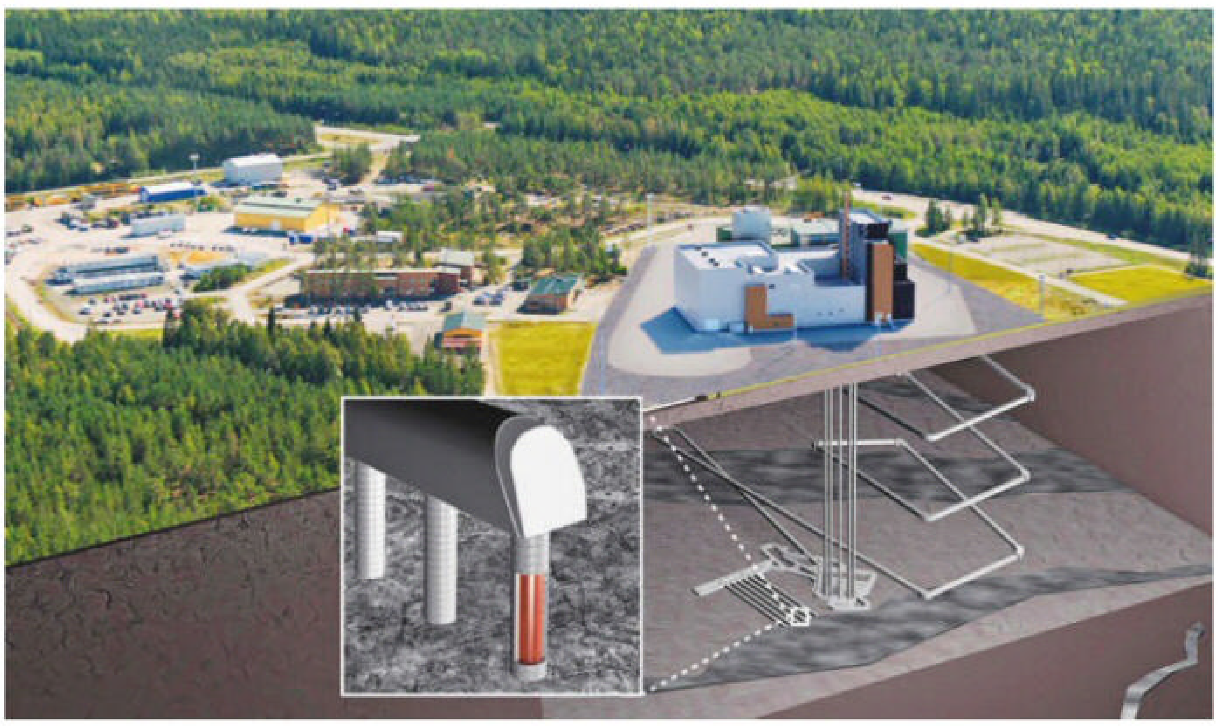
Eventually, the containers may corrode. How long that will take is debated. In 2007 Peter Szakalos, a chemist in Sweden, published a study suggesting copper canisters can do so even in oxygen-free water, and that this could cause them to crack within decades or centuries, not millennia. These findings caused some angst among regulators in Sweden and Finland. Nevertheless, in January of this year, Swedish authorities announced that their concerns had been allayed and construction at Formsark was given the go-ahead.

The current consensus is that corrosion rates, combined with the rates of processes which might bring any radioactive material towards the surface, are so slow that by the time anything does get there it will pose little risk to whatever life is around.

The technology needed to dispose of Finland's waste is thus now in place. But, crucially for Onkalo's success, the government has also, through decades of careful communication and negotiation, obtained popular buy-in for the project.

"It represents 50 years of building trust," says Mr Mokka. That trust-building started with the local power plant. On June 11th, at a summer fair in a town square in Rauma, 20km down the road from the repository, children tottered about holding balloons emblazoned with the logo of the local electricity company. Jenna, a young mother, described how she visited the plant on a school trip when she was a little older than her own child is now. Most people are fine with a nuclear facility just up the road, she says. It is an important employer, and the property taxes its operators pay help local finances. Of the final five sites that had appropriate geology to host Onkalo, two had local populations that were extremely pro-nuclear. Both were next to nuclear-power plants.

Other countries face more difficulties. France's deep-storage efforts, though well advanced, are plagued by demonstrations. America's Yucca Mountain project, in Nevada, is stalled by state-level opposition. But feelings could change over coming decades, and technological advances may make recycling spent fuel first before disposing of it—something France does already—a more attractive option. But regardless of whether nuclear power experiences a comeback, just solving the problem of that 260,000 tonnes of existing waste will surely require lots of digging. ■



Infertility

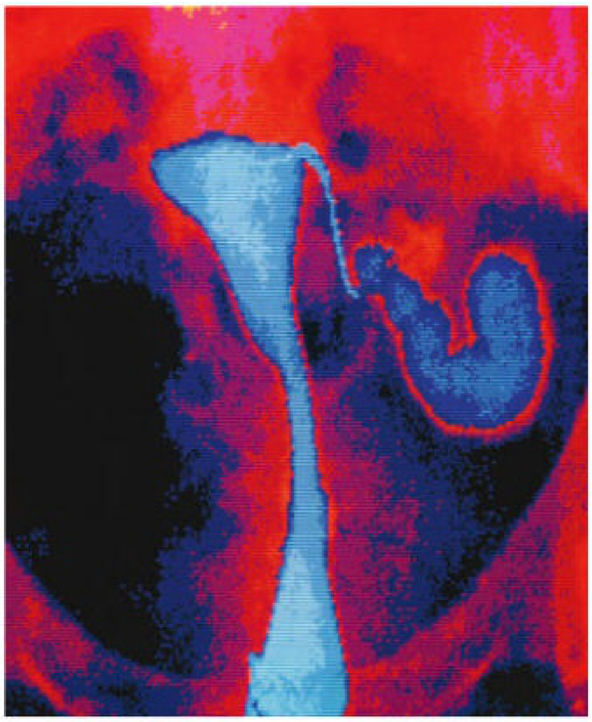
Unblocking the problem

Fertility doctors may be missing a trick

In-vitro fertilisation (IVF) is marvellous. But it is also a palaver. It involves drugs, injections, early morning vaginal ultrasound monitoring, sedation, minor surgery, medical skill, high-tech machines and luck. And at several thousand dollars a pop, it is expensive. Not to mention that it is more likely than not to fail.

In cases where infertility is caused by blockage of the Fallopian tubes, which carry eggs from the ovaries to the uterus, an obvious alternative might seem to be to try unblocking the tubes in question. If the blockage is merely a result of dried mucus, that can be done fairly simply using a procedure called Fallopian tube recanalisation. This involves pushing a fine guidewire out through the end of a catheter and up the blocked tube. It is not a new approach. But it is, in the view of Lindsay Machan, an interventional radiologist at the University of British Columbia, in Vancouver, an underused one. According to Dr Machan, many reproductive endocrinologists and interventional radiologists do not know about it. And he thinks they should.

Between 2015 and 2021, as they reported on June 13th to the Society of Intervention-



A clear candidate for unblocking

al Radiology's annual meeting in Boston, Dr Machan and his team examined 951 women who had been diagnosed with at least one blocked Fallopian tube using a procedure called an X-ray hysterosalpingogram (HSG). This involves sending dye into the uterus to check, among other things, whether the tubes are clear.

For each woman, the team first repeated an HSG, under light sedation. Almost a quarter of their patients, they found, actually had two normal, unblocked tubes. Dr Machan's explanation for this is that without sedation an HSG can trigger a spasm which causes the tubes to clamp shut. This may be mistaken for a blockage.

For the remaining 725 women the team conducted, while they were still under sedation, a more focused procedure called a selective salpingogram. This involves sliding a fine catheter up through the cervix, across the uterus and into the opening of one the tubes, and then injecting dye through it directly into that tube.

Results from the selective salpingograms showed that many of the women had a blockage of a kind that appeared treatable by Fallopian tube recanalisation, which the team then conducted through the catheter that was already in place. In all, they were able to reopen a clogged tube in this way in 539 of their patients—more than half of those originally presenting.

The acid test, of course, is how many of these women have gone on to become pregnant by more natural means than IVF. To that question, Dr Machan has no answer. His purview as a radiologist does not extend to asking it. But, with about 2.5m cycles of IVF performed around the world every year, somebody should do so. If Fallopian tube recanalisation does routinely enable pregnancy, and if the numbers Dr Machan found in his study are anything like typical, it suggests that fertility clinics may be missing an important trick. ■

Sputnik V vaccine

Irregular regularity

Clinical trial results for the Russian covid vaccine are called into question

If you flip a coin, your chances of getting heads or tails are equal. But if several people flip a dozen times each, the chance of them all getting a 50:50 split is small. Neither are they likely all to get exactly the same split, 50:50 or otherwise, between heads and tails. This simple concept is what Kyle Sheldrick of the University of New South Wales, in Sydney, and his colleagues have used to show that clinical trial results for Russia's Sputnik V covid-19 vaccine, published in the *Lancet* in 2021, contain some numbers which are extremely unlikely to occur in that type of trial.

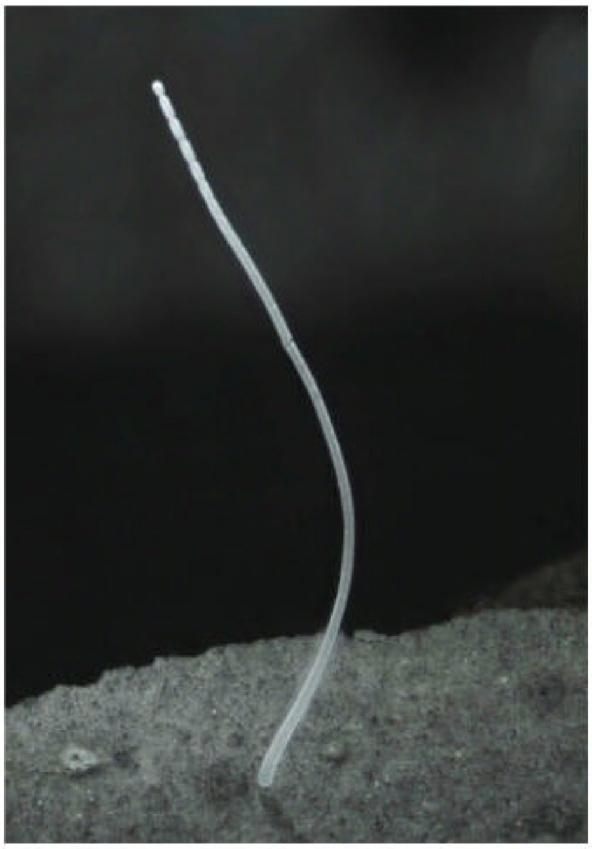
Dr Sheldrick's team published their analysis on June 20th in the *American Journal of Therapeutics*. It was motivated by concerns that other researchers had raised earlier about one particular pattern in the Sputnik V paper: the vaccine's efficacy was almost identical in each of the five age groups shown. The Russian scientists' answer was that these results reflected a true efficacy that did not differ by age. But clinical trials are usually affected by all sorts of random circumstances, known as "noise" in the jargon. The implication is that, in this particular trial, the various sources of noise cancelled one another out in a way that generated a pattern of equivalent efficacy in all age groups.

To examine how likely this would be to have taken place, Dr Sheldrick's team examined what happens when various combinations of statistical noise occurred in a hypothetical sample of trial participants constructed according to the methods described in the Sputnik V paper. They used computer simulation to create 1,000 random variations of noise and counted in how many of these the vaccine efficacy resulting in each of the five age groups fell within the range reported by the Russian scientists. For comparison, they replicated this exercise for four other covid vaccines: those by AstraZeneca, Johnson & Johnson, Moderna and Pfizer.

For the four comparison vaccines, between a quarter and a half of the computed efficacies for all age subgroups fell within the range of their actual published efficacies. For Sputnik V none did. The researchers then repeated the exercise with 50,000 simulations per vaccine. For Sputnik V only 13 of those iterations fell in the reported ranges. Put another way, a trial would need to be repeated, on average, more than 3,800 times in order to produce a single case where the efficacies in all age groups were in the reported ranges. For the four comparison vaccines, that result would be obtained in two to four repetitions.

These results thus call into question the efficacy numbers reported in the original Sputnik V paper. For its part, the *Lancet* said it recognised the concerns about the validity of the data and would be inviting the authors of the paper "to respond to these latest questions".

The matter could be resolved if those authors were to release the data in question, so others could verify the results, says Enrico Bucci of the Sbarro Health Research Organisation, in Philadelphia, who was one of the first to flag the matter up. The ball is now in the Russian team's court. ■



The world's biggest bacterium

At a full centimetre long, this is the largest species of bacterium yet discovered. It was found in a mangrove swamp in Guadeloupe by Jean-Marie Volland of Lawrence Berkeley National Laboratory, in California, and his colleagues. They have dubbed it *Thiomargarita magnifica* in a paper just published in *Science*. To supply its elongated body with appropriate biomolecules, it contains half a million copies of the circular DNA molecules that constitute its genome, each doing its thing locally to keep the organism alive.

Palaeontology

A story carved in ivory

The Buesching mastodon died about 13,200 years ago, aged 34

GEOLOGISTS ARGUE about what is truly the first trace of life on Earth. But to say that living things have been around since about 4bn years ago will do as a nice, round estimate. Ever since then, the winnowing of natural selection has done its work. Only the strong have survived long enough to deliver their genes to the next generation. And boy, was this guy strong. Two tonnes of rippling muscle draped over a skeleton weighing the same, all powered by another four tonnes of visceral organs. And tusks. Two enormous tusks, each three metres long and weighing 40kg.

It is those tusks that best tell the Buesching mastodon's tale. More than 13 millennia after his last, fateful encounter with another bull—one that proved stronger, or cleverer, or just luckier—they were discovered, along with the rest of his almost complete skeleton, in peat workings near Fort Wayne, Indiana, owned by a family called Buesching. That was in 1998. Joshua Miller of the University of Cincinnati and Daniel Fisher of the University of Michigan have since been studying them, and have published what amounts to a biography of the animal in the *Proceedings of the National Academy of Sciences*.

Tusks are giant teeth. And teeth contain calcium phosphate. This is the material that strengthens them. But calcium is in the same column of the periodic table as strontium, a rarer element, so the two are chemically similar—so similar (and strontium so rare) that natural selection has never bothered to learn the difference. If the tusk-assembly process comes across a strontium atom, it incorporates it as though it were calcium, no harm done.

This harmless mistake gave Dr Miller and Dr Fisher much of what they needed to write their mastodon's life story. Commonly, strontium comes in two isotopes (atoms of different weights). The ratio of these in plants of the sort which mastodons ate depends on their ratio in the underlying rocks. Like trees, tusks have annual growth layers. And the rocks of America's Midwest are so well studied that their strontium ratios are well known. So the pair were able to trace with reasonable confidence whereabouts their mastodon was when a pertinent bit of a tusk was growing.

When he was there was given away by a second pair of isotopes—this time of oxygen atoms. Water molecules with the heavier version of oxygen in them are more reluctant to evaporate, so the ratio of the two isotopes in rainwater depends on the temperature, and therefore the season. And the oxygen from rainwater also ended up in mastodons via their fodder.

Where, then. And also when. But, reluctant to take for analysis more than the bare minimum of material from their precious sample, Dr Miller and Dr Fisher concentrated on the years when the animal was aged between 11 and 16, and between 31 and 34. And they had other information as well. Nutritional stress showed up in the appearance of the growth layers, as did damage caused by fighting other mastodons.

Previous studies suggest that male mastodons lived when young with their mothers, siblings, aunts and cousins, in matriarchal groups similar to those of modern-day elephants. Dr Miller and Dr Fisher did not bother to waste precious ivory confirming this. Instead, they started with the rebellious teenager.

The teenage Buesching mastodon, they found, was extending his range year by year, stomping over land in what are now the states of Illinois, Indiana, Ohio and Michigan. But he showed no seasonal preference for a particular place. He was also stressed by those adolescent years. At least, his tusks suggest he was not eating as well as he might have been.

Full-grown and at the height of his powers, though, all signs of stress are gone. The later samples indicate he was now migrating seasonally—returning in summer to an area near the centre of his range that seems to have served as a mating ground.

And he was pugnacious. Tusk damage indicates that from the age of 26 he was getting into regular scraps at this time of the year. These may reflect musth—periods of aggressive temperament experienced by modern male elephants. If they do, it suggests musth evolved a long time in the past. The last common ancestor of mastodons and modern proboscideans lived about 25m years ago.

Whatever the details, he met his match in the eighth year of these jousts. The procreative instincts drilled into his genes by his ancestors' successes over the aeons culminated in the moment of his death. One of his opponent's tusks punched through his right temporal fossa, a weak area on the side of the skull, severing an artery. That was the end of him. But previous seasons' successes would probably have seen him get his genes into the next generation, so job done.

A frank encounter

Nothing, though, lasts for ever—even the lines of creatures as mighty as mastodons. Palaeoanthropologists differ about when the peopling of the Americas began, but all recognise the rise of a culture called Clovis, with its suite of effective stone tools and weapons, particularly spearheads. That started shortly after the Buesching mastodon's final, fatal fight.

Clovis weapons changed the rules of engagement between humans and the local wildlife. Mastodons, along with their proboscidean cousins the mammoths and a whole range of other large American mammals, from sabre-toothed cats to armour-plated glyptodonts, did not long survive contact with this supreme embodiment of the 4bn-year winnowing of the gene pool. All gone, their genetic lines cut off. But not forgotten. At least, not while biographers like Dr Miller and Dr Fisher ply their trade. ■

→ Also in this section

82 America's national anthem
83 A Manhattan street vendor
83 North Korean hackers
84 Nuclear nightmares
86 Back Story: Pet Shop Boys' magic

Feminist history

The rule of three

LISBON

A book that caused a scandal in Portugal 50 years ago remains powerfully relevant

LEAVING HOME one summer's evening in 1971, Maria Teresa Horta noticed a car was following her. She had recently published a volume of poetry, "Minha Senhora de Mim" ("My Lady of Myself"), which reflected on female sexual pleasure. Portugal's dictatorial regime, led by Marcello Caetano, did not approve. The goons in the car confronted Ms Horta, warning her not to write such smut again. The beating they administered put her in hospital.

A few days later she turned up to lunch with two friends and fellow writers. They were appalled. "God, if a single woman has something like that happen to her because of a book of poetry," Maria Velho da Costa said, "imagine if the three of us wrote a novel." Ms Horta was enthusiastic about the idea; the third woman, Maria Isabel Barreno, was more cautious. Yet when they next met, Barreno had begun the book.

For nine months the three convened every week to exchange work. The result was more ambitious and strange than a novel: a mix of poems, letters and essays inspired by "Letters of a Portuguese Nun", a 17th-century epistolary story in which a Franciscan nun addresses her French former lover and describes being held in a convent against her will. The authors felt this was an apt metaphor for women's lives in modern Portugal. "What woman is not a nun, sacrificed, self-sacrificing, without a life of her own, sequestered from the world?" they wrote. "What change has there been in the life of women through the centuries?"

They called the book "New Portuguese Letters" and, seeing it as a joint endeavour, did not identify their contributions. Using a sometimes bewildering cast of characters, they comment on the subjugation of women in the home, misogynist laws, sexual and domestic violence, abortion, the Catholic church and the colonial wars Portugal was waging in Africa. They anticipated a backlash, but "the machismo of the Portuguese had to be made clear," says Ms Horta, now 85. "It was a macho country that gagged women. It was a country that wanted us to obey the rules and customs that had been in place for decades."

"New Portuguese Letters" was published 50 years ago, in 1972. Tipped off by the printers, the government acted swiftly. It banned the book, seizing copies on the grounds that the text was "irreparably pornographic and incompatible with public morality". Copies already sold circulated on the black market. The women were questioned, charged with abusing the freedom of the press, then released on bail. A trial was set for 1973. The country's media were not permitted to report on the case.

But word of the women's persecution, and the stifling of free speech in Portugal, got out. A friend of Barreno smuggled copies of the book into France and sent ▸▸

them to feminist writers including Christiane Rochefort, who publicised the case. French newspapers published excerpts of the text, which was shared among women's liberation groups. In Britain authors including Doris Lessing, Iris Murdoch and Jean Rhys wrote to the *Times* expressing their disgust with the trio's treatment. At the International Feminist Planning Conference held in Massachusetts in June 1973, representatives of dozens of countries agreed to rally round the "Three Marias".

The suppression of "New Portuguese Letters" became the first international feminist cause, known from Buenos Aires to Islamabad. Women round the world put pressure on Caetano's government by signing petitions, writing letters to embassies and appealing to the UN Human Rights Commission. In London and New York, theatres hosted readings from the book; women in Brussels and Paris marched in solidarity. In The Hague feminists climbed onto the roof of the Portuguese embassy and unfurled a banner.

The regime was "internationally discredited by the negative publicity of the Marias' case", says Hilary Owen of Oxford and Manchester universities. At home, the furore fed a dissenting mood. Already unpopular for its costly, grim wars in Angola, Guinea-Bissau and Mozambique, the dictatorship was overthrown in a military coup on April 25th 1974.

The women were acquitted soon after the coup, known as the Carnation revolution, and interest in Barreno, da Costa (who died in 2016 and 2020 respectively) and Ms Horta waned. Other reforms took precedence over gender issues; for a time the book went out of print. Today many Portuguese have heard of it but not read it.

The letters and the law

Ana Luísa Amaral, a poet and academic, says that is changing. She has edited a volume on the international reception of "New Portuguese Letters" and published an annotated edition that made the writing more accessible. She says scholarly interest has risen, both because it is a "great book" and because its themes still resonate. A section on abortion, only liberalised in Portugal in 2007, might profitably be read by American judges; it describes the lengths to which women have gone to end a pregnancy, using anything "they had at hand that would penetrate and scrape". A letter written in the voice of a Portuguese fighter, articulating his fear and despair, "could very well have been written by soldiers in Iraq", Ms Amaral says.

The 50th anniversary may prompt more readers to seek out the book. An exhibition focused on the case is travelling across the country; Rita Rato and Joana Alves of the Aljube Museum in Lisbon say it was popular with school-age children there, attracting lots of atypical visitors. Already performed in Lisbon and Guimaraes, a play about the lawsuit will be staged in Almada and Funchal later this year. Ms Horta will appear in "Mulheres de Abril" ("Mothers of April"), a forthcoming documentary film and accompanying television series about Portuguese female activists.

Half a century on, Ms Horta says the book remains relevant as "equal opportunities are far from being achieved". Ms Rato notes the glass ceiling that still limits women's careers in Portugal and the soft sentences often given to perpetrators of violence against them. "My sisters", asks a passage in "New Portuguese Letters", "what can words do?" The book's own history offers a kind of answer. ■

America's national anthem

Proof through the night

O Say Can You Hear? By Mark Clague. *W.W. Norton; 325 pages; $28.95 and £20.99*

IN JULY 1814 an unsigned magazine article bemoaned the state of patriotic music and poetry in America. "Our national songs are full of ridiculous exaggeration, and frothy rant, and commonplace bloated up into fustian," complained the writer, thought to be Washington Irving. When would someone produce an anthem worthy of the new republic?

Just two months later, as it turned out. Inspired by the Battle of Fort McHenry, a young lawyer named Francis Scott Key wrote the words for "The Star-Spangled Banner" and set them to a popular tune. Irving's *Analectic Magazine* published the lyrics, which caught on across the country. Key's song served less to reflect than to encourage national unity. As Mark Clague says in "O Say Can You Hear", Key had written "an implicit critique of anyone who sustained the nation's partisan divide" during the War of 1812 with Britain.

Mr Clague, a music professor at the University of Michigan, has produced a thoughtful and elegant history of America's national anthem. Unlike a flag, he writes, a song must be performed, so it is "not a static icon but a patriotic act". Removing your hat for it signals respect. Kneeling or raising a fist, as African-American athletes have done to protest against racism, makes a political statement. Almost any deviation from custom can cause a stir. Translate the anthem into another language, sing it poorly or adapt it to a new musical tradition and someone will howl.

All the same, "The Star-Spangled Banner" has also been remarkably pliable. More than 30 other songs set to the same tune were written about the War of 1812 alone. During the civil war the Confederates twisted the lyrics: "O say does that Rag-Strangled Banner still wave/O'er the land of the thief and the home of the slave?" Later the proper version helped reconcile the foes. At the Court House in Appomattox, a quartet of Union soldiers serenaded former Confederate officers as the peace was signed. "Gentlemen," said the rebels, "if we'd had your songs, we'd have licked you out of your boots!"

Alongside the anthem's historical significance, Mr Clague explores its musicology. It is famously hard to sing. Many a performer has fretted over the high note on the word "glare", yet "to sound this note true and in tune is to signal the melody's extraordinary ambition, not only to symbolise heroism but in a sense to be heroic." The music itself was written in around 1778 by John Stafford Smith, an Englishman. Mr Clague reckons the greatest modern performance was by Whitney Houston at the Super Bowl in 1991 (pictured). His personal favourite—for musical ambition, political awareness and sheer audacity—is by Jimi Hendrix at Woodstock.

Key's own biography muddies the story. In his day job, the amateur lyricist filed over 100 freedom petitions for enslaved African-Americans, more than any other lawyer in the District of Columbia. But he also represented slaveholders, owned slaves himself and despised abolitionism (the word "slave" appears ambiguously in his little-sung third verse). Rather than proposing to tear down monuments to Key—as happened in San Francisco in 2020—or find a new anthem, Mr Clague embraces the vexed historical record. Contradictory, beautiful and full of aspirations unfulfilled, "The Star-Spangled Banner" remains the perfect song for America. ■

A higher love

World in a dish

In the street kitchen

NEW YORK

What Manhattan's street-food vendors reveal about their city

SHERIF BAIOUMY'S morning begins at around 7am in a garage in Queens, where he loads up his cart with the day's food: marinated chicken, a ten-pound skewer of ground lamb, rice, vegetables, hot dogs, falafel, frozen chips, canned soft drinks and bottled water. A colleague hitches the cart to the back of a pickup truck, and by 9.30 they've rolled it into place on the south-west corner of 48th Street and 6th Avenue, in the heart of office-worker Midtown.

Soon the lamb is rotating on its skewer, chicken is sizzling on the grill and falafel burbling in the deep-fryer (the cart is a symphony of efficient design, without an inch of wasted space). Too many people consider food vendors a nuisance, or somehow déclassé. In fact they play a vital role—not just by feeding people, but as living records of their cities' changing habits and demography.

The next eight hours are a steady stream of frying, wrapping and unceasing banter. Calling Mr Baioumy friendly is like calling water damp; he is ebullient and warm, whether fist-bumping with his regulars or enticing passers-by. In restaurants, where chefs are generally secreted in the kitchen, they can afford to be surly. Buying lunch from a vendor is a more intimate experience, and chatting to him as he cooks is part of the charm.

Mr Baioumy runs one of Manhattan's "halal carts", a term with a meaning specific to New York. Usually overseen by Afghans, Bangladeshis or Egyptians like him, they mainly serve halal chicken or lamb over rice or in a pita, garnished either with "white sauce" (a bafflingly popular spiced mayonnaise cut with vinegar) or hot sauce. Much like *pho* stalls in Hanoi or taco trucks in Los Angeles, New York's halal carts have similar menus, but each vendor has his own style. Mr Baioumy's marinade has an almost Mediterranean flavour, with strong notes of lemon, garlic and rosemary.

These carts were unknown a couple of decades ago, when souvlaki was the street lunch of choice. But as immigration from Greece slowed and Greek vendors aged, newer arrivals took their place. That cycle recurs around the world. Grilled chicken, papaya salad and sticky rice came to the streets of Bangkok—home to perhaps the world's most delicious and varied street food—with migrants from Isaan, the country's impoverished north-east.

The work is gruelling, especially in the heat. Mr Baioumy reckons that on a good day he takes home $200 in profit, but every two years $20,000 of that goes to the Florida-based owner of his licence. Because New York issues a paltry number, the licences are valuable commodities, though that is set to change: the city will give out 4,450 more in the next decade, and will require the holders actually to run the carts.

In time, the chicken and lamb that Mr Baioumy sells may seem as unremarkably American as bagels or hot dogs, both of which were once the province of immigrant vendors. But as the food evolves, New York's food carts serve the same function: offering a quick meal and friendly greeting to a city eternally in a hurry. ■

Cybercrime

The pirates of Pyongyang

The Lazarus Heist. By Geoff White. *Penguin Business; 304 pages; $29.95 and £20*

THE "HERMIT KINGDOM" of North Korea is so technologically backward that it is visible—or rather invisible—from space. Photographs taken at night show a country covered in darkness, with only a few pinpricks of light around Pyongyang, the capital. China, Japan and South Korea, by contrast, glow with artificial illumination.

But as Geoff White, a BBC journalist, explains in his rollicking new book, that backwardness has helped make a handful of North Koreans very technologically savvy indeed. He tells the story of the Lazarus Group, the name given by security analysts to a collection of North Korean state-sponsored hackers. In a country where access to the internet is a luxury afforded to only a tiny few, they have, over the past decade, become some of the world's most prolific cybercriminals.

The Lazarus Group is thought to have been responsible for a $100m raid on Bangladesh's central bank in 2016; the WannaCry malware attack that in 2017 hit organisations around the world, from Maersk, a shipping giant, to Britain's National Health Service; and a string of more recent hacks and cryptocurrency frauds. The group's various schemes are thought to have netted billions of dollars of precious foreign currency for the North Korean regime.

"The Lazarus Heist", which is based on a BBC podcast of the same name, provides both a pacey insight into the cutting edge ▸▸

Hackers of the hermit kingdom

of modern crime and an equally fascinating portrait of life inside North Korea (gleaned from a mix of official sources and interviews with defectors). In theory, the regime preaches *Juche*, usually translated as "self-reliance", deliberately isolating itself from the decadent capitalism that contaminates the rest of the world.

But self-imposed isolation has left North Korea impoverished and underdeveloped. Its pursuit of nuclear weapons has brought sanctions, compounding the problem. With the economy strangled and citizens poor and sometimes starving, Mr White describes a state trying its hand at a variety of criminal schemes, from counterfeiting to smuggling and cooking crystal meth, in an effort to earn foreign currency. Eventually it alighted on computer hacking—especially electronic bank raids—as the most lucrative. A UN report of 2019 attributed 21 separate attacks to the Lazarus Group, most aimed at foreign banks.

Despite its technical topic, the book is breezily written. Well-observed pen portraits make the revolving cast of characters—Chinese underworld fixers, hapless bank employees, casino croupiers and hackers in rural England—easier to follow. Knotty details are skimmed over without sacrificing the crucial points, though at one stage Mr White guides the reader through a few lines of low-level computer code, perhaps to reassure the technically minded of his bona fides.

And the tales themselves need no embellishment. A bank clerk frustrated by a misbehaving printer comes to realise it was one of the few outward signs of a huge scam taking place under his nose. Bangladesh's losses are limited by a piece of blind luck: a destination bank for the stolen money is located on Jupiter Street in Manila, and "Jupiter" happens to be the name of a shipping firm involved with Iran, which trips anti-fraud systems. The stolen Bangladeshi loot is laundered through the VIP baccarat tables of a Filipino casino; gangs of money mules pose as high-rollers yet seem oddly bored and listless while placing enormous bets.

Conspicuously missing, despite the title, are the stories of the hackers themselves. Mr White describes how mathematically talented children from across North Korea can be funnelled into what has become a prestigious job, offering better housing, social status and even occasional trips to the outside world. He shows how the hackers' sophistication has grown alongside their confidence. But North Korea's isolation, and the fact that the culprits remain safely ensconced thousands of miles from the targets of their heists, mean only one of them is ever given a name—Park Jin Hyok, whose face adorns the FBI's "Cyber Wanted List". And even that may be a pseudonym. ■

Nuclear accidents

Ghosts in the machines

Atoms and Ashes. By Serhii Plokhy. *W.W. Norton; 368 pages; $30. Allen Lane; £25*

Given that they are grounded in an aspect of nature unknown before the turn of the 20th century, it is not surprising that the immense, insensible powers of nuclear reactions have something of the supernatural about them. That sense of otherworldliness lends a ghost-story dread to the moments of nuclear malfunction when the reactions intrude into the world of the bodily and perceptible.

Serhii Plokhy's accounts of the world's six worst nuclear accidents to date capture those occasions with haunting drama. He evokes the moment in 1954 when—30km from the unexpectedly titanic Castle Bravo H-bomb test on Bikini Atoll—a shock wave transforms the toilet in the firing team's bunker into a fetid fountain. He describes the terrible, scaled-up recapitulation of that eruption when, in 1957, 150 tonnes of concrete are blown 20 metres into the air from the top of a nuclear-waste storage tank at Chelyabinsk-40, releasing a plume of radioactive material that would contaminate 20,000 square kilometres of the eastern Urals.

In the same year, a technician at Windscale, in north-west England, peers through an access port and sees the reactor within on fire, its graphite face glowing red. Then in 1986 an operator at Chernobyl (the subject of a previous book by Mr Plokhy) hears a "roar" of a "completely unfamiliar kind, very low in tone, like the moan of a human being", as the core of reactor 4 slipped for ever out of control.

This is the stuff of good storytelling, and on that score "Atoms and Ashes" succeeds. All six accounts provide context and telling detail. Some feature bravery and some obtuseness. It is hard, with the benefit of hindsight, not to want to shout at the operators at Three Mile Island in Pennsylvania (pictured), who so consistently did the wrong thing before the partial meltdown of 1979. There are touches of humour, too. Arthur Wilson, the technician who looked into the burning heart of the reactor at Windscale, recalls thinking: "Oh dear, now we are in a pickle."

Nevertheless, the book should not be treated as definitive. Microcuries and millicuries are confused, as are megawatt-days and kilowatt-days and plutonium and beryllium. In a couple of places the text suggests that nuclear reactors can be used to produce uranium-235, which is not the case. Besides these slips, "Atoms and Ashes" is less satisfying when it and the reader pull back from the individual dramas to consider the subject of nuclear technology as a whole.

Mr Plokhy, a Ukrainian historian at Harvard whose other books include a history of the Cuban missile crisis, holds that the inevitability of accidents is one of several reasons to encourage nuclear power to drift into disuse, rather than give it a new role in the fight against climate change. He argues that if the world pursues nuclear power on a grand scale to cut carbon emissions and one of the plants involved has its own accident, the nuclear strategy will stall and the possibility of using other technologies to the same end will have been forgone.

The longest three miles

That is a well-observed worry. But looking at past accidents in context does not make them seem so necessarily damning. The three associated with nuclear weapons and their manufacture—those at Bikini, Windscale and Chelyabinsk—all happened in programmes being rushed forward at a tremendous pace. Chernobyl, too, was in part the result of a rush. The Soviet Union felt it had fallen behind in nuclear energy and decided to roll out RBMK reactors because they could be built quickly, ignoring the fact that, by using both cooling water and graphite moderators, they combined the risks of fire and explosion. The design was nightmarish in other ways, too, as was a culture that valued the personal authority of bosses over safety regulations, which were consciously ignored.

These accidents amount to a case against hasty programmes based on limited knowledge and carried out in cultures of secrecy, autocracy and fear. Three Mile Island showed the need for more considered operator training; the Fukushima disaster in Japan in 2011 demonstrated the danger of a nuclear regulatory body too entangled with the industry it regulated, and with a government from which it should have been independent.

As Mr Plokhy says, lessons have been learned from all the episodes in his book. It is fair to be concerned about how well those lessons have been assimilated, especially given that a lot of today's reactors are being built in or by China and Russia, not countries in which authority tends to be questioned and the public informed, nor places much inclined to independent regulators. But it is a step too far to foresee a future in which nuclear power must be abandoned altogether. ■

Back Story Debussy to a disco beat

Pet Shop Boys achieved a kind of musical alchemy—transmuting sadness into joy

When "It's a Sin" was released in 1987, gay marriage was barely a dream. Margaret Thatcher's government would soon pass a law banning the "promotion of homosexuality" in classrooms. Neil Tennant, Pet Shop Boys' singer and lyricist, drew on his spell at a Catholic school in Newcastle, characteristically using language at once limpid and flexible, so that the "sin" seems to cover all manner of impulses. In a video directed by Derek Jarman, Mr Tennant was tormented by inquisitors as he made his pulsating confession:

> When I look back upon my life
> It's always with a sense of shame
> I've always been the one to blame

Times have changed. Mr Tennant (pictured) came out in 1994; recently his song lent its title to a TV drama about the AIDS crisis of the 1980s. He and Chris Lowe, the keyboardist and other half of Pet Shop Boys, are in their 60s. Yet on June 26th they will headline the Glastonbury festival, midway into a greatest-hits tour bound from Europe to North America in the autumn. Their staying power is down to more than stamina or fans' nostalgia: their best music still pulls off an emotional alchemy that few bands—and no other art form—can match.

The pair met in a synthesiser shop on the King's Road in 1981, both northerners in London (Mr Lowe is from Blackpool) and keen on electronic music. Some of their songs are hymns to the city, its promise and loneliness, exhilaration and vertigo. From the noir opening—"Sometimes, you're better off dead"—"West End Girls", a transatlantic number one in 1986, mixes anomie with the frisson of cross-class desire, the glitz and grind of "a West End town in a dead-end world".

That song was influenced by the chattering voices in "The Waste Land". Russian history is a recurring motif in Mr Tennant's lyrics; some are sly critiques of Thatcherism. Since their "imperial phase" in the late 1980s, the duo have confirmed their reputation for "intellectronica" with a pop oratorio about the gay codebreaker Alan Turing and a soundtrack for Sergei Eisenstein's "Battleship Potemkin".

For all the bookishness, though, the band's appeal lies partly in a kind of sublime simplicity: expressing sadness and longing in plain yet supple words that are poignant even when they also seem ironic. "What Have I Done to Deserve This" mourns a failed relationship, "Rent" the sense of being trapped in one ("Look at my hopes, look at my dreams…"). "Suburbia" laments the claustrophobia of the suburbs, "Being Boring" the way the lives of friends diverge, and some end prematurely: "All the people I was kissing/Some are here and some are missing." That track commemorated a friend who died of AIDS; on the current tour Mr Tennant dedicates it to the victims of covid-19.

The other part of Pet Shop Boys' genius is to set these feelings of heartache to tunes that urge you to wave your arms, stamp your feet and chant the chorus. Their sound brought together the tempo of the "hi-NRG" dance music that had developed in America with influences from David Bowie and Kraftwerk to film scores and rap, combining them into a dramatic brand of electropop. It counterpoints the melancholy of the lyrics with infectious beats, arresting key changes, swooning refrains and operatic climaxes.

So when Mr Tennant sings about running with the dogs in suburbia, you want to run with them. In "Left to My Own Devices", a rousing riff on isolation, you wouldn't mind being in the head of the "lonely boy, no strength, no joy" who hears "Che Guevara and Debussy to a disco beat".

In the new show, the act's trademark lighting and effects illuminate an otherwise limited spectacle—Mr Lowe standing as impassively as ever at his keyboard as Mr Tennant potters about the stage. For "It's a Sin", flames and bursts of crimson swirl behind them. The throbbing chords and breathless crescendos turn shame into defiance, repression into joy.

> For everything I long to do
> No matter when or where or who
> Has one thing in common, too:
> It's a…It's a…It's a…It's a sin.

Classic songs are a time machine. These hits teleport Pet Shop Boys' older listeners to their youth, a thrill even if those years were hard. They capture the bygone mood of a gritty age. More than that, they let you smile at sorrow, at once echoing your woes and making you feel better. Doing either is an artistic achievement; doing both together is a feat that only words and music can perform, and only rarely. It will never get old.

UN Capital Development Fund

UNCDF
Unlocking Public and Private Finance for the Poor

June 15, 2022

Subject: RFP No. RFPHQ2-UNCDF- 90721
Request for Proposal (RFP) on Lead Arranger Services Provider for the Issuance of the Blue Peace Bond for the Gambia River Basin Development Organization (OMVG)

The UN Capital Development Fund (UNCDF) is looking for the services of a Lead Arranger who will perform tasks related to the issuance of the Blue Peace Bond for the Gambia River Basin Development Organization (OMVG) in West Africa within the territories of the Gambia, Guinea, Guinea-Bissau and Senegal.

The Blue Peace Bond is an integral part of the Blue Peace Financing Initiative which promotes access to capital markets for regional non-sovereign entities responsible for the management of water resources. The initiative is a partnership between the UN Capital Development Fund (UNCDF), the Swiss Agency for Development and Cooperation (SDC) and the Gambia River Basin Development Organization (OMVG).

All interested parties are invited to join the virtual pre-bid conference scheduled for 7 July 2022 at 10 AM EDT (New York) to provide further information regarding the Blue Peace Financing Initiative and respond to questions in relation with the assignment of the Lead Arranger. Notwithstanding the opportunity to ask questions during the pre-bid conference, prospective bidders may also send questions related to the RFP at any time to this email address: uncdf.procurement@uncdf.org.

The Public announcements related to this tender is here: https://procurement-notices.undp.org/view_notice.cfm?notice_id=90721

To participate to the pre-bid conference, please register here: https://undp.zoom.us/webinar/register/WN_KUH4_cQxReunz7R8V6R8kw

For more information on the Blue Peace Financing Initiative, please also visit: UNCDF website: https://www.uncdf.org/mif/blue-peace-financing-initiative

Brochure: https://www.uncdf.org/article/7568/blue-peace-financing-initiative-for-regional-non-sovereign-entities

UN Capital Development Fund
Two United Nations Plaza, 26th Floor — New York, NY 10017, USA
info@uncdf.org | +1 212 906 6565 | www.uncdf.org

Announcements

JUDICIAL ACQUISITION OPPORTUNITY OF AGRO-INDUSTRIAL COMPLEX IN ARGENTINA- VICENTIN S.A.I.C.

For court file “VICENTIN S.A.I.C. s/ CONCURSO PREVENTIVO” (CUIJ 21-25023953-7), the comminatory schedule for the period set forth in Section 48, Act 24522 was approved, establishing 7/13/2022 the as the date of public opening of bids. Provided the process is initiated, bids may be presented to acquire the total share issue of the corporation.

The company’s main activity focuses on agro-industrial activities and activities arising therefrom (**https://www.vicentin.com.ar**) (Approximate capacities: soybean milling: 7.5 million tons per year, sunflower milling: 500 thousand tons per year, Ethanol production: 100000 m3 per year, Biodiesel production: 160 thousand tons per year). Court resolution and other records are available at **www.concursopreventivovicentin.com.ar**.

For more commercial information, please contact **sindicaturaconcursalvicentin@gmail.com** or **gn@rnca.com.ar**.

Courses

UNIVERSITY OF OXFORD
Saïd Business School

Online programmes

Prepare for an ever-changing and uncertain future with Saïd Business School

It has never been more important to understand and respond to the issues shaping the future. Recognising the increasing complexity of our global landscape and often inevitable choices for sectors which operate within competitive environments.

Our online programmes fall into five categories

- DISRUPTIVE
- LEADERSHIP
- ENTREPRENEURSHIP
- STRATEGY & INNOVATION
- FINANCE

If you would like to discuss our online programmes further, please get in touch with our team.

OnlineExecEd@sbs.ox.ac.uk
Or call +44 (0)7701 305954

Economic & financial indicators

Economic data

	Gross domestic product, % change on year ago, latest		quarter*	2022†	Consumer prices, % change on year ago, latest		2022†	Unemployment rate, %		Current-account balance, % of GDP, 2022†	Budget balance, % of GDP, 2022†	Interest rates, 10-yr gov't bonds latest,%	change on year ago, bp	Currency units, per $ Jun 22nd	% change on year ago
United States	3.5	Q1	-1.5	2.3	8.6	May	7.8	3.6	May	-4.3	-5.9	3.2	168	-	
China	4.8	Q1	5.3	4.0	2.1	May	2.1	5.9	May‡§	2.5	-6.2	2.6 §§	-36.0	6.72	-3.7
Japan	0.4	Q1	-0.5	2.1	2.4	Apr	2.2	2.5	Apr	1.4	-6.1	nil	-8.0	136	-18.5
Britain	8.7	Q1	3.0	3.6	9.1	May	7.2	3.8	Mar††	-2.7	-5.5	2.6	174	0.81	-11.1
Canada	2.9	Q1	3.1	3.8	7.7	May	6.2	5.1	May	1.1	-3.6	3.5	209	1.29	-3.9
Euro area	5.4	Q1	2.5	2.3	8.1	May	7.1	6.8	Apr	2.3	-4.4	1.6	178	0.94	-10.6
Austria	9.5	Q1	10.0	3.5	7.7	May	7.0	4.4	Apr	-1.1	-4.6	2.2	214	0.94	-10.6
Belgium	4.9	Q1	2.2	2.0	9.0	May	9.2	5.7	Apr	-1.3	-3.8	2.3	220	0.94	-10.6
France	4.5	Q1	-0.8	2.2	5.2	May	5.5	7.2	Apr	-1.4	-5.7	2.3	216	0.94	-10.6
Germany	3.8	Q1	0.9	1.3	7.9	May	7.7	3.0	Apr	6.3	-3.2	1.6	178	0.94	-10.6
Greece	7.9	Q1	9.7	4.0	11.3	May	7.0	12.7	Apr	-5.7	-4.9	3.9	301	0.94	-10.6
Italy	6.2	Q1	0.5	2.7	6.8	May	6.5	8.4	Apr	1.0	-5.9	3.6	275	0.94	-10.6
Netherlands	7.0	Q1	0.1	2.4	8.8	May	10.4	3.3	May	8.4	-3.5	1.9	199	0.94	-10.6
Spain	5.5	Q4	1.3	4.0	8.7	May	7.2	13.3	Apr	0.8	-5.7	2.8	232	0.94	-10.6
Czech Republic	5.1	Q1	3.7	2.2	16.0	May	11.9	2.4	Apr‡	-2.5	-4.8	5.4	370	23.3	-8.1
Denmark	6.6	Q1	-0.4	2.1	7.4	May	6.9	2.4	Apr	8.2	1.0	2.0	186	7.02	-11.0
Norway	4.8	Q1	-3.8	3.2	5.7	May	4.8	2.9	Mar‡‡	16.4	8.7	1.4	76.0	9.89	-13.0
Poland	9.4	Q1	10.4	4.5	13.9	May	10.1	5.1	May§	-2.2	-3.7	7.2	540	4.43	-14.2
Russia	3.5	Q1	na	-10.0	17.1	May	21.0	4.0	Apr§	9.9	-4.4	8.9	173	53.7	36.2
Sweden	3.1	Q1	-3.2	2.4	7.3	May	5.1	8.5	May§	4.1	0.4	2.0	163	10.1	-15.3
Switzerland	4.4	Q1	1.9	2.4	2.9	May	2.5	2.2	May	6.3	nil	1.4	154	0.96	-4.2
Turkey	7.3	Q1	4.9	3.0	73.5	May	62.2	10.6	Apr§	-4.2	-3.6	18.8	174	17.4	-50.0
Australia	3.3	Q1	3.1	3.0	5.1	Q1	5.0	3.9	May	3.1	-3.2	4.0	244	1.44	-7.6
Hong Kong	-4.0	Q1	-11.4	0.8	1.3	May	4.1	5.1	May‡‡	0.3	-6.7	3.2	200	7.85	-1.0
India	4.1	Q1	1.9	6.9	7.0	May	7.3	7.1	May	-1.5	-6.6	7.4	137	78.4	-5.1
Indonesia	5.0	Q1	na	5.1	3.6	May	5.3	5.8	Q1§	0.2	-4.8	7.5	88.0	14,868	-3.1
Malaysia	5.0	Q1	na	5.0	2.3	Apr	3.0	3.9	Apr§	2.8	-6.2	4.3	97.0	4.41	-5.7
Pakistan	6.2	2022**	na	6.2	13.8	May	16.1	6.3	2021	-5.3	-7.1	12.9 †††	313	212	-25.3
Philippines	8.3	Q1	7.8	7.1	5.4	May	4.7	5.7	Q2§	-3.0	-7.7	6.8	285	54.5	-10.7
Singapore	3.7	Q1	2.8	3.6	5.4	Apr	6.0	2.2	Q1	18.3	-0.9	3.0	153	1.39	-2.9
South Korea	3.0	Q1	2.6	2.7	5.4	May	4.4	3.0	May§	3.4	-2.3	3.7	165	1,298	-12.8
Taiwan	3.1	Q1	4.3	4.4	3.4	May	3.8	3.7	Apr	13.9	-1.2	1.2	79.0	29.8	-6.2
Thailand	2.2	Q1	4.7	2.9	7.1	May	5.7	1.5	Dec§	0.1	-5.0	2.9	136	35.5	-10.5
Argentina	8.6	Q4	6.3	4.2	60.7	May	61.7	7.0	Q4§	0.7	-4.6	na	na	124	-22.9
Brazil	1.7	Q1	4.0	1.3	11.7	May	10.4	10.5	Apr§‡‡	nil	-6.7	12.9	353	5.14	-2.5
Chile	7.2	Q1	-3.0	2.1	11.5	May	10.2	7.7	Apr§‡‡	-4.5	-3.4	6.5	224	887	-14.7
Colombia	8.2	Q1	4.0	4.2	9.1	May	9.8	11.2	Apr§	-3.7	-4.8	12.0	493	4,032	-6.0
Mexico	1.8	Q1	4.1	1.9	7.7	May	7.6	3.1	Apr	-0.6	-3.2	9.2	227	20.0	2.9
Peru	3.8	Q1	8.1	2.5	8.1	May	7.1	6.3	May§	-3.3	-2.5	7.7	215	3.73	6.7
Egypt	8.3	Q4	na	5.9	13.5	May	12.9	7.2	Q1§	-6.0	-5.9	na	na	18.7	-16.3
Israel	9.5	Q1	-1.9	4.3	4.1	May	4.2	3.5	Apr	3.1	-2.1	2.9	177	3.44	-5.2
Saudi Arabia	3.2	2021	na	7.5	2.2	May	2.5	6.9	Q4	14.9	10.1	na	na	3.75	nil
South Africa	3.0	Q1	8.0	1.9	6.6	May	6.0	34.5	Q1§	-1.1	-6.1	10.1	107	15.9	-9.5

Source: Haver Analytics. *% change on previous quarter, annual rate. †The Economist Intelligence Unit estimate/forecast. §Not seasonally adjusted. ‡New series. **Year ending June. ††Latest 3 months. ‡‡3-month moving average. §§5-year yield. †††Dollar-denominated bonds.

Markets

In local currency	Index Jun 22nd	% change on: one week	% change on: Dec 31st 2021
United States S&P 500	3,759.9	-0.8	-21.1
United States NAScomp	11,053.1	-0.4	-29.4
China Shanghai Comp	3,267.2	-1.2	-10.2
China Shenzhen Comp	2,119.8	1.0	-16.2
Japan Nikkei 225	26,149.6	-0.7	-9.2
Japan Topix	1,852.7	-0.2	-7.0
Britain FTSE 100	7,089.2	-2.5	-4.0
Canada S&P TSX	19,004.0	-3.1	-10.5
Euro area EURO STOXX 50	3,464.6	-1.9	-19.4
France CAC 40	5,916.6	-1.9	-17.3
Germany DAX*	13,144.3	-2.5	-17.3
Italy FTSE/MIB	21,788.6	-3.0	-20.3
Netherlands AEX	641.9	-3.2	-19.6
Spain IBEX 35	8,145.4	-0.4	-6.5
Poland WIG	53,001.7	-0.7	-23.5
Russia RTS, $ terms	1,403.4	9.6	-12.1
Switzerland SMI	10,528.3	-2.4	-18.2
Turkey BIST	2,574.3	1.7	38.6
Australia All Ord.	6,682.3	-1.5	-14.1
Hong Kong Hang Seng	21,008.3	-1.4	-10.2
India BSE	51,822.5	-1.4	-11.0
Indonesia IDX	6,984.3	-0.3	6.1
Malaysia KLSE	1,431.1	-1.9	-8.7

	index Jun 22nd	% change on: one week	% change on: Dec 31st 2021
Pakistan KSE	42,458.1	2.5	-4.8
Singapore STI	3,093.3	-0.4	-1.0
South Korea KOSPI	2,342.8	-4.3	-21.3
Taiwan TWI	15,347.8	-4.1	-15.8
Thailand SET	1,560.0	-2.1	-5.9
Argentina MERV	85,662.5	-3.2	2.6
Brazil BVSP	99,522.3	-3.2	-5.1
Mexico IPC	47,144.4	-2.5	-11.5
Egypt EGX 30	9,612.9	-3.6	-19.3
Israel TA-125	1,890.7	1.1	-8.8
Saudi Arabia Tadawul	11,319.9	-5.5	-0.1
South Africa JSE AS	65,712.7	-2.7	-10.8
World, dev'd MSCI	2,537.3	-0.8	-21.5
Emerging markets MSCI	993.6	-2.6	-19.4

US corporate bonds, spread over Treasuries

Basis points	latest	Dec 31st 2021
Investment grade	167	120
High-yield	494	332

Sources: Refinitiv Datastream; Standard & Poor's Global Fixed Income Research. *Total return index.

Commodities

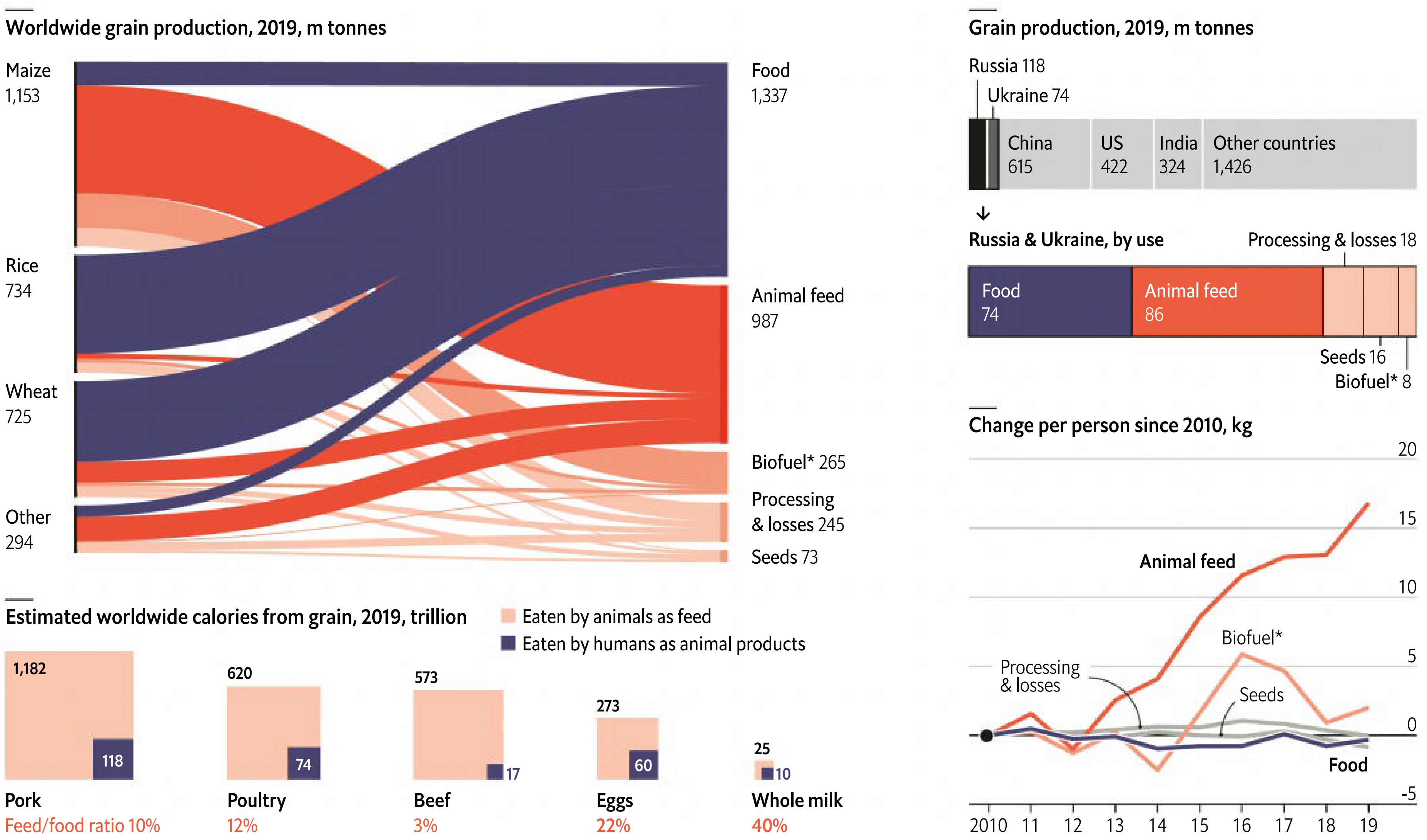
***The Economist* commodity-price index**

2015=100	Jun 14th	Jun 21st*	% change on month	% change on year
Dollar Index				
All Items	174.5	169.1	-6.5	-7.0
Food	158.0	159.6	-3.3	23.7
Industrials				
All	190.0	177.9	-9.0	-23.0
Non-food agriculturals	172.2	170.3	-3.2	12.8
Metals	195.2	180.2	-10.5	-29.3
Sterling Index				
All items	221.9	210.1	-4.6	5.4
Euro Index				
All items	185.9	177.5	-5.0	4.8
Gold				
$ per oz	1,813.6	1,838.5	-1.5	3.2
Brent				
$ per barrel	121.1	114.7	0.8	53.2

Sources: Bloomberg; CME Group; Cotlook; Refinitiv Datastream; Fastmarkets; FT; ICCO; ICO; ISO; Live Rice Index; LME; NZ Wool Services; Thompson Lloyd & Ewart; Urner Barry; WSJ. *Provisional.

For more countries and additional data, visit
Economist.com/indicators

→ Almost half of the world's grain is fed to animals or burned as fuel. This share has been rising over time



*And other non-food uses, such as plastics and hygiene products Sources: UN FAO; Observatory for Economic Complexity; "Human appropriation of land for food", P. Alexander et al., 2016; "Redefining agricultural yields", E. Cassidy et al., 2013; "Biomass use, production, feed efficiencies, and greenhouse gas emissions from global livestock systems", M. Herrero et al., 2013; *The Economist*

Against the grain

Most of the world's grain is not eaten by humans

THE YELLOW and blue of Ukraine's flag evokes the country's bountiful wheat beneath a cloudless sky. Today, smoke from artillery has turned the skies grey. Tractors have been hauling heavy weapons, not grain, and a Russian naval blockade has prevented past harvests from reaching their destinations. The loss of this output has caused already high grain prices to surge. The World Food Programme warns that 47m people are at risk of hunger as a result.

Despite talks with Turkey over shipping Ukrainian grain, Russia is unlikely to let exports pass through the Black Sea. Ukrainian grain is difficult to reroute by rail. If Ukraine remains cut off from world markets, it might seem like simple maths to infer that production elsewhere must expand to keep the world fed. But in fact, more than enough grain is already grown to meet humanity's needs. The problem is that 43% is either burned as biofuel or used to feed animals. That is equal to six times the grain output of Ukraine and Russia combined.

Less than half of the world's grain harvest is eaten by people. Take wheat, the most important crop grown by the two warring countries. In 2019, the latest year for which data are available, Russia and Ukraine jointly produced nearly 103m tonnes, less than the 129m tonnes fed to animals. Another 22m tonnes were turned into biofuel. The belligerents' second-biggest crop, maize, was even less likely to end up on a plate: humans ate just 13% of global output. Because Russia and Ukraine produce little rice, the total share of their grain output eaten by people was just 37%, below the global average of 46%.

Around the world, grain production went up by 17% in the 2010s, exceeding population growth by six percentage points. Consumption per person, however, remained flat, even as many went hungry.

Instead, the extra grain was put to other uses. Nearly one-tenth was converted into biofuel, which is used mainly to power cars. But the lion's share went to animals. In 2019 pigs ate 431m tonnes of grain, 45% more than the people of China did, according to our calculations. Overall, from 2010 to 2019 the amount of grain used for animal feed rose from 770m tonnes per year to 987m, as the world's pasturelands shrank and appetite for meat grew.

Some grain by-products, such as maize husks, are unsuitable for human food. And feeding grain to animals does generate food for people indirectly, in the form of milk, meat and eggs. However, this process is highly wasteful. For every 100 calories of grain fed to a cow, just three emerge as beef. Along with other feed crops and pasture, rearing animals also uses land that could produce human food.

In response to the war, governments are mulling policies to get a greater share of grains into grub. Germany and Belgium may ease biofuel mandates, and China has warned that it will "strictly control" the conversion of maize into ethanol. But with fuel prices soaring, the International Energy Agency nevertheless projects biofuel demand to rise by 5% in 2022.

In the long run, the only way to avoid such trade-offs is to get energy from other sources—ideally using renewables. That would benefit future harvests, endangered by climate change, too. But for now, reducing waste and turning wheat and maize into bread instead of animal feed is probably the best remedy. Ironically, one of the most effective ways for individual consumers to alleviate the world's grain shortage is to eat more grain—at the expense of meat. ■

Fight without end

Roman Ratushny, a civic and environmental activist in Ukraine, was killed fighting near Izyum on June 9th, aged 24

In 2013, when he was 16, Roman Ratushny lay down in Maidan Nezalezhnosti, Independence Square, in the centre of Kyiv and tried to sleep. It was difficult. The square was full of students, almost all older than he was. They were there to protest against the decision by the president, Viktor Yanukovych, to go back on a special trade deal between Ukraine and the European Union. By day the square was alive with blue and yellow flags, EU as well as Ukrainian; girls wore them round their shoulders. Now, at night in the chill of late November, braziers were burning instead.

He had been there for several nights, sleeping in college lectures rather than miss anything. But on that night, the 30th, something odd started to happen. The stage they had set up for speeches was being taken down. People began to shout, and suddenly hundreds of riot police burst into the square, laying about them with sticks. He fled then, like the others, though not without getting bruised on his back and whacked on his leg as the men of the Berkut chased him through the streets.

The rally appeared to have failed, but he learned many things that night. First, how quickly you could summon a community to a cause, and how good and powerful it felt to be part of one. And second, that even if you were trampled and dispersed you could still set something going. Small acts of defiance could grow. In this case, their protest led to far bigger rallies in January and February and, eventually, to the fall of the Yanukovych regime. Scores of people died to get that outcome, shot by security forces on the Maidan on February 20th, but that was what you had to do: risk your life. He would not hesitate to start the fire again and, this time, he would not run away.

Ukraine after the revolution was still not the country he wanted it to be. Corruption flourished there. Businessmen were in cahoots with the government, illegality was covered up and bribes were passed round freely. For civic activists, as he soon became—having realised how his bright, direct gaze could galvanise people—it was a dangerous place. Those who spoke out faced rough treatment, foot-dragging courts and no police investigations. His friend Kateryna Handziuk, who fought police corruption in Kherson, was doused with sulphuric acid and died. Serhiy Sternenko, a right-wing green activist in Odessa, was sentenced to a swingeing seven years in jail for robbery and possession of a weapon. At a rally for Mr Sternenko in Kyiv in 2021, where paint was sprayed on the presidential palace and glass broken in the doors, he himself was accused of hooliganism and sentenced to two months' house arrest. He had to wear an electronic bracelet, like a criminal, when the only evidence against him was a police video in which nothing was visible except white dots on blackness. But he had to be made to suffer because he was a troublemaker.

His field of action seemed fairly small. It was a corner of a forested ravine, Protasiv Yar, that ran through central Kyiv, an unexpected ribbon of green. Part of it was a complex where people could ski and go snowboarding, but the rest was precious wilderness. Inevitably developers were interested, the city government illegally sold them a permit, and plans were drawn up to build shops and offices in 40-storey towers. This had to be stopped. Kyiv was his birthplace, a city he loved with a passion, and for years his journalist father had campaigned to protect the Old Town from similar destruction. So in 2019 he set up a group called Save Protasiv Yar, which from then on became his cause and his life.

Early protests were mild, with pipers, fiddlers and himself with a megaphone encouraging a straggling band of citizens, some with their dogs, to block the road that ran by the park. But he also confronted the thugs in high-viz who guarded the building site, got pushed away and had his phone smashed. High-ups from the building company threatened to break his back and make him disappear. They began to watch his house, so for a time he moved out.

Most of his fighting, though, was conducted through the courts. He had been to law school, knew how to talk to ministers, CEOs and officials, and had a keen sense of injustice even before that. After the first Euromaidan rally, he was one of the plaintiffs who took its violent dispersal to the European Court of Human Rights, and won. When he defended himself in the Sternenko case he had already recruited a raft of poets, actors and writers to stand bail for him, and two international human-rights committees weighed in on his behalf. The fight for Protasiv Yar took him in and out of court for two years, until in 2021 the park was decisively declared a green zone that could not be built on.

Soon enough, however, another war intervened; or perhaps it was all one war, to build a better, purer and more beautiful Ukraine. On the first day of the Russian invasion, he volunteered. Before proper volunteer units were even formed he had made his own in Kyiv, naturally called "Protasiv Yar", and went shopping to buy small drones to spy out Russian military positions. He was now a go-to man to organise resistance, drawing in others and offering their services to any commander who could use them. Eventually he was moved into the 93rd Mechanised Brigade and, after fighting round Sumy for a while, was sent to the east.

Actual war thrilled and hardened him. On the eastern front the battle was fierce. Round Izyum, where he was doing reconnaissance, Russian shelling was relentless. In the selfies he posted his face was still boyish, but his eyes were steel. Defiantly he held up a cloth badge of St Michael, sword-wielding patron of Kyiv, who had thrust the devil back to hell. One post, about his joy in fighting ("The more Russians we kill right now, the fewer will be left for our children to kill") was taken down by Facebook and Twitter. But how could he not hate the existential enemies of his country?

One post showed him in a trench in a forest, his helmet a bit askew, grinning. His grey-brown camouflage merged perfectly with the grey-brown earth. He looked at home there, among the tree roots. He had saved just such a forest, back home. This forest could not save him. ■