Sustainability Trends Report 2021

generation

Welcome

Sustainability Trends Report 2021 identifies tipping points across the landscape of sustainability that set the scene for COP26 and the post-pandemic recovery – from the mainstreaming of net zero to action on social equity, and the rise of clean technologies and natural solutions. But as we enter this exciting new phase for sustainable investing, stronger guardrails are urgently needed.

This is a pdf version of the report. For an interactive digital version, please visit str2021.generationim.com. The report has the following six chapters. The State of Sustainability section summarises the key messages in the report.

About the report

The 2021 Sustainability Trends Report

Sustainability Trends Report 2021 is the fifth edition of this annual publication by Generation Investment Management. The report takes a comprehensive look at the landscape of sustainability trends from a business and investment perspective.

Tipping points

STR2021 highlights tipping points across the landscape of sustainability. What do we mean by this? Tipping points are small changes at a critical point that qualitatively alter the future fate of a complex system. Strictly speaking, it is often hard to pin down the tipping point itself. What we can do is try to observe systems as they move into a new phase, a hard-to-identify tipping point having been crossed.

The tipping points concept is often used to describe the risk of systemic risks to our planet. But tipping events in society, policy, finance and technology are also necessary to move society into a sustainable and regenerative state, avoiding the worst kind of climatic and ecological tipping points. After all, we are all part of the same planetary system.

Safeguards and greenwash

The need for safeguards around sustainable investing is a key finding in this year's report. There are several different types of challenges. Consumers face misleading claims online. Many companies are setting long-dated commitments with limited short-term plans. Studies continue to find major flaws in carbon-offset markets. Combining two of these concerns in one, some companies are even using offsets to claim that fossil fuels are green.

With natural solutions gaining much attention, this is a particularly sensitive area. As one study this year has found, biodiversity markets are part of the solution and a powerful vehicle for change, but they also need to be carefully governed to avoid the risks around excessive financialisation. How to scale and innovate natural solutions — but with safeguards — is a central dilemma we need to solve.

Topics in the report

Net zero

All eyes are on COP26. Businesses and investors are coming to terms with cutting emissions in half by 2030, on the way to net zero. Although the path to 1.5°C is narrow, there is remarkable momentum — we highlight the mainstreaming of net-zero commitments in the capital markets, and three-quarters of global GDP is now under net-zero commitments made by governments.

Sub-topics

Net zero, Resilience, Renewables & batteries, Value chains, Plastics, Hydrogen, Nature-based solutions

Nature

This is a big year for nature. Scientists have sounded the alarm on degradation of the natural world, species loss and the risk of ecosystem collapse. At the same time, some of the most exciting areas for sustainable investing lie in natural solutions. Many corporates are committing to be nature-positive. There are new insights on how to integrate the economy with the natural world. Guardrails and standards are of particular importance for all natural, nature-based and bio-based solutions.

Sub-topics

Natural solutions, Biodiversity, Regenerative approaches

Social equity & justice

Social justice and equity issues broke through to the boardroom this year. We are a long way from solving our deep, entrenched problems, but there is room for optimism too. Social equity and justice lie at the core of action on sustainability and a just transition. We explore dimensions of social equity and justice throughout the report.

Sub-topics

Equity, Diversity & inclusion, Wellbeing, Future of work, Behaviour change

Visit the report online to navigate by these topics

Important information

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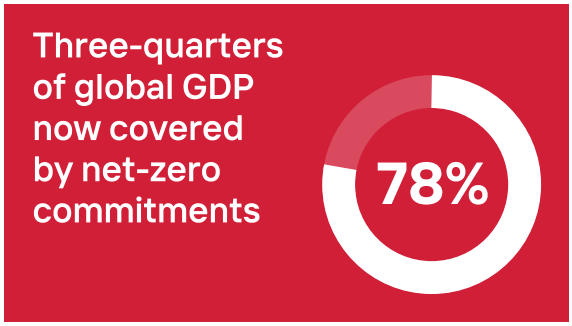
The information presented herein is based on Generation's analysis of publicly available data and is intended to present a global perspective on different areas that Generation believes represent a sustainable economy. The jurisdictions and time periods presented herein may vary, as the data shown is what Generation used in its own assessment and believes to be the most complete view to support each identified area of sustainability and the associated trends. 2021 and other historic estimates made throughout the report were extrapolated from cited research and based on previous trends and known current data. While the data is from sources Generation believes to be reliable, Generation makes no representation as to the completeness or accuracy of the data.

Contents

State of Sustainability

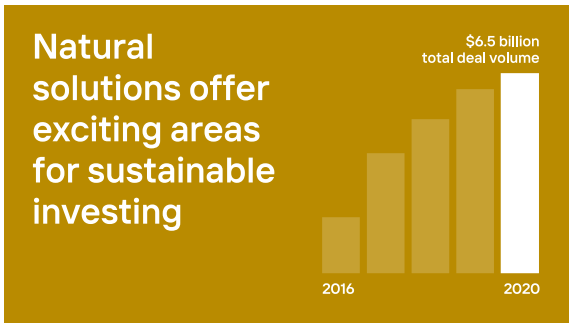
This has been a year of tipping points and transformation

We find evidence of tipping points across multiple dimensions of sustainability, from capital allocation and government commitments, to technological innovation and societal awareness.

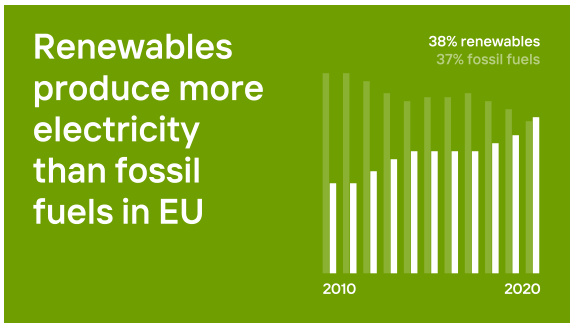


Sources: IMF; ECIU; Generation

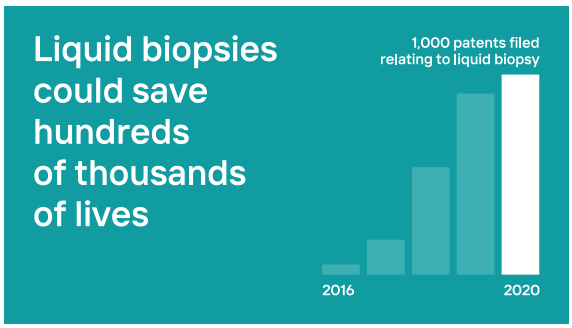
Source: Net Zero Asset Managers initiative



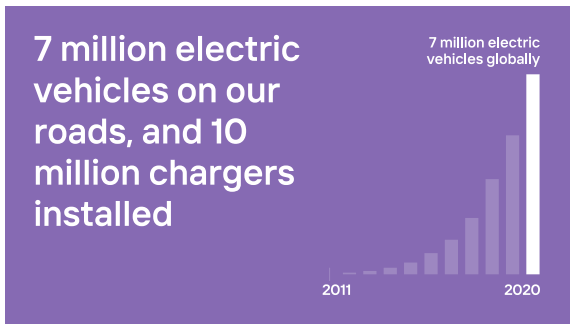
Sources: CB Insights; Generation



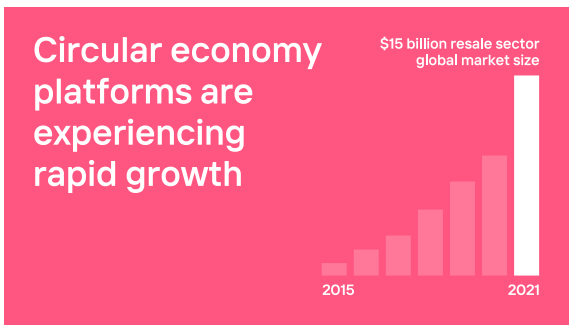
Source: Ember and Agora Energiewende



Sources: Google Patents; Generation



Sources: IEA; IHS Automotive



Source: thredUP

Sustainability is the lodestar for the post-COVID-19 recovery

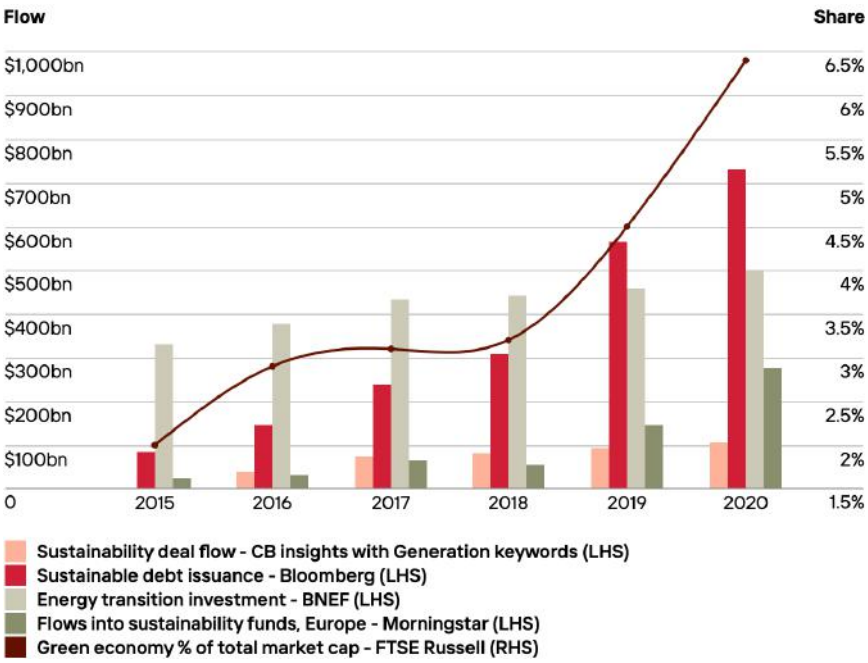
Governments are still wrestling with what "building back better" really means, but there remain huge opportunities to invest in areas that boost jobs and wellbeing, accelerate the transition to net zero and also put the economy on a sustainable footing.

There is no agreed way to measure trends in sustainable finance comprehensively, but it is clear that these flows number in the trillions. In the five years we have been producing this report, we have seen a step change across many areas: among them, flows to ESG funds and sustainable debt issuance; investments into solutions for net zero; deal flow in private equity and venture capital in sustainability-related areas; and the market capitalisation of companies focused on the green economy.

These trends reflect the growing business and investor relevance of the energy transition and net zero, the rise in natural solutions, and investment that improves social wellbeing and creates more resilient economies.

The next phase is critical. Recovering from COVID-19 is a global challenge. As well as scaling up investment at home, richer countries must do much more to support developing countries on climate finance, vaccine access and debt relief. The lack of progress here risks undermining the prospects for COP26 as well as our shared future.

Figure 1: Trends in sustainability-related finance, 2015-2020



Since 2015, we have seen a 10x increase in flows to ESG funds in Europe, a 9x increase in sustainable debt issuance, a 2x increase in PE/VC deal flow in the sustainability space and investments in the energy transition have increased by 1.5x. Over 6% of market cap is now estimated to come from the green economy, up from 2% in 2015. Sources shown in chart legend.

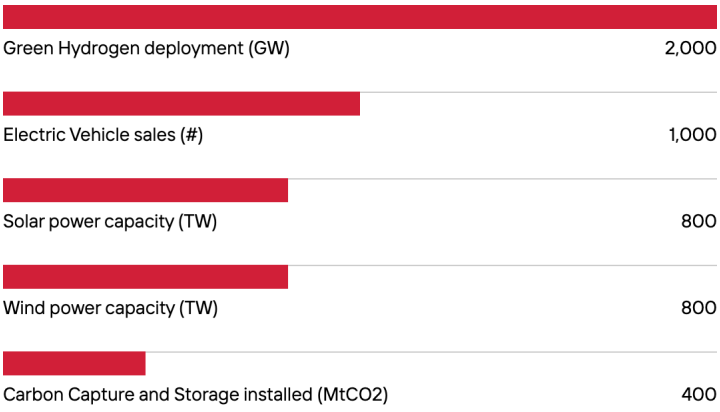
Source: Generation analysis of data from CB Insights; Bloomberg; BNEF; Reuters; FTSE Russell

A rapid acceleration is needed on all fronts to keep sustainability goals within reach

The tipping points we observe give us confidence, but there is no room for complacency. Huge increases in deployment of sustainability solutions are needed to limit global temperatures to 1.5°C above pre-industrial temperatures and to address injustices in society.

For climate, increases in deployment rates of the order of 5 to 10x from current levels are needed over the next few years for many technologies.

Figure 2: Required level of deployment of different technologies by 2030, index where 2019=100, for a 1.5°C pathway



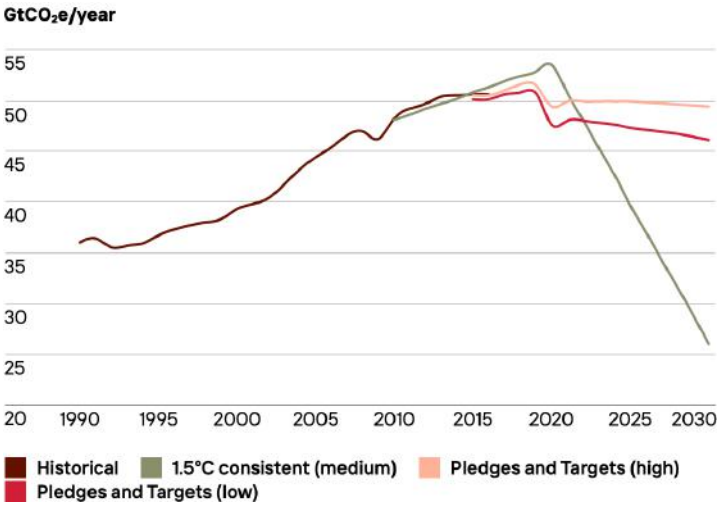
Source: IRENA; EV-Volumes; IEA; McKinsey: "Climate math: What a 1.5-degree pathway would take"

As COP26 approaches, there is a yawning gap between long-term goals and near-term plans

Despite important new commitments by some governments in recent months, we are nowhere close to being on course for 1.5°C. CO_2 emissions must be cut in half this decade.

Greenhouse-gas emissions have rebounded since the height of the pandemic in most countries, putting the prospects of building back better at risk.

Figure 3: The 2030 emissions gap



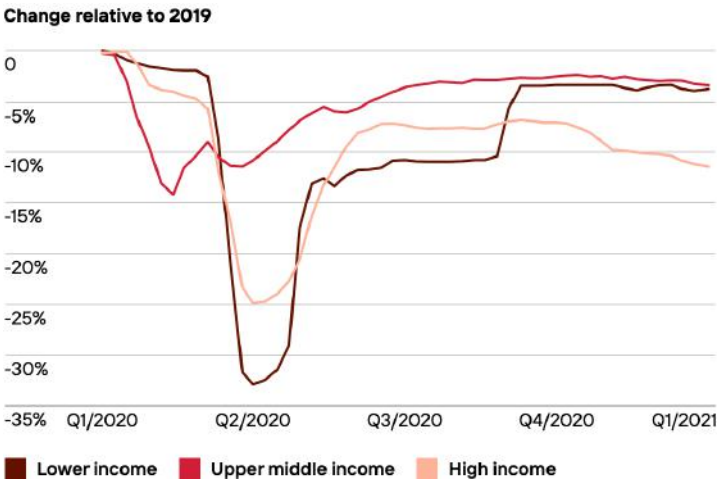
The gap is 20-23 GtCO2e in 2030. This is the difference between current pledges (high and low estimates) and a 1.5°C pathway. This gap closed by around 2.6 to 3.9 GtCO2e (or 11 to 14%) due to new pledges announced since September 2020.

Source: Climate Action Tracker, May 2021 update

> "There are no new oil and gas fields approved for development in our pathway, and no new coal mines or mine extensions are required"

"Net Zero by 2050: A Roadmap for the Global Energy Sector", IEA, May 2021

Figure 4: CO_2 emissions, change on pre-pandemic level, by country-income level, 2020-2021



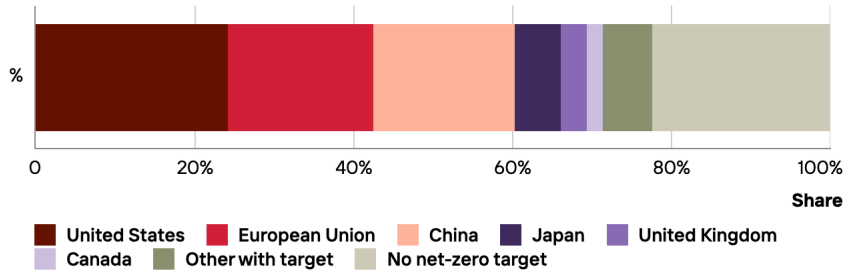
Source: Le Quéré, Corinne, Glen P. Peters, Pierre Friedlingstein, Robbie M. Andrew, Josep G. Canadell, Steven J. Davis, Robert B. Jackson, and Matthew W. Jones. "Fossil CO_2 emissions in the post-COVID-19 era." Nature Climate Change 11, no. 3 (2021): 197-199.

Net-zero goals span the global economy. Now we need the actions to match

Net zero will soon be the law of the land, where this isn't already the case. Over three-quarters of the global economy is now covered by national-level commitments to net zero, whether these are in law or in proposed legislation and policy documents.

Yet many governments and companies have not made interim commitments consistent with these long-term goals and taken the steps required. There is a huge difference between commitments, plans and action.

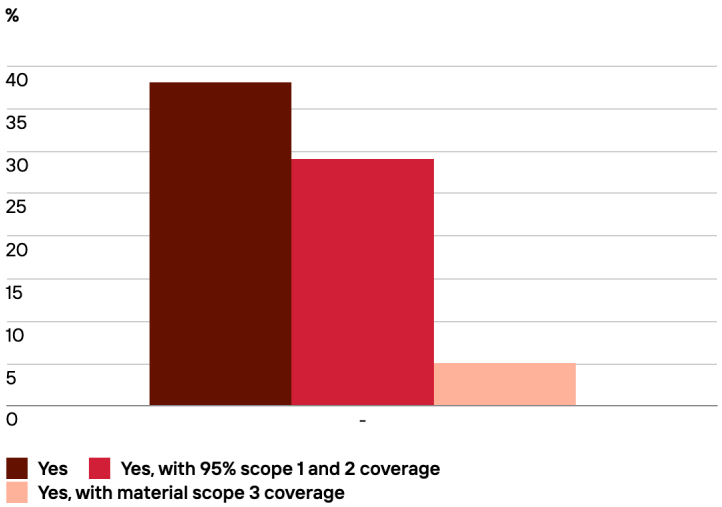
Figure 5: Net-zero targets as a share of global GDP



Based on IMF estimate for GDP in 2021 and the ECIU net-zero tracker.

Source: IMF World Economic Outlook, April 2021; ECIU Net Zero Tracker

Figure 6: Focus companies* with medium-term (2026-2035) GHG emissions target, 2020



* 160 global companies that have significant greenhouse gas (GHG) emissions and/or are critical to the net-zero emissions transition and to meeting the objectives of the Paris Agreement

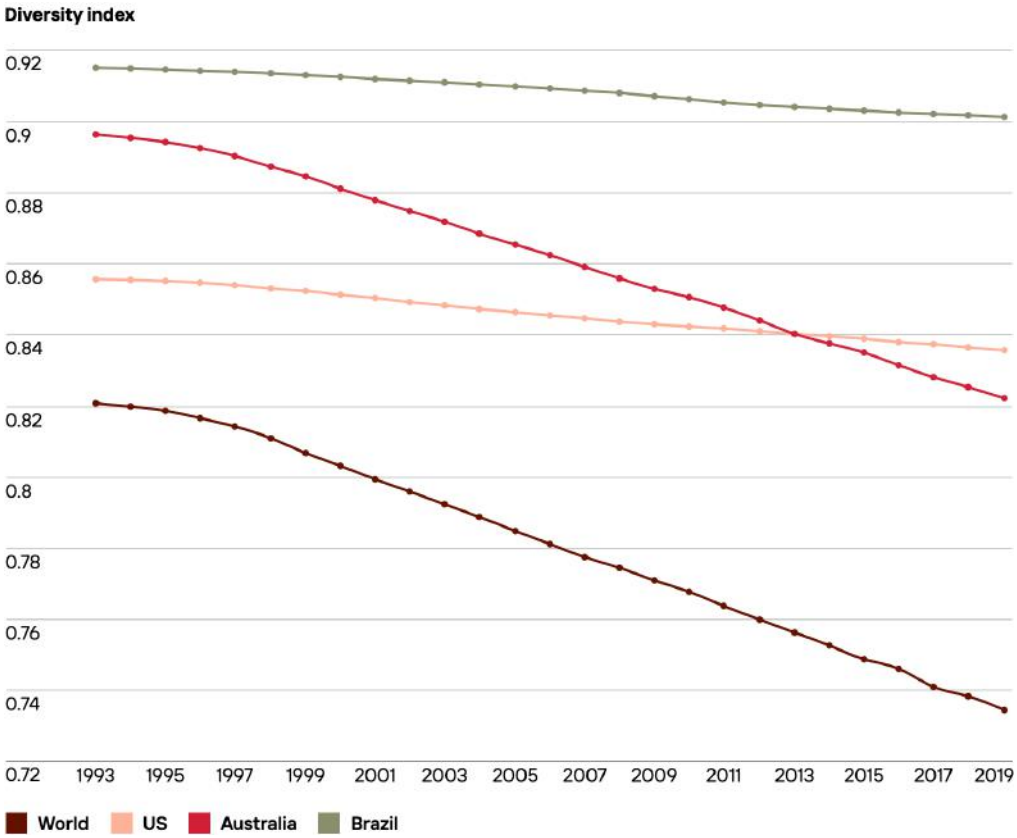
Source: Climate Action 100+: "2020 Progress Report"

In a critical year for nature, the threats to our planet are clear

Concern over ecological and climatic tipping points is rising. Species diversity continues to decline. Climate scientists have identified multiple tipping points that could irreversibly alter our climate.

While around half of the Fortune 100 mention biodiversity in their reports, only five have made specific, measurable, and time-bound commitments on biodiversity. Targets on nature have often been missed in the past, not least on avoided deforestation. There is much work to do.

Figure 7: Red-list index (RLI) species diversity, 1993-2019



An RLI value of 1.0 equates to all species qualifying as Least Concern (i.e., not expected to become extinct in the near future). An RLI value of 0 equates to all species having gone extinct.

Source: Our World in Data: "Red List Index, 2019"

> "Our economies, livelihoods and wellbeing all depend on our most precious asset: Nature"

Dasgupta, Partha. The Economics of Biodiversity: the Dasgupta Review. HM Treasury, 2021.

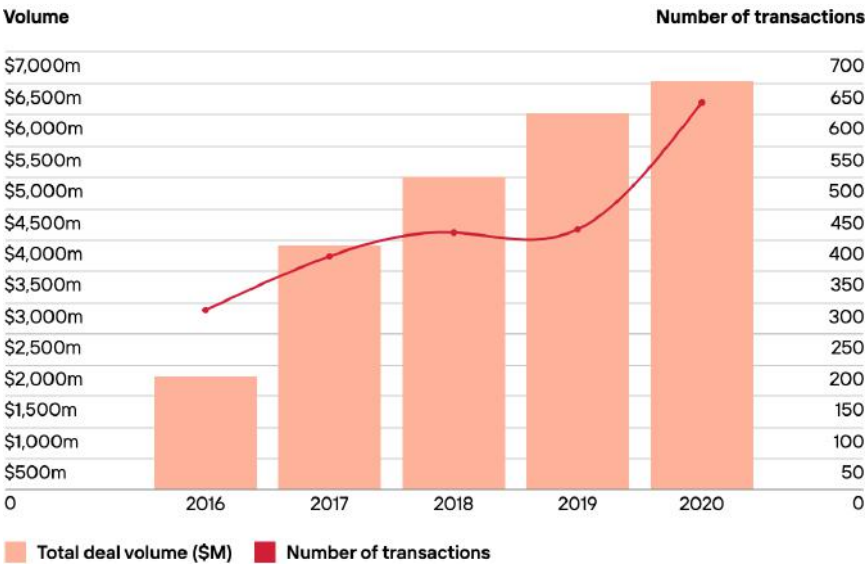
Natural solutions for sustainability are also a cause for optimism

Natural solutions for sustainability are taking off. Investment and innovation are accelerating. Defined in broad terms, nature now offers some of the most exciting areas for sustainable investing. Regenerative solutions promise to heal and rebuild our ecological and social landscapes, going far beyond minimising damage.

Regenerative agricultural systems are moving from fringe to centre-stage

Soybean plants with cover crop. Image: Sarah M. Golonka / Alamy

Figure 8: Investment volumes in natural solutions, 2016-2020



Source: Generation analysis of CB Insights data

Social justice and equity lie at the core of all action on sustainability

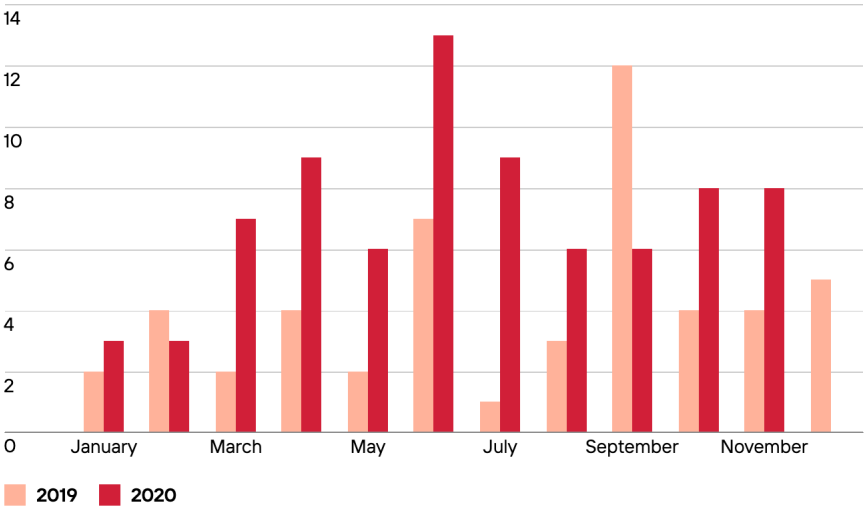
Last year, we highlighted a palpable restlessness for change in society. We now find growing evidence that social issues are hitting the mainstream for investors and companies.

Social equity and justice are central concerns for sustainability on their own terms, but they are also indivisible from action on climate and nature.

Black Lives Matter protest, London

May 2020. Image: Reuters/John Sibley/Alamy

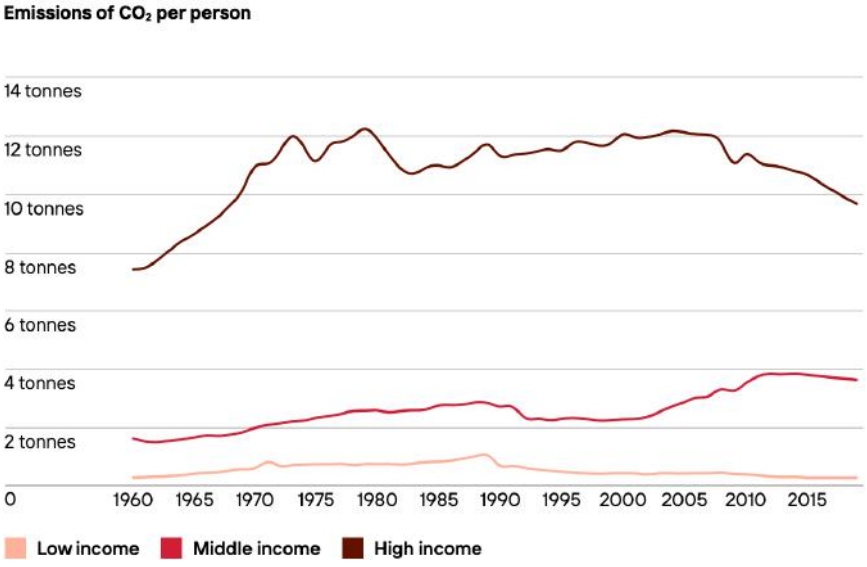
Figure 9: New protests, global, 2019-2020



There was a noticeable spike in protests after the murder of George Floyd on May 25th 2020. Data from the Carnegie Endowment for International Piece, analysed by Generation, suggests that there were 73% more protests in 2020 than in 2019.

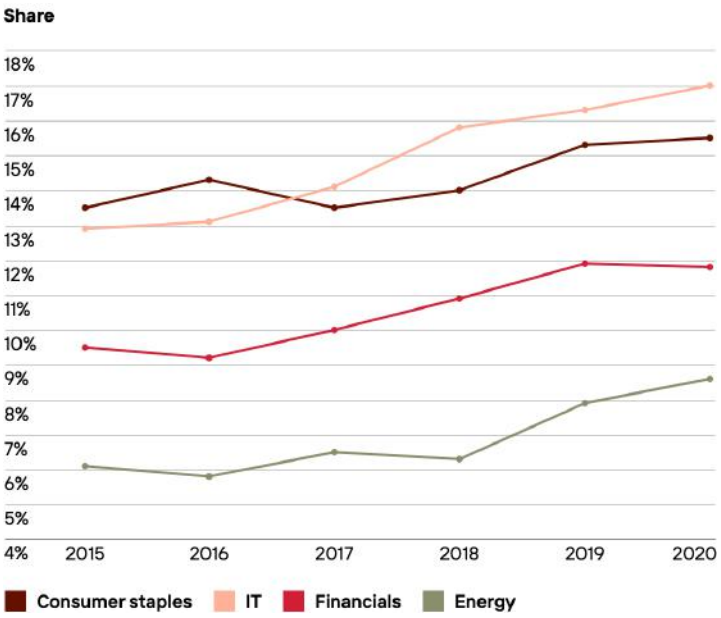
Source: Carnegie Endowment for International Peace: "Global protest tracker". The chart focuses on "significant protests": sizable street protests that express opposition to the national government as a whole or to its recent policies or actions.

Figure 10: CO_2 emissions per person, global, by income level, 1960-2019



Source: World Bank: "CO_2 emissions: metric tons per capita"

Figure 11: Share of board seats filled by directors who are Hispanic, Black, Asian-American, Pacific Islander or Native American, US companies, 2015-2020



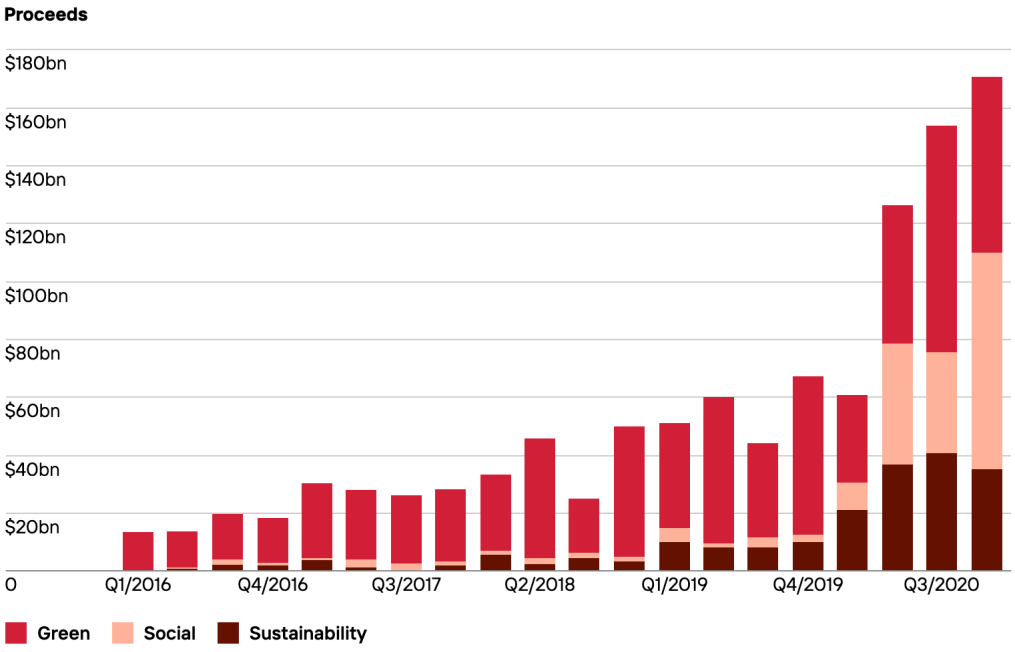
Source: New York Times, 15th September 2020: "Diversity Push Barely Budges Corporate Boards to 12.5%, Survey Finds"

This has been a banner year for ESG

Global ESG volumes are soaring, driven in particular by renewed focus on the S in ESG.

Financial institutions are stepping up on net zero. Launched in 2020, the Net Zero Asset Managers Initiative now has 87 signatories with $37 trillion of assets under management. Similar commitments are being made across the financial sector. Investor engagement with companies on climate change also reached a new level this year.

Figure 12: Global ESG quarterly volumes, 2016-2020



Source: Refinitiv cited in Forbes, 18th December 2020: "ESG Investing Came Of Age In 2020 - Millennials Will Continue To Drive It In 2021"

> "A tiny hedge fund dealt a major blow to Exxon Mobil Corp on Wednesday, unseating at least two board members in a bid to force the company's leadership to reckon with the risk of failing to adjust its business strategy to match global efforts to combat climate change"

Reuters, May 27th 2021. Since then Exxon confirmed a third would be replaced, too.

But the threat of greenwash is rising. For COP26 and beyond, the watchwords are quality and safeguards

We are seeing a proliferation in sustainability-related commitments, such as on "net zero", "nature positive" and "regenerative agriculture". Social issues have also come to the fore, with concepts such as "just transition", "diversity & inclusion" and "building back better".

These offer big opportunities for sustainable investing. But they will do more harm than good if we fail to set a high bar. There is growing unease at the low quality of some net-zero commitments, the absence of guardrails for natural solutions and the sustainability performance of "offset" markets. Misleading sustainability claims are also spreading online at an alarming rate.

Figure 13: Website greenwashing

42%

of websites found to have misleading claims on the environment, EU, 2020

National consumer protection authorities had reason to believe that in 42% of cases the claims were exaggerated, false or deceptive and could potentially qualify as unfair commercial practices under EU rules.

Source: Screening of websites for 'greenwashing': half of green claims lack evidence. European Commission

Figure 14: Apparent over-crediting in California's carbon offset market

29.4%

over-crediting percent

$410M

over-crediting value

The quality of carbon offset markets remains a concern, even in regions with strong governance. California's prominent forest carbon offsets programme falls far short of its claimed climate benefits, according to a recent study.

Source: Badgley, Grayson, Jeremy Freeman, Joseph J. Hamman, Barbara Haya, Anna T. Trugman, William RL Anderegg, and Danny Cullenward. "Systematic over-crediting in California's forest carbon offsets program." bioRxiv (2021).

> "Clean crude? Oil firms use offsets to claim green barrels"

Reuters, April 2021

01 Economy & Finance

1.1 Key trends

This has been a year of economic shock and transformation. In what has been a banner year for ESG, we highlight the need to tackle greenwash and put social equity to the fore. Key tipping points in this chapter include the rise of net zero as an organising construct for economies and capital markets, and diversity and inclusion becoming a boardroom priority.

This has been a banner year for ESG

Governments and businesses are making net-zero commitments

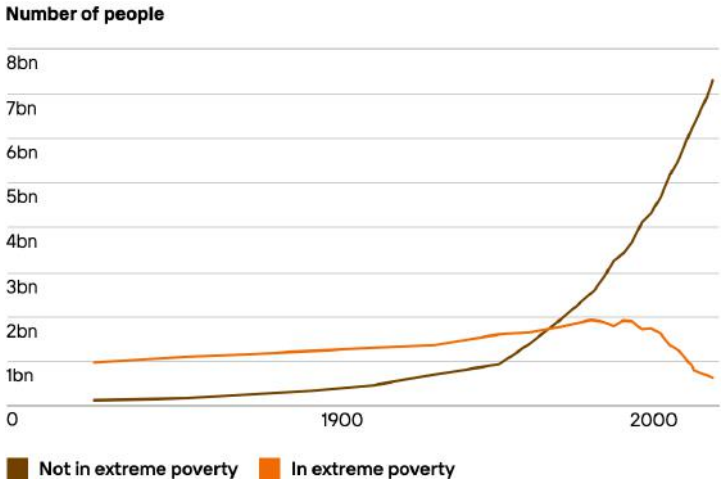
Social equity has become a corporate priority

But we need stronger safeguards to cut out the greenwash

After decades of improvement, poverty soared in 2020 as COVID-19 shook societies around the world

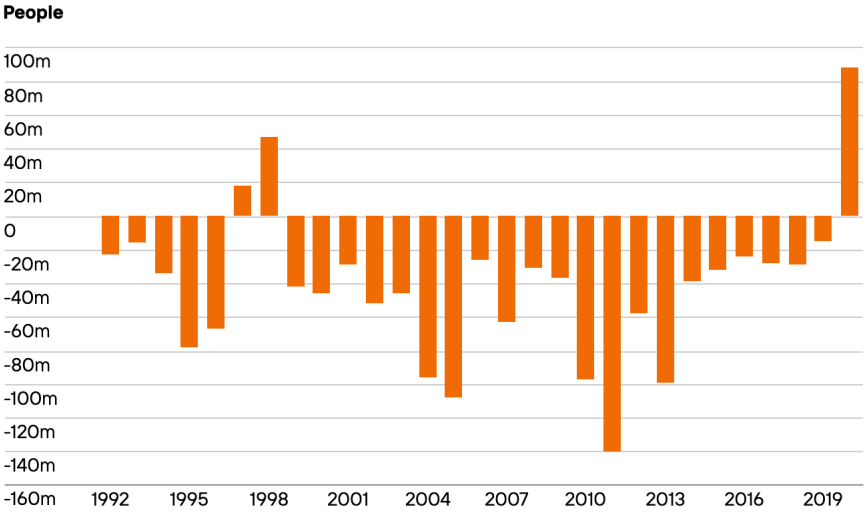
Global poverty is on a long downward trajectory. But global poverty rose sharply in 2020.

Figure 15: World population in extreme poverty, 1820-2019



Source: Our World in Data: "Global extreme poverty"

Figure 16: Annual change in the number of extreme poor, 1992-2020



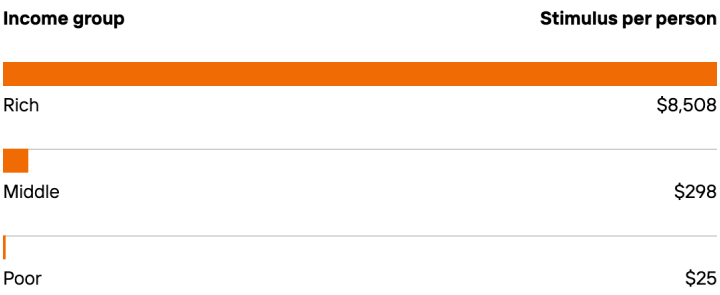
Source: World Bank: "Updated estimates of the impact of COVID-19 on global poverty: Looking back at 2020 and the outlook for 2021"

The economic pain of COVID-19 has been unequally distributed, within and between rich and poor countries

Black and minority ethnic people are especially likely to have seen income losses from COVID-19. People in poor countries, with worse safety nets, have suffered disproportionately. Rich countries had far more ability to respond to the pandemic with stimulus dollars.

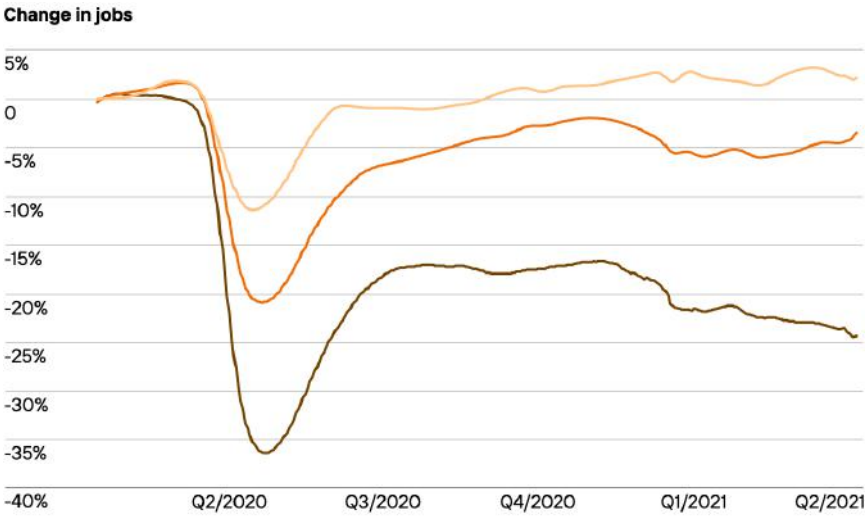
Generation analysis of IMF data indicates that stimulus spending per person in rich countries was over $8,500, but just $25 per person in poor countries.

Figure 17: Stimulus spending per person, by country-income group, 2021



Source: Generation analysis of World Bank and IMF data

Figure 18: Change in employment relative to pre-pandemic, by neighbourhood type, US, 2020-2021

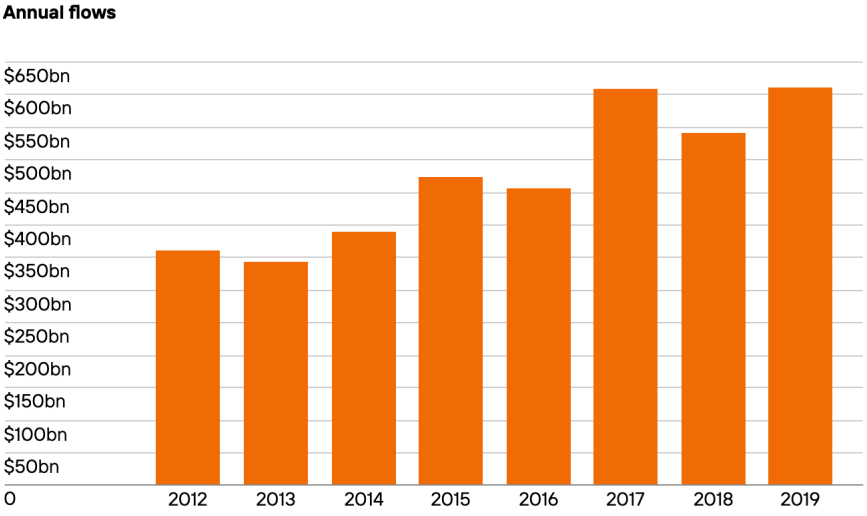


Source: https://tracktherecovery.org/

Climate-finance flows continue to rise, but are far below the levels required

Climate-finance flows have nearly doubled in a decade. This data, from the Climate Policy Initiative, includes local, national or transnational financing — drawn from public, private and alternative sources — that seeks to support mitigation and adaptation actions that will address climate change.

Figure 19: Climate-finance flows, global, 2012-2019



Source: Climate Policy Initiative: "Updated View on the Global Landscape of Climate Finance 2019"

The question, now, is what does "build back better" actually mean?

Many governments and organisations have adopted the phrase over the past year. Building Back Better was the major theme of the UK-hosted G7 summit.

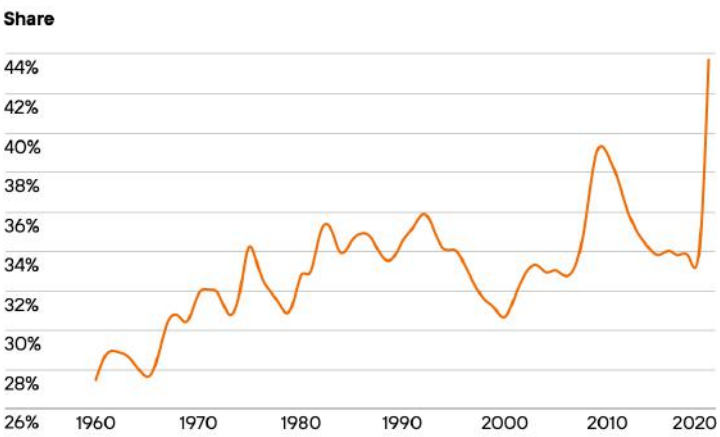
G7 Leaders Plenary Session on Building Back Better from COVID-19

UK G7 Image: Flickr

Economic strategy has undergone a revolution in the past year

Economists and policymakers are keener on helping low- and middle-income families than they were even a decade ago.

Figure 20: Government spending as a share of GDP, US, 1960-2020



Source: Federal Reserve Bank of St Louis, "Government Current Expenditures/Gross Domestic Product"

> Given the number of people who have lost their jobs and the likelihood that some will struggle to find work in the post-pandemic economy, achieving and sustaining maximum employment will require more than supportive monetary policy. It will require a society-wide commitment, with contributions from across government and the private sector"

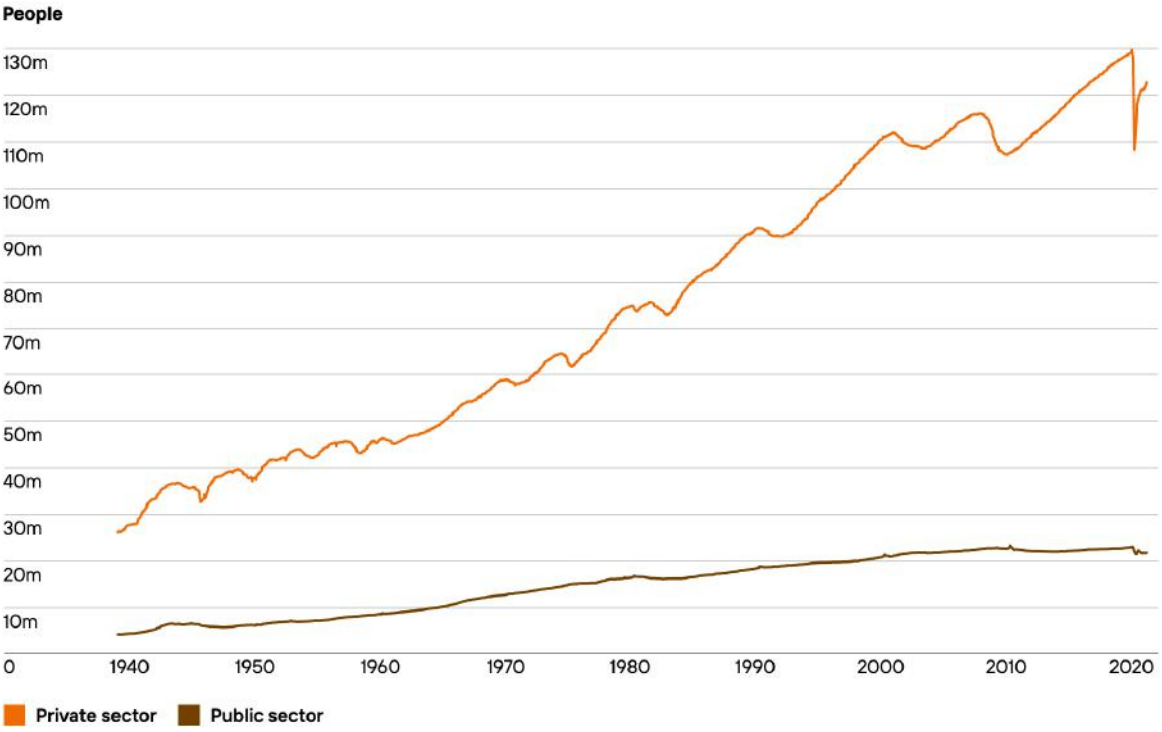
Jerome Powell, Fed chairman.

Businesses have a vital role to play

In almost every country in the world, private-sector employment is far higher than public-sector employment. Businesses therefore do a huge amount to shape people's lives. Some corporates have stepped up to offer at-cost vaccines or to allow their IP to be freely appropriated.

Image: Reuters/Dado Ruvic/Alamy

Figure 21: Employment by sector, US, 1939-2021



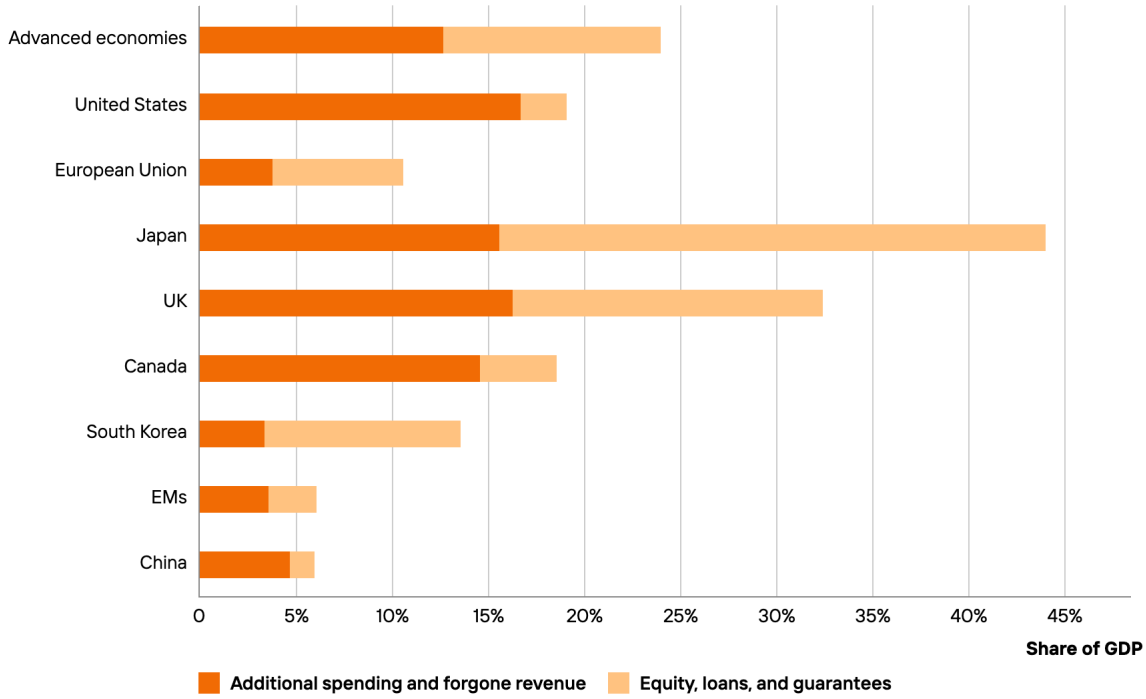
Source: Federal Reserve Bank of St Louis, "Total Nonfarm Private Payroll Employment"

1.2 What does "building back better" really mean?

A new age of government? Spending, if done wisely, can have huge social benefits

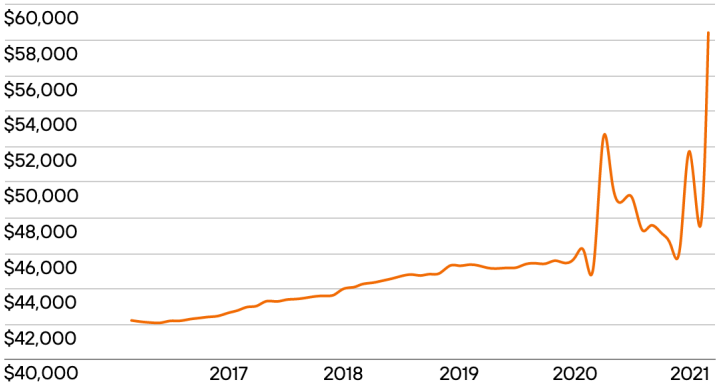
Governments enacted huge fiscal responses to deal with COVID-19. Fiscal stimulus was so generous that in America, average household income actually rose in 2020 (see Figure 22).

Figure 22: Fiscal response to COVID-19, as a share of GDP



Source: Fiscal Monitor Database of Country Fiscal Measures in Response to the COVID-19 Pandemic - accessed June 01 2021, IMF

Figure 23: Real disposable personal income per person, US, 2016-2021

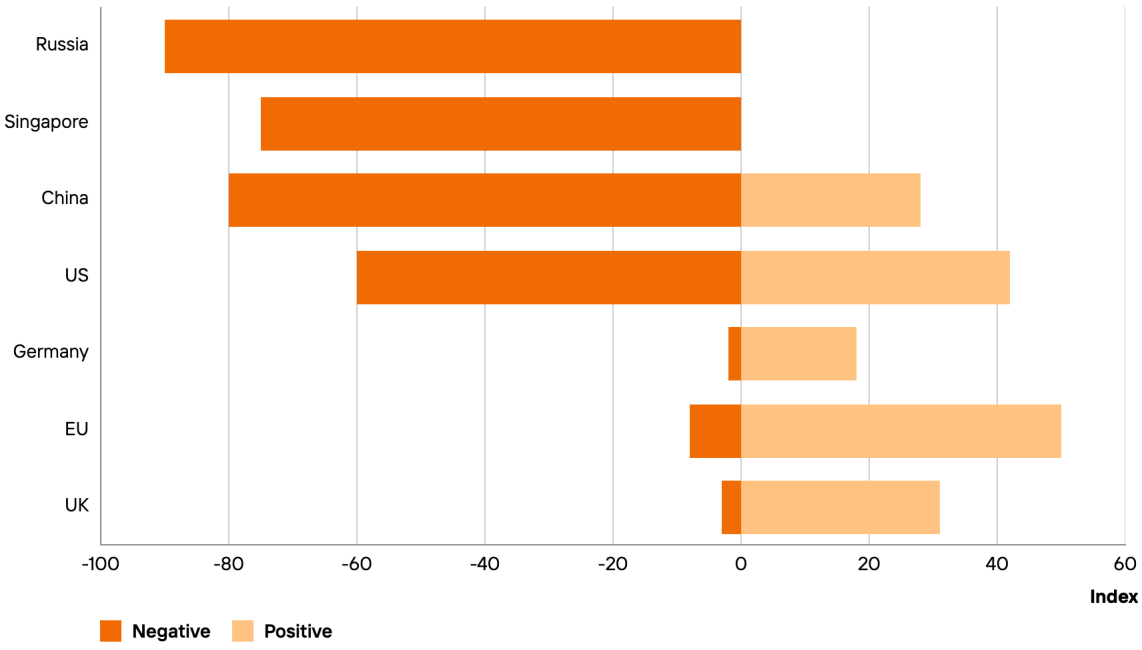


Source: Federal Reserve Bank of St Louis, "Real Disposable Personal Income: Per Capita"

The jury is still out on whether or not governments will adopt green stimulus

Many countries have pumped money into fossil-fuel industries in order to jump-start their economies. In recent months, however, the trend has been improving.

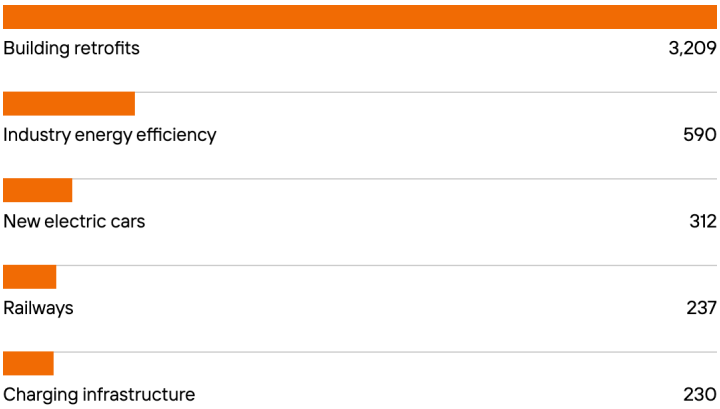
Figure 24: Greenness of stimulus index, February 2021



Source: Vivid Economics, "Greenness of stimulus index"

The shift to sustainability can lead the economic recovery

Figure 25: Estimated job-years that could be created by efficiency-related stimulus announcements to date, by efficiency measure

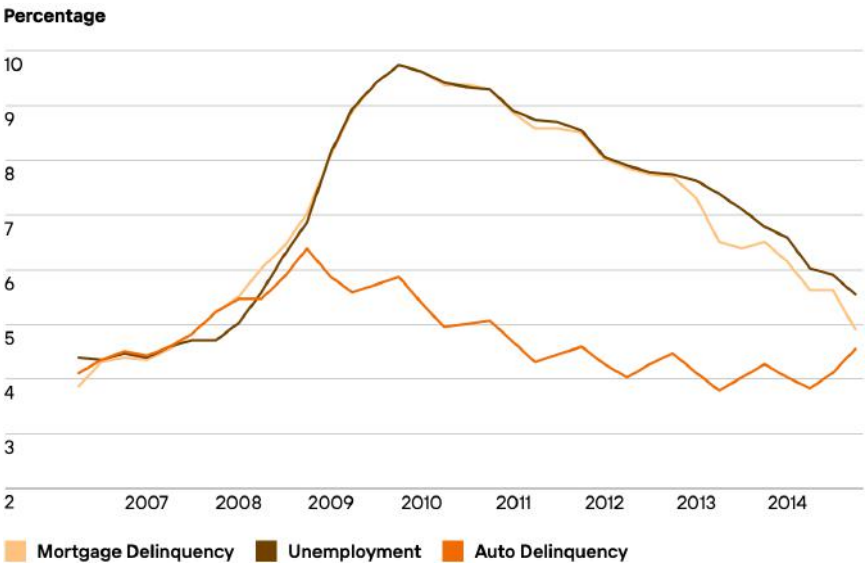


Source: IEA, "Energy efficiency jobs and the recovery"

Policymakers have contained some of the collateral economic damage of the pandemic

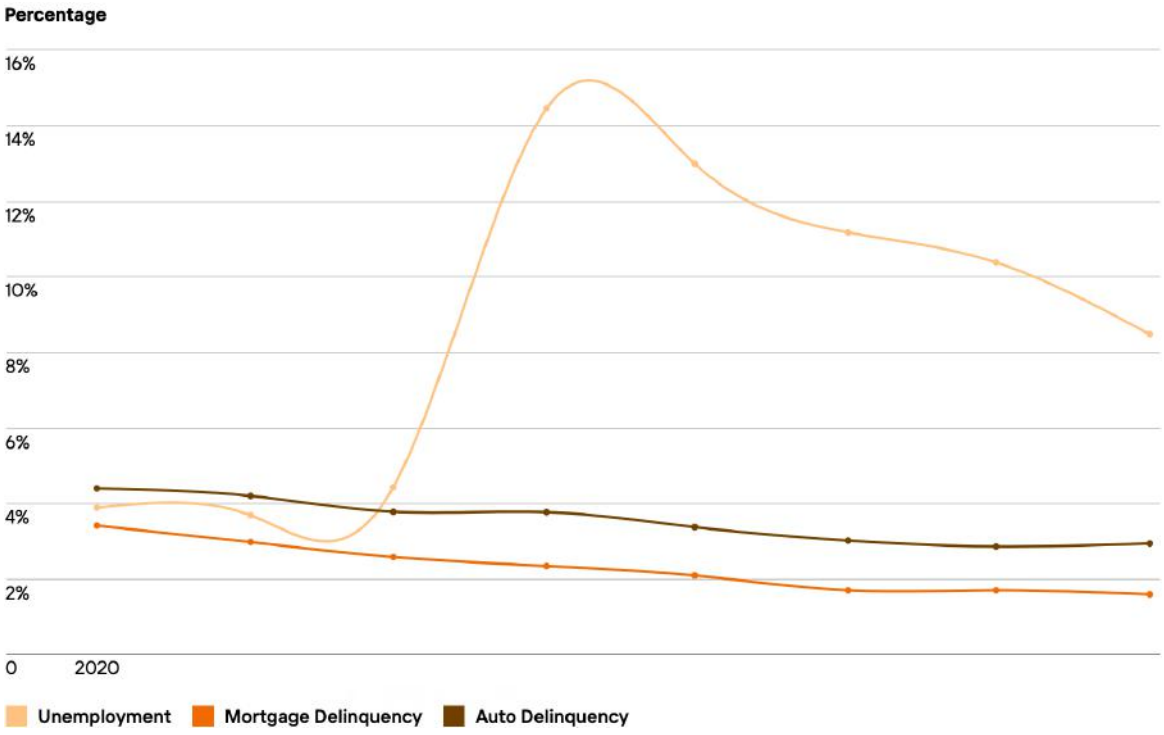
In the last recession, defaults rose sharply. However, policy has prevented that from happening in the COVID-19 recession, providing important lessons for the future.

Figure 26: Mortgage deliquencies, auto delinquencies and the unemployment rate, America, during the Great Recession



Source: FEDS Notes: "Why is the Default Rate So Low? How Economic Conditions and Public Policies Have Shaped Mortgage and Auto Delinquencies During the COVID-19 Pandemic"

Figure 27: Mortgage deliquencies, auto delinquencies and the unemployment rate, America, during the COVID-19 recession



Source: FEDS Notes: "Why is the Default Rate So Low? How Economic Conditions and Public Policies Have Shaped Mortgage and Auto Delinquencies During the COVID-19 Pandemic"

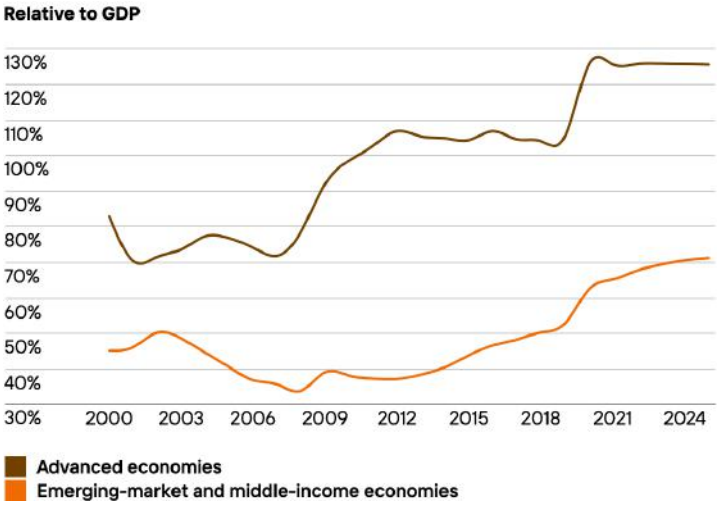
> "Despite COVID-19, remittance flows remained resilient in 2020, registering a smaller decline than previously projected. Officially recorded remittance flows to low- and middle-income countries reached $540 billion in 2020, just 1.6 percent below the 2019 total of $548 billion"

World Bank

Governments will still need to grapple with high debt loads

In many countries public debt is higher than it was at the end of the second world war.

Figure 28: Gross public debt to GDP, 2000-2025

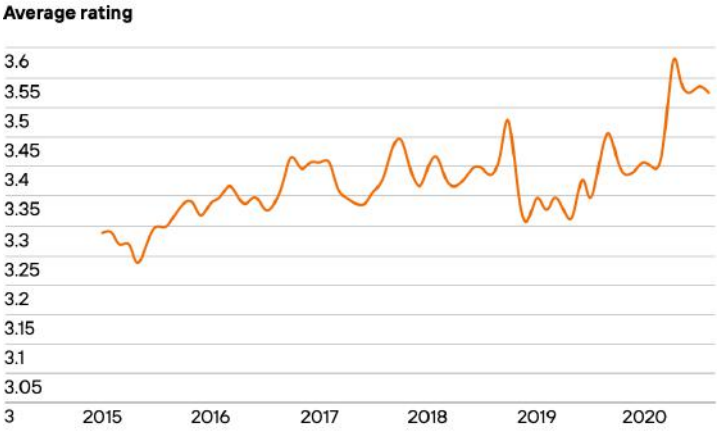


Source: IMF, "World Economic Outlook Database"

Many businesses have stepped up for their workers during the pandemic

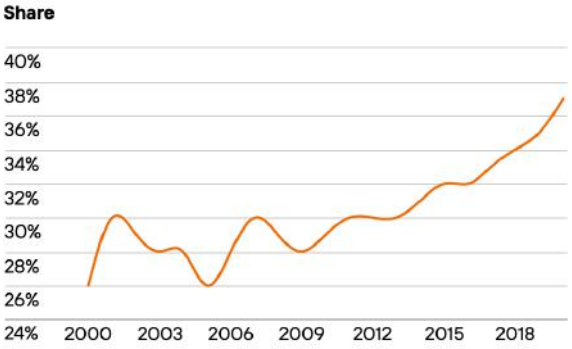
Employees' ratings of culture and values actually rose during the pandemic. Employee engagement rose too. Companies are also taking diversity and inclusion mandates more seriously.

Figure 29: Glassdoor scores for "culture and values", US 2015-2020



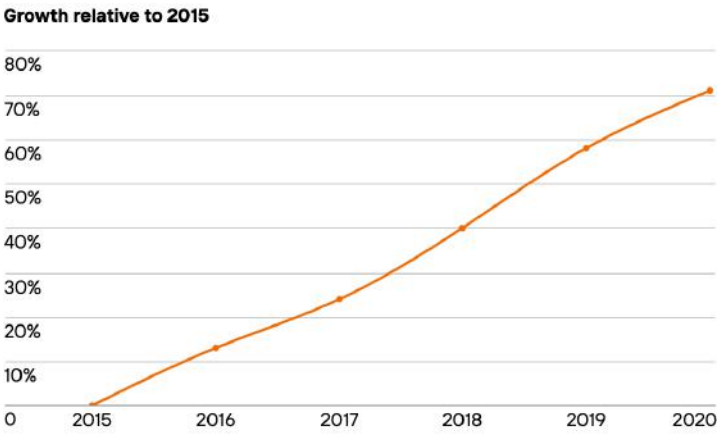
Source: Charles Sull and Donald Sull, 2020. MIT Sloan Management Review, 28th October 2020, "How Companies Are Winning on Culture During COVID-19"

Figure 30: US employee-engagement trend, 2000-2020



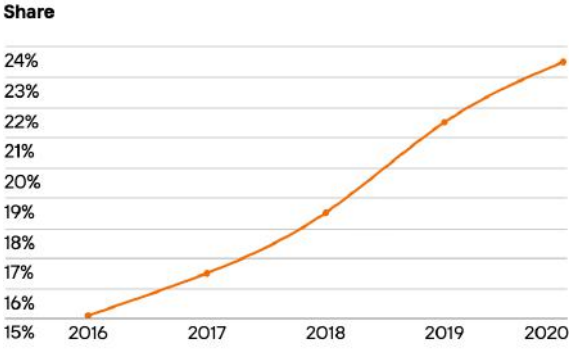
Source: Gallup, "US Employee Engagement Rises Following Wild 2020"

Figure 31: Growth of diversity and inclusion employees, global, 2015-2020



Source: LinkedIn, "Why the Head of Diversity is the Job of the Moment"

Figure 32: Share of directors who are female, Russell 3000 companies, 2016-2020

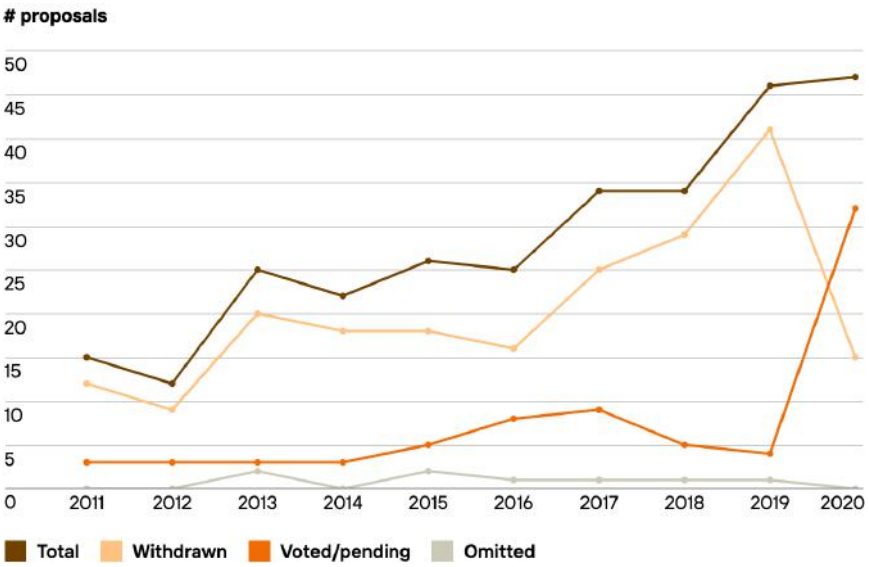


Source: Equilar: "Q4 2020 Equilar Gender Diversity Index"

There are some signs that the quest for social justice is translating into meaningful action

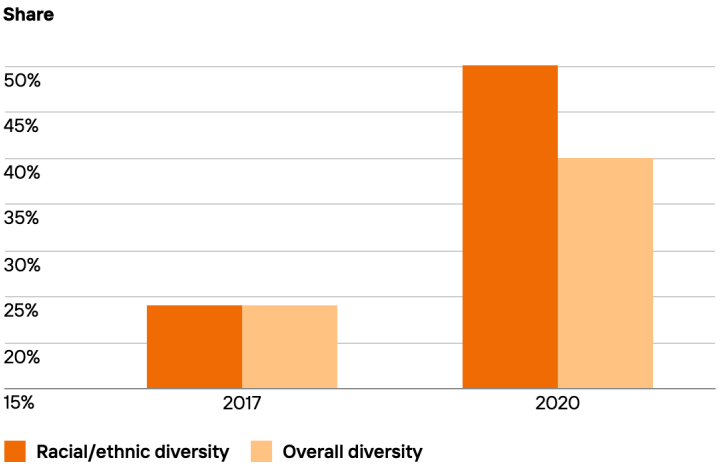
Board diversity programmes are becoming increasingly mainstream, while more boards disclose their makeup.

Figure 33: Shareholder proposals to make corporate boardroom more diverse, US, 2011-2020



Source: Proxy Preview, "Diversity on the Board"

Figure 34: Fortune 100 companies which disclosed diversity metrics, %, 2017-2020

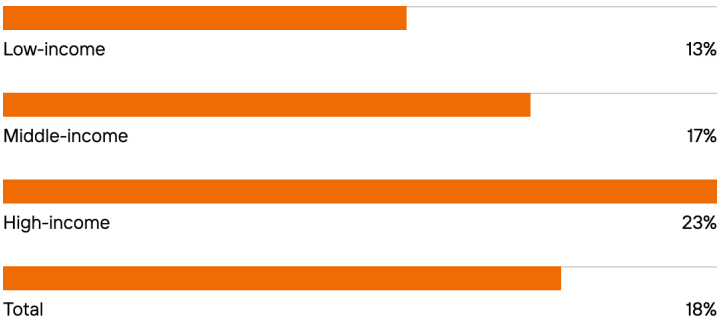


Source: EY, "Four ESG highlights from the 2020 proxy season"

But in some areas the gaps are growing. The large-scale shift to working from home is leaving many behind

Even in rich countries, only a minority of the workforce can WFH.

Figure 35: Share of workforce that can work from home, by country type, 2021

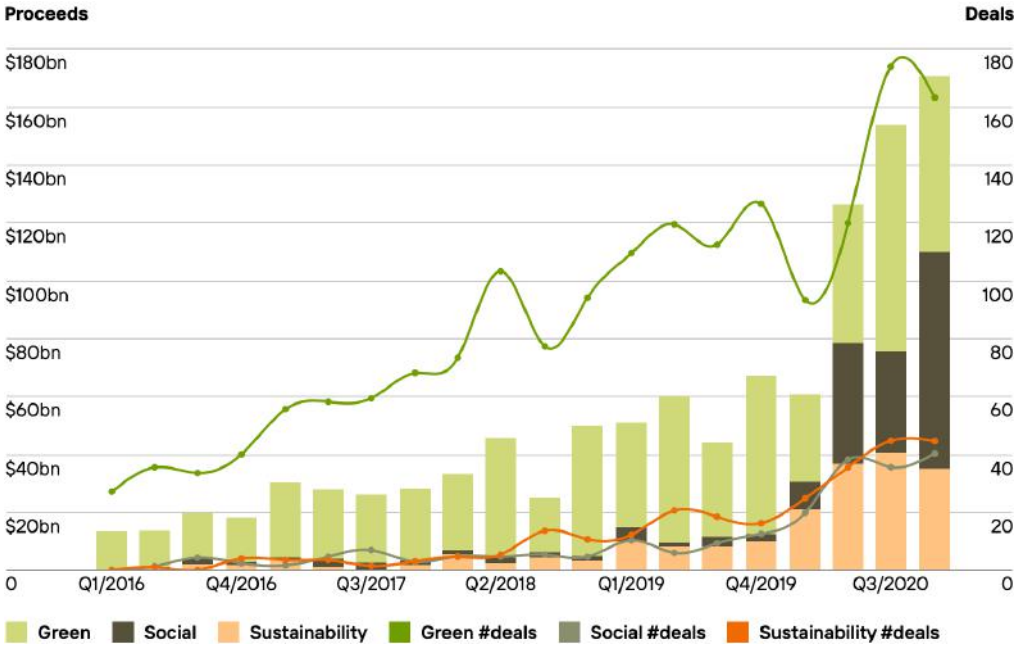


Source: Pérez, Sergio Torrejón, Marta Fana, Ignacio González-Vázquez, Enrique Fernández-Macías, Shinnosuke Kikuchi, Sagiri Kitao, Minamo Mikoshiba, Zsoka Koczan, and Alexander Plekhanov. "Working from home: Estimating the worldwide potential."

1.3 Cutting out the greenwash from sustainable investment

Sustainable investment reached a tipping point in 2020

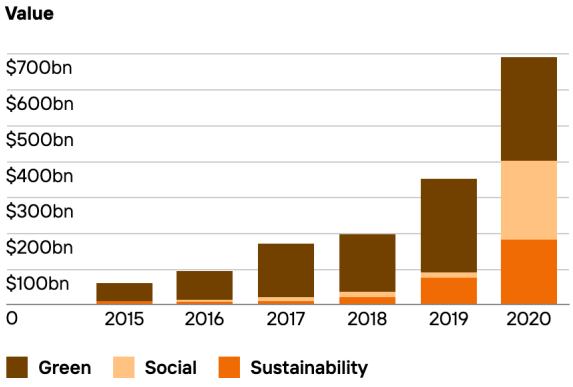
Figure 36: ESG quarterly volumes, global, 2016-2020



Source: Forbes, 18th December 2020, "ESG Investing Came Of Age In 2020 - Millennials Will Continue To Drive It In 2021"

ESG volumes are rising across the board

Figure 37: Sustainable bond issuance, global, 2015-2020

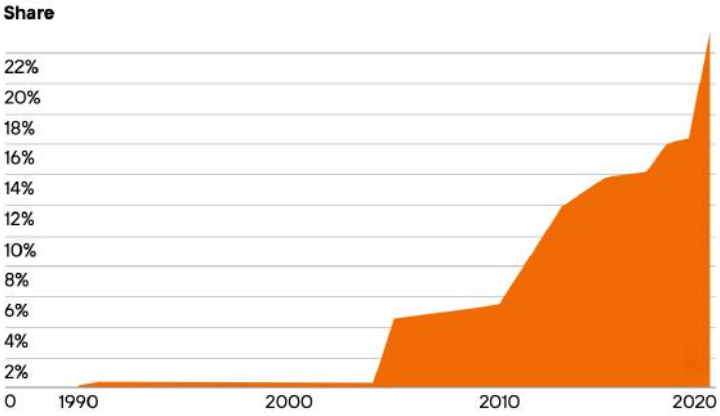


Source: Climate Bonds Initiative, "Sustainable debt: Global state of the market"

A growing share of global emissions are covered by carbon pricing

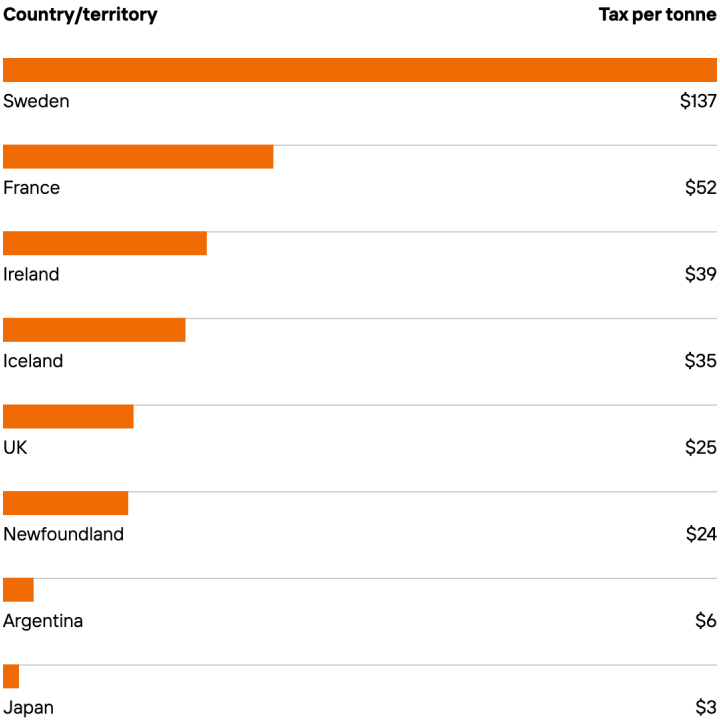
By 2020 over a fifth of global emissions were covered by carbon-pricing initiatives, but there is wide variation in how these are implemented.

Figure 38: Share of global emissions covered by carbon-pricing, global, 1990-2021



Source: World Bank, "Carbon Prices now Apply to Over a Fifth of Global Greenhouse Gases"

Figure 39: Global carbon prices, selected countries/territories, 2021

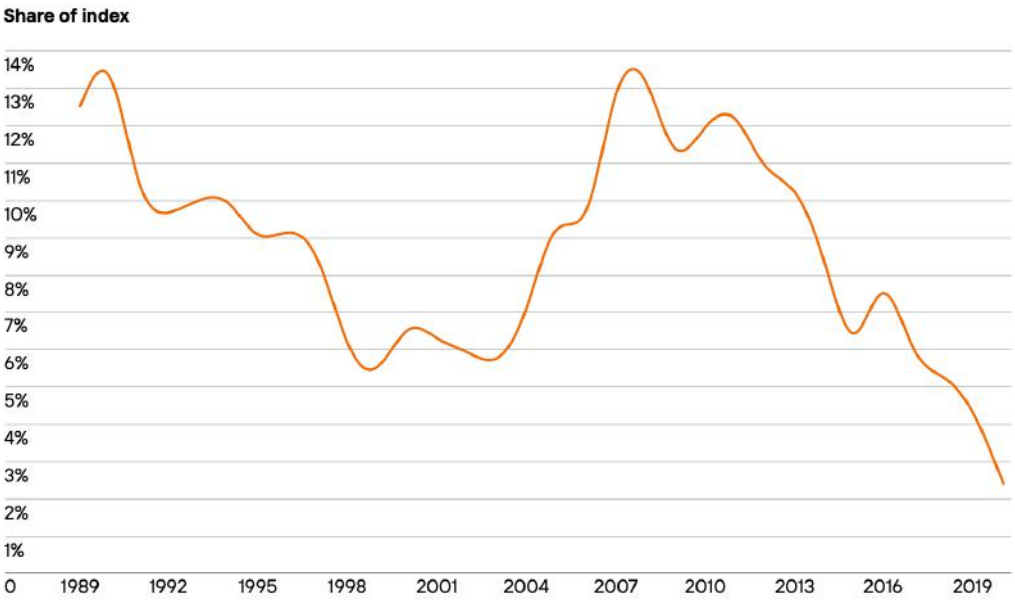


Source: World Bank, "State and Trends of Carbon Pricing 2021"

The declining influence of big oil is a sign of how far the economy has transformed

Energy companies have much lower weight in the S&P 500 than they did only a few years ago. In 2020, Exxon left the Dow Jones Industrial Average after 92 years of continuous presence, to be replaced by Salesforce, the tech company.

Figure 40: S&P 500 energy-sector weight, 1989-2020



2020 figure is as of August 24, 2020

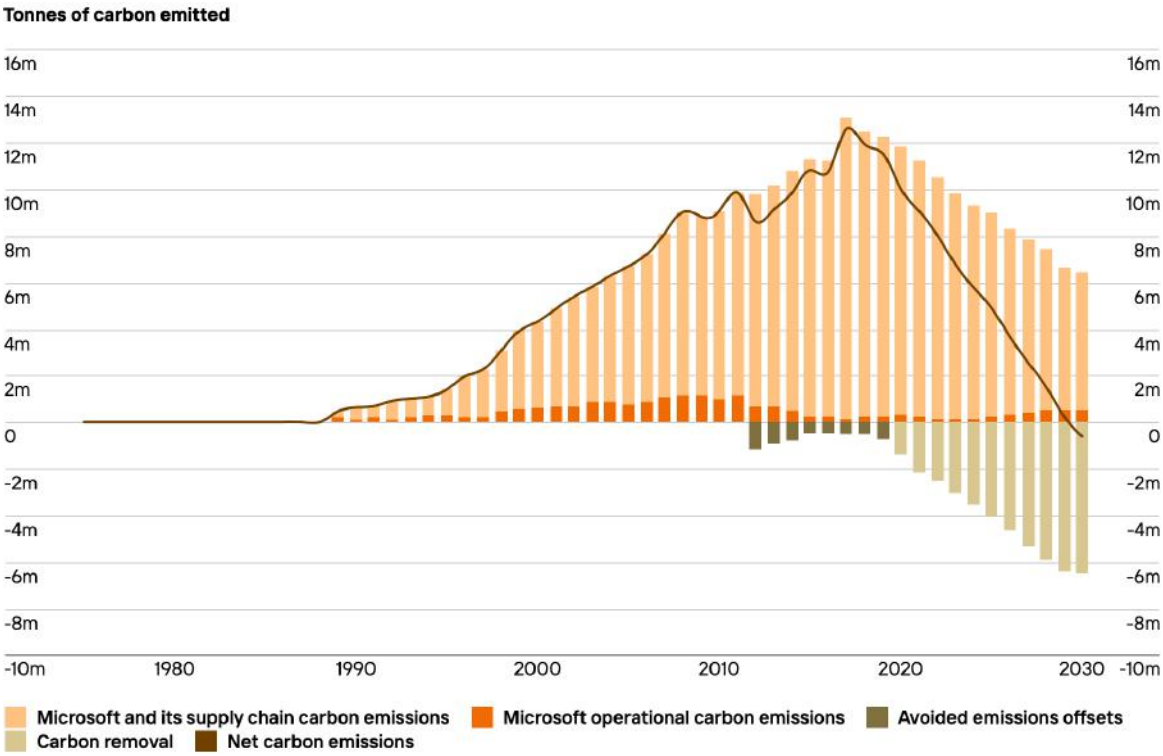
Source: Wall Street Journal, August 25th 2020, "Exxon's Departure From Dow Highlights Market's Retreat From Energy Bets"

Tech players are among those making the boldest commitments to climate action

Microsoft is aiming to go beyond net zero, to eliminate all its historical emissions.

This is a sign that mindsets are changing. To be seen as a leader on sustainability, companies now need to offer a positive impact on the world, rather than minimising the damage they cause.

Figure 41: Microsoft's pathway to carbon negative by 2030



Source: Microsoft, "Microsoft will be carbon negative by 2030"

Finance sector commitments to net-zero climate goals also snowballed in the run-up to COP26

Net-zero initiatives have emerged across the financial sector in recent months. There is now a home for net-zero committed institutions across asset owners, asset managers, banks and (soon) insurers. Other parts of the ecosystem are not far behind.

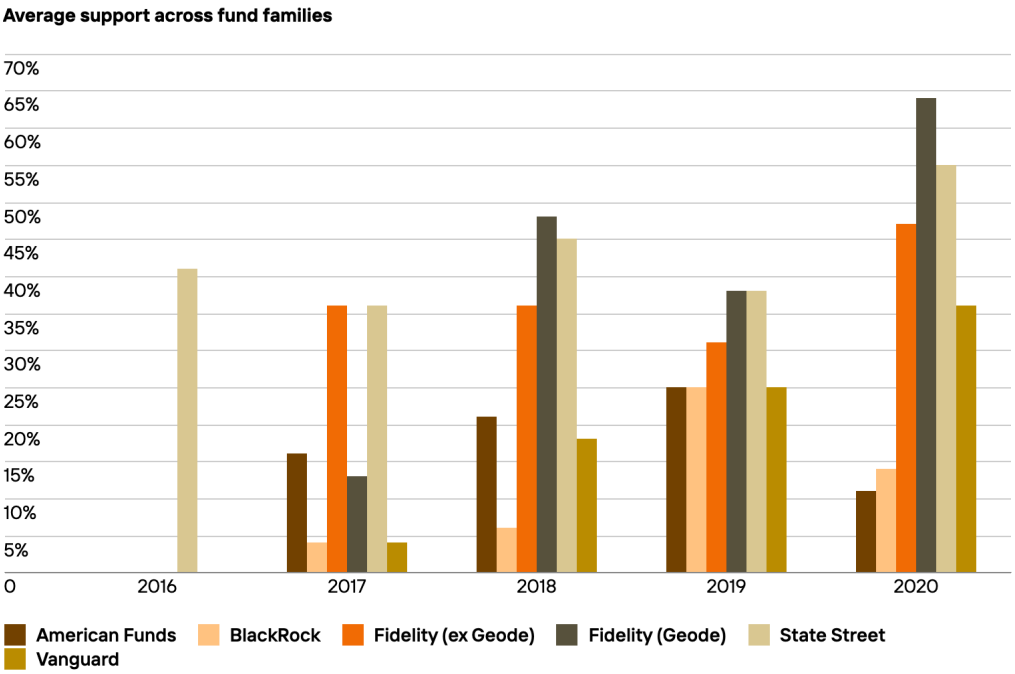
In the run-up to COP26, these commitments are now all part of the Glasgow Financial Alliance for Net Zero (GFANZ). This brings together over 160 firms, which are together responsible for over $70 trillion of assets.

The Race to Zero campaign is coordinating net-zero commitments by all non-state actors. The reach is impressive: it now spans 708 cities, 24 regions, 2,360 businesses and 624 higher education institutions.

Shareholder resolutions in favour of tackling climate change are more popular, but progress is mixed

Issues of social and racial justice are becoming increasingly mainstream in board discussions.

Figure 42: Shareholder votes on requiring climate-risk disclosures, 2016-2020



In 2020 Vanguard, State Street and Fidelity increased support for shareholder resolutions aimed at tackling climate change, while BlackRock voted 'no' more than 80% of the time.

Source: Morningstar, "How Big Fund Families Voted on Climate Change: 2020 Edition"

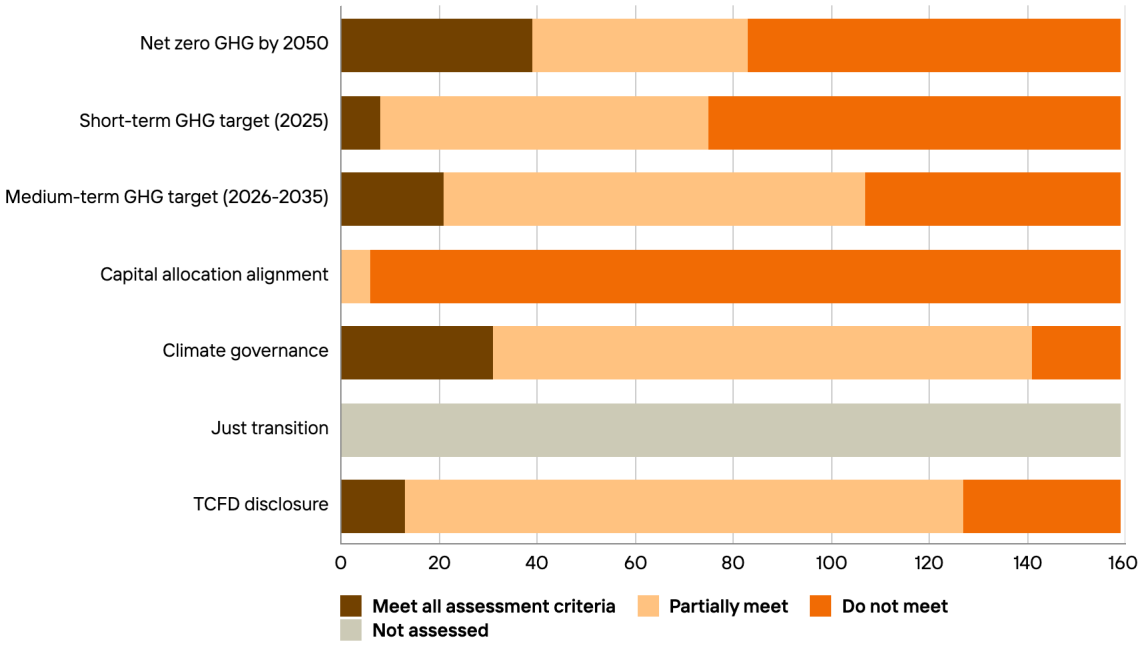
There are big differences between net-zero goals, plans and action

All companies need credible, near-term plans for net zero. Few currently have them. The good news is that frameworks are emerging to judge the quality and credibility of net-zero plans. Capital allocation to zero-carbon business activities is a key dimension. Whether corporates are working to support a just transition in their net-zero plans is a priority for future assessment.

The time for celebrating vague, long-dated net-zero goals has passed. Investors need clarity over how companies will act in the next few years, with strong interim targets for 2030 or sooner.

Greenhouse-gas emissions cuts made today are worth more than cuts promised in the future, due to the escalating risks associated with the pace and extent of climate action. We call this concept the Time Value of Carbon.

Figure 43: Climate Action 100+, net-zero company assessments



* near term: 2025, ** medium term: 2026-2035

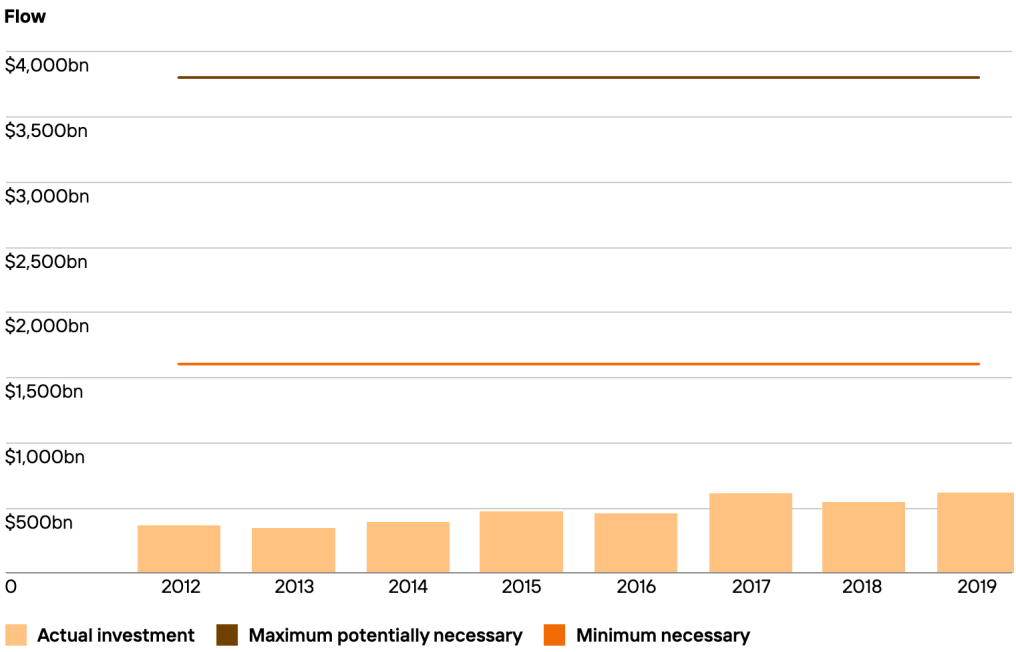
Source: Climate Action 100+, "Climate Action 100+ issues its first-ever net zero company benchmark of the world's largest corporate emitters"

There is a troubling disconnect between the ESG take-off and the real economy

Capital markets are undereducated and overexposed on climate: not a good combination. Given the changes needed in the 2020s across environmental and social agendas, we are about to find out who is serious about sustainability and who is along for the ride.

As well as managing their portfolios in line with net zero, the finance sector needs to facilitate a huge increase in investment in key technologies to meet the 1.5 degree goal. Currently we are far below what is required.

Figure 44: Investment in climate solutions, versus investment needed each year in a 1.5°C scenario ($bn)



Source: Climate Policy Initiative, "Updated view on the Global Landscape of Climate Finance 2019"

Stronger foundations of climate and environmental science are needed to avoid potential tripwires

> "There is a growing concern among the investment community... that companies are not accurately characterising climate change risk in their reporting nor adequately preparing for its physical impacts. Estimates of the impact of climate change on the financial sector range from US$2.5–24.2 trillion, whereas valuations of risk to manageable assets range from US$4.2–43.0 trillion in net present value terms, depending on discount rates used"

Goldstein, Allie, Will R. Turner, Jillian Gladstone, and David G. Hole. "The private sector's climate change risk and adaptation blind spots." Nature Climate Change 9, no. 1 (2019): 18-25.

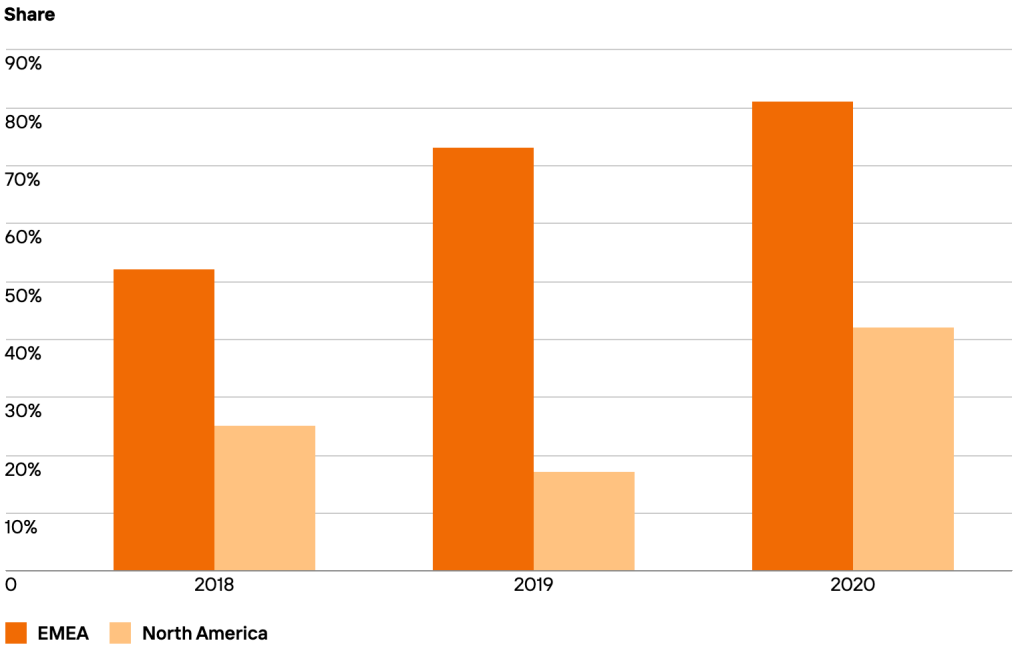
> "Assessment of future climate risk requires knowledge of how the climate will change on time and spatial scales that vary between business entities. The rules by which climate science can be used appropriately to inform assessments of how climate change will impact financial risk have not yet been developed"

Fiedler, Tanya, Andy J. Pitman, Kate Mackenzie, Nick Wood, Christian Jakob, and Sarah E. Perkins-Kirkpatrick. "Business risk and the emergence of climate analytics." Nature Climate Change 11, no. 2 (2021): 87-94.

Lessons-sharing and coordination across markets must be stepped up

EMEA is well ahead of North America when it comes to the implementation of sustainable investment.

Figure 45: Applying ESG considerations to smart beta strategy, by region, %

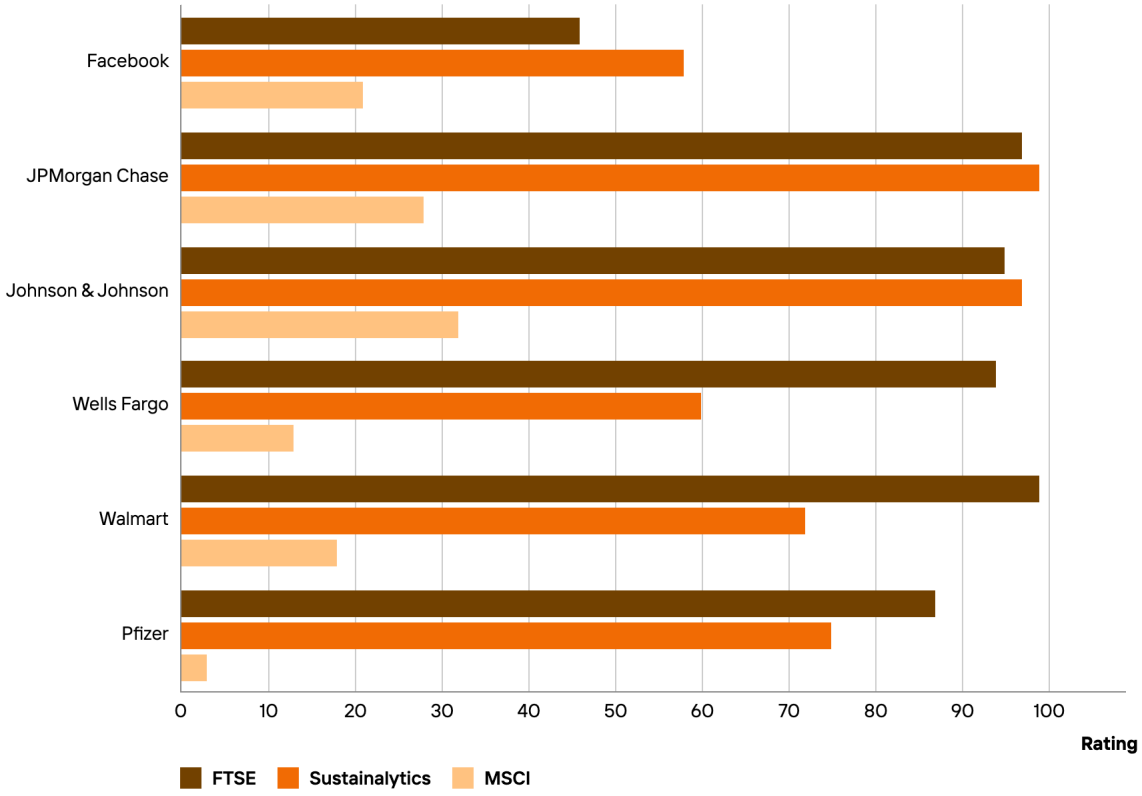


Source: FTSE Russell, "Implementation and evaluation of ESG considerations"

Confusion over ESG ratings has provided a perennial opportunity for greenwash

Academic research has shown that different providers of ESG come to radically different conclusions about the ESG commitments of big companies.

Figure 46: ESG ratings, select companies, by different raters



Source: FTSE Russell, "Implementation and evaluation of ESG considerations"

But ESG metrics are finally starting to consolidate

International Business Council and WEF, with the key standard-setting bodies and accounting firms, proposed a single set of ESG metrics in October.

These 21 critically important metrics and disclosures (plus 34 optional ones) are designed to provide a consistent structure for sustainability reporting.

They are organised under four pillars:

The Four Pillars

1 – Principles of Governance	The definition of governance is evolving as organisations are increasingly expected to define and embed their purpose at the centre of their business. But the principles of agency, accountability and stewardship continue to be vital for truly "good governance".
2 – Planet	An ambition to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations.
3 – People	An ambition to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfil their potential in dignity and equality and in a healthy environment.
4 – Prosperity	An ambition to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social and technological progress occurs in harmony with nature.

The SEC's renewed focus on ESG oversight could be the next tipping point for the sector. It needs to set a high bar

It is crucial that regulators set a high bar for sustainability claims, rather than lock in insufficient quality and ambition.

Moves by regulators in the US, China and the EU show that net zero will soon be the law of the land. There is no single model for ESG governance that will satisfy all, but it is important to build bridges between these regimes to avoid fragmentation. Net zero and social justice must be the focus for all regulators.

United States Securities and Exchange Commission, Washington DC. Image: Pgiam/Getty

> "Investors increasingly want to understand the climate risks of issuers. Investors representing literally tens of trillions of dollars of assets under management are looking for consistent, comparable, decision-useful information to determine whether to invest, sell, or make a proxy vote one way or another"

Gary Gensler, SEC Chair, June 23rd 2021

> G7 finance ministers made a commitment at the meeting to make it mandatory for corporates to report climate impacts and investment decisions, alongside new measures to strengthen central company beneficial ownership registries to crack down on environmental crime"

EuroActiv, June 7th 2021

02 Natural Solutions

2.1 Key trends

This is a critical year for nature, with a series of global summits on biodiversity, food and climate change. Scientists are sounding the alarm over ecological destruction and the risk of irreversible damage to our planet. But natural solutions also offer some of the most exciting solution areas for sustainability.

With rising threats to our natural world

Many companies are making commitments on nature

We are seeing the rise of natural solutions

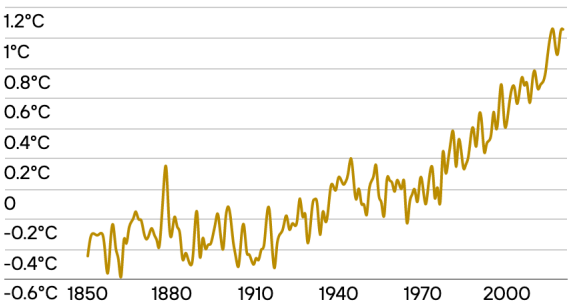
Guardrails are crucial as they go to scale

Nature has never been under greater threat

The degradation of nature continues and there is rising concern over ecological tipping points. Over half of the world's GDP, $44 trillion of economic value, is at moderate or severe risk due to nature loss, according to the World Economic Forum.

Pressures on natural ecosystems are also amplifying other risks, including water scarcity and the risk of disease.

Figure 47: Land and ocean temperature anomaly, global, 1850-2020



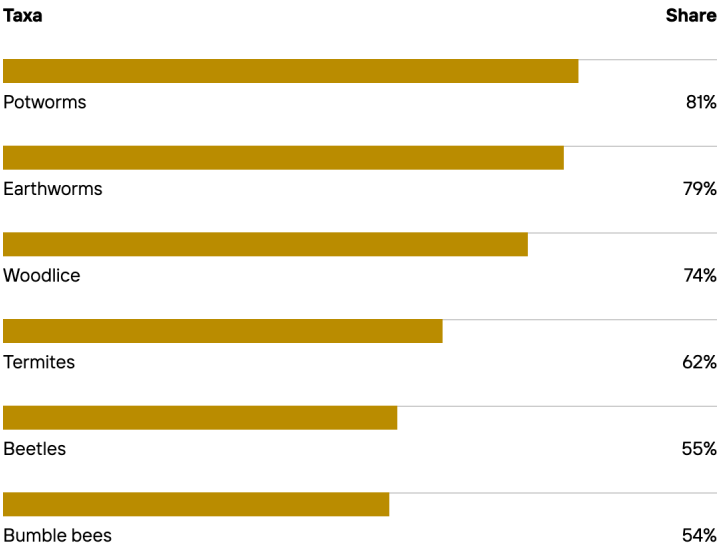
A temperature anomaly is the departure from the average temperature, positive or negative, over a certain period.

Source: Berkeley Earth, "Global Temperature Report for 2020"

> Climate change and biodiversity loss are two of the most pressing issues of the Anthropocene"

IPBES-IPCC Co-sponsored workshop: "Biodiversity and climate change: Workshop report", June 2021

Figure 48: Share of studies showing negative effects of pesticides, by taxa, 2021 estimate



Source: Gunstone, Tari, Tara Cornelisse, Kendra Klein, Aditi Dubey, and Nathan Donley. "Pesticides and Soil Invertebrates: A Hazard Assessment." Frontiers in Environmental Science 9 (2021): 122.

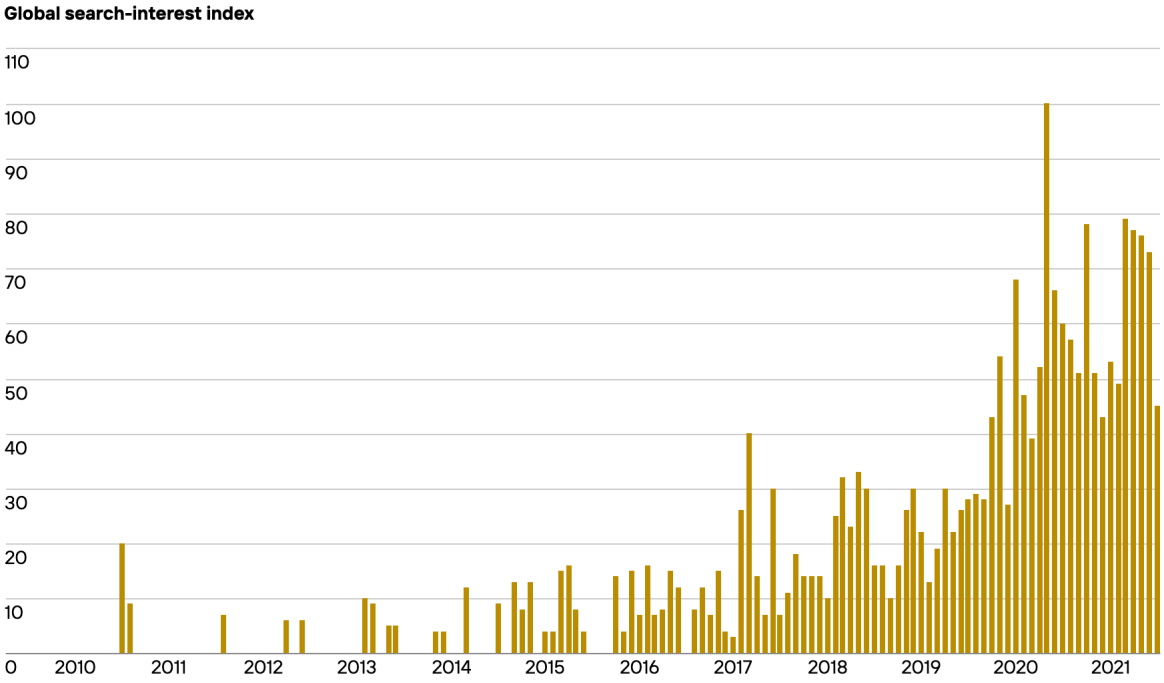
> Humanity is waging war on nature. This is senseless and suicidal. The consequences of our recklessness are already apparent in human suffering, towering economic losses and the accelerating erosion of life on Earth"

António Guterres, Secretary-General of the United Nations, February 2021

There is growing interest in nature-based solutions for sustainability

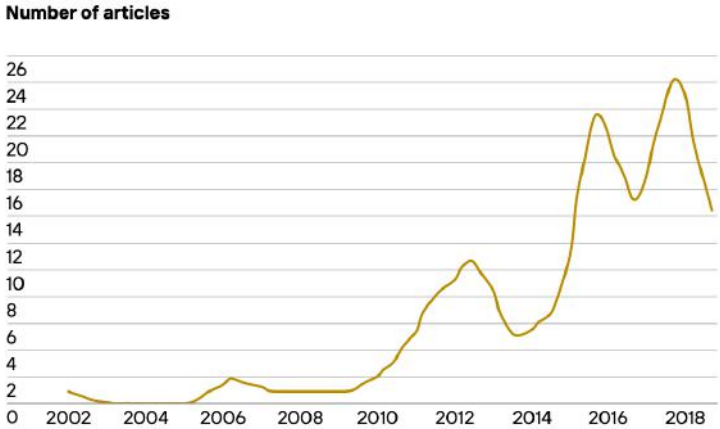
Global search interest in "nature-based solutions" is soaring, and scientists are writing about it more frequently.

Figure 49: Global interest in "nature-based solutions", 2010-2021



Source: Google Trends

Figure 50: Scientific articles about nature-based solutions, 2002-2018

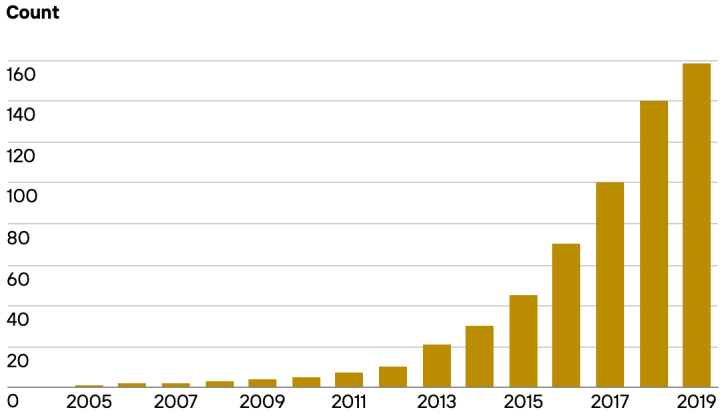


Source: Dick, J., Carruthers-Jones, J., Carver, S. et al. "How are nature-based solutions contributing to priority societal challenges surrounding human well-being in the United Kingdom: a systematic map." Environ Evid 9, 25 (2020).

There is rising interest in regenerative food systems that restore and nourish land, ecosystems and livelihoods

More companies say they are embracing regenerative agriculture. That said, the earlier experience with the watering down of "organic" is instructive here, and there's already evidence of large agribusiness claiming to sell a few regenerative products while still, for example, supporting deforestation-driven beef production on a larger scale.

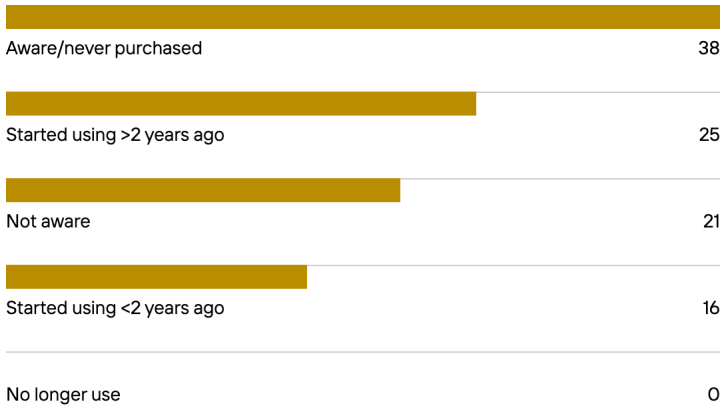
Figure 51: Number of entities using "regenerative agriculture", global, 2005-2019



"Entities" includes companies, investors, organisations, and farms

Source: HowGood

Figure 52: Grower familiarity with regenerative agriculture



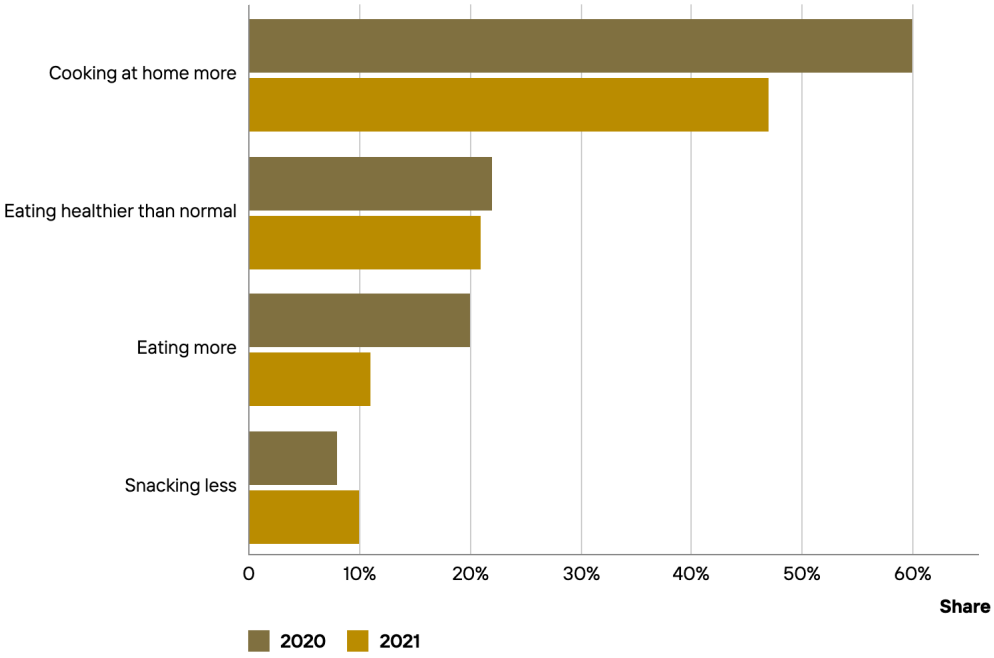
No growers who have used regenerative agriculture have stopped doing so, according to a recent survey. Among those growers who currently use regenerative agriculture, nearly two-thirds said that they planned to use it more in the future

Source: LEK, "Regenerative Agriculture Spreads Its Roots"

And the pandemic led people to make radically different food choices

Different natural pathways have different mitigating potential over time.

Figure 53: Behavioural changes regarding food, US, 2020-2021

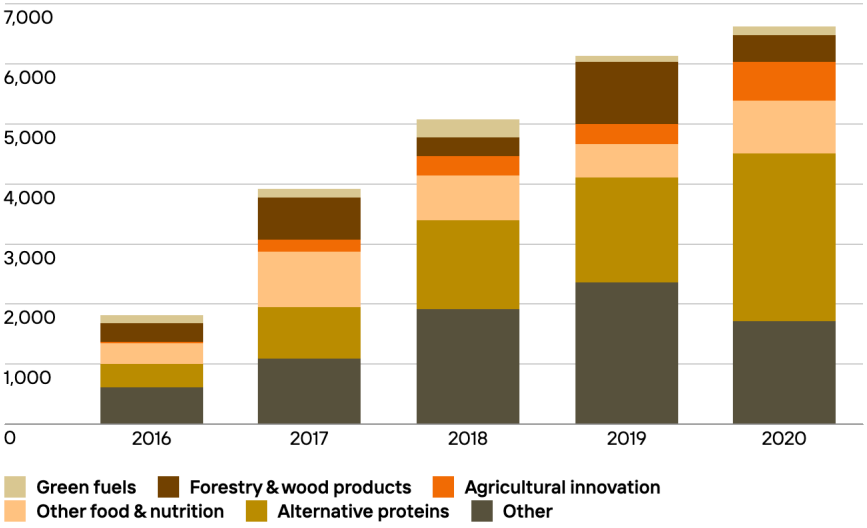


Source: Food Insight, "2021 Food & Health Survey"

Investment activity in natural solutions is taking off

Private investment is accelerating across several key segments of natural solutions. Investment is largely focused on alternative proteins and other activity on the demand side. Other types of natural solutions discussed in this chapter are still at the early stages of scaling up.

Figure 54: Investment in natural-solutions companies, 2016-2020

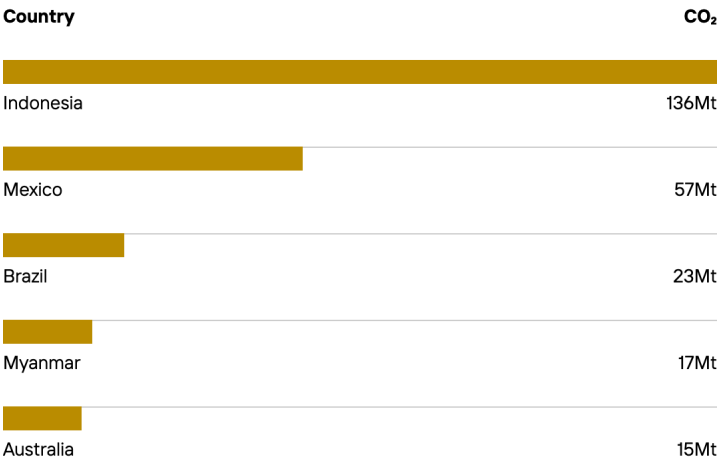


Source: Generation analysis of CB Insights data

Some countries are natural-solutions superpowers

Different countries have very different sequestration potential. Mangroves are one of nature's most productive carbon assets, and can sequester carbon up to 400% faster than land-based tropical rainforests. Indonesia has 24% of the world's restorable mangrove ecosystem.

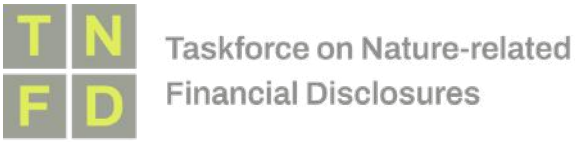
Figure 55: Carbon-sequestration potential from mangrove restoration, top five countries, 2020



Source: Earth Security, "Financing the earth's assets: The case for mangroves as a nature-based climate solution"

Frameworks for assessing nature and biodiversity impact are urgently needed

The Taskforce on Nature-related Financial Disclosures started to take shape this year, with the support of the G7 countries. Clear and robust frameworks are important for evaluating whether companies and portfolios are nature-positive, and for ensuring there are strong safeguards around all natural solutions.



2.2 Regenerative food systems — from fringe to centre-stage

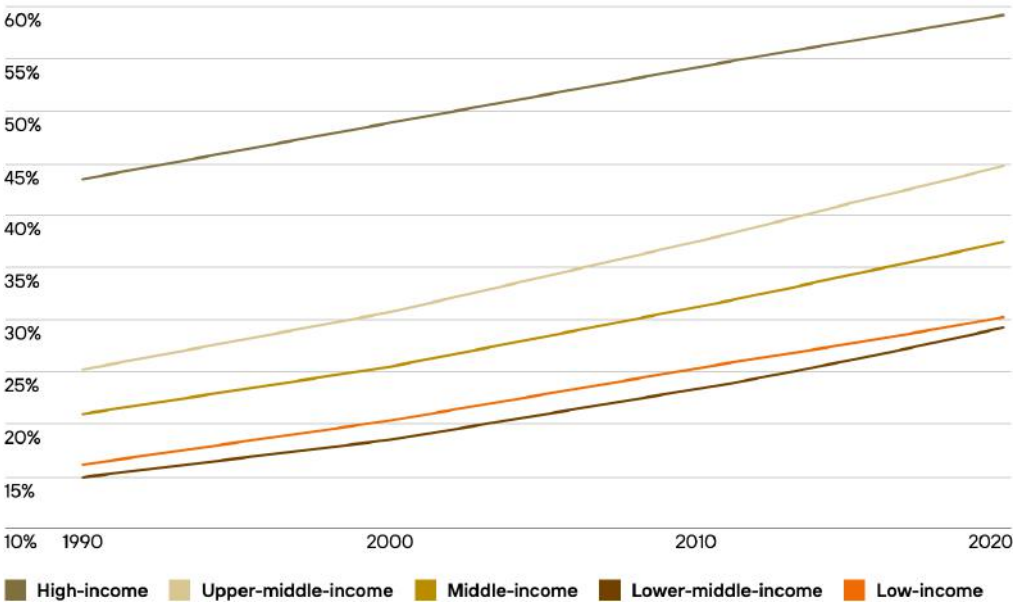
What we eat has a huge impact on our health

The number of overweight people in poorer countries is now rising rapidly, having been high for a while in the rich world. "Lifestyle diseases" are thus becoming more common in poorer countries and will become ever more so.

And even in the world's richest countries, anaemia (and other conditions linked to deficiencies of certain nutrients) remains very high and there are indications that it may be rising.

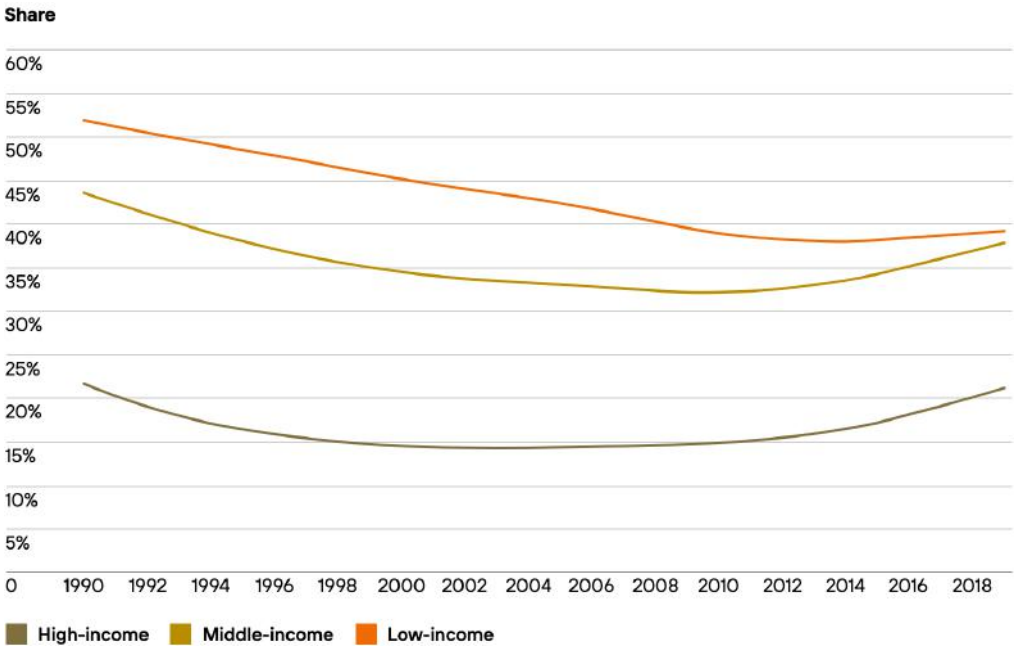
The most basic problems with food continue to cause huge global problems. Each year worldwide, unsafe food causes 600m cases of foodborne diseases and 420,000 deaths, according to the WHO. 30% of foodborne deaths occur among children under 5 years of age. Even in the world's richest countries, food insecurity is a big problem — especially during the pandemic.

Figure 56: Prevalence of overweight, by country income group, 1990-2020



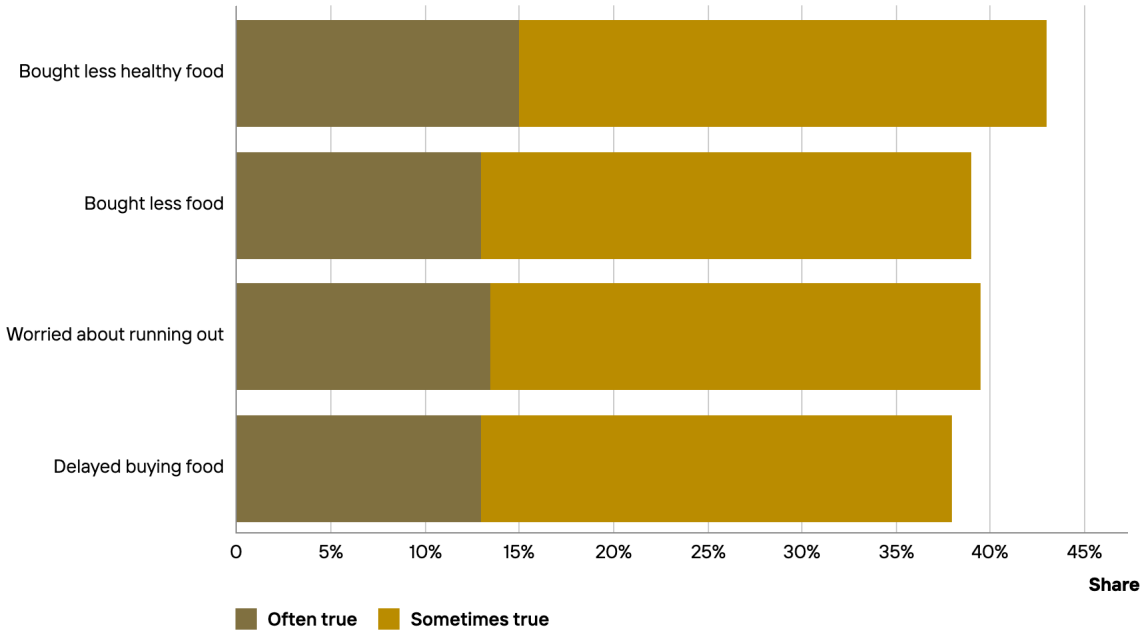
Source: World Bank

Figure 57: Anaemia in women of reproductive age, global, 1990-2019



Source: Our World in Data, "Micronutrient Deficiency"

Figure 58: Behavioural changes due to income loss in 2020, US

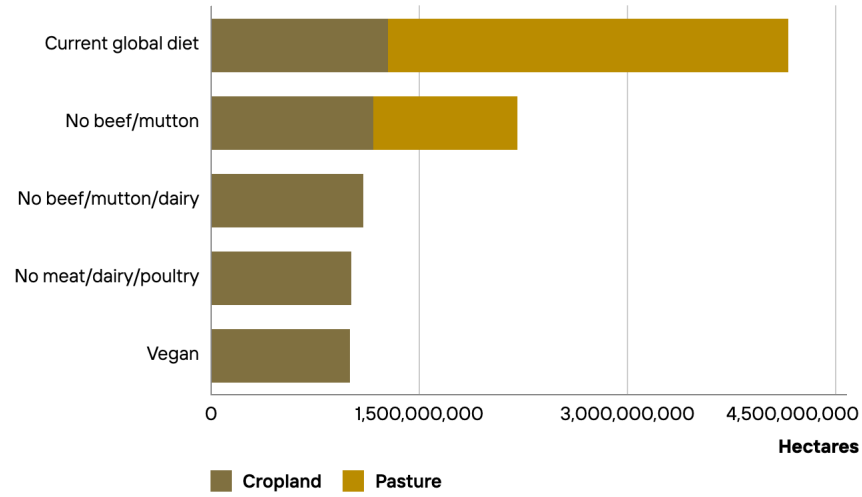


Source: foodinsight.org

Food systems have a massive impact on the planet

Agriculture uses up huge amounts of land, and creates large-scale environmental damage, such as ocean dead zones.

Figure 59: Global land use for agriculture across different diets, latest data

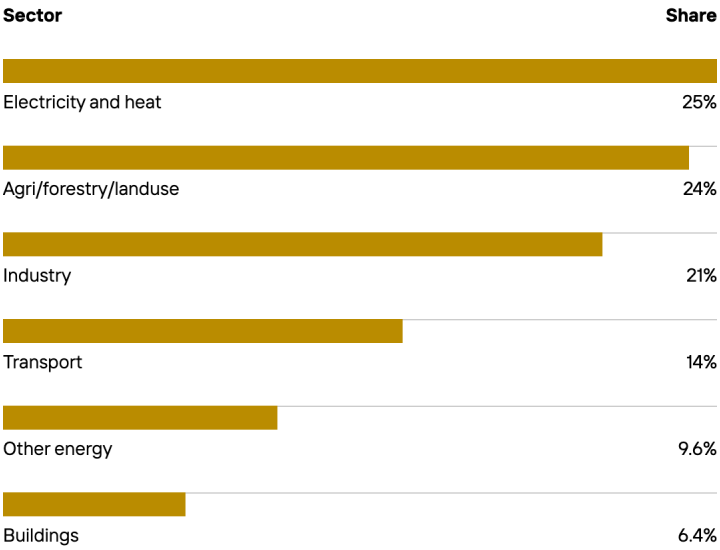


Source: Our World in Data, "If the world adopted a plant-based diet we would reduce global agricultural land use from 4 to 1 billion hectares"

Food systems account for a huge share of greenhouse-gas emissions

Food production accounts for around one-quarter of all greenhouse-gas emissions. If the full food value chain is included, this increases to around one-third.

Figure 60: Global greenhouse-gas emissions by economic sector, %



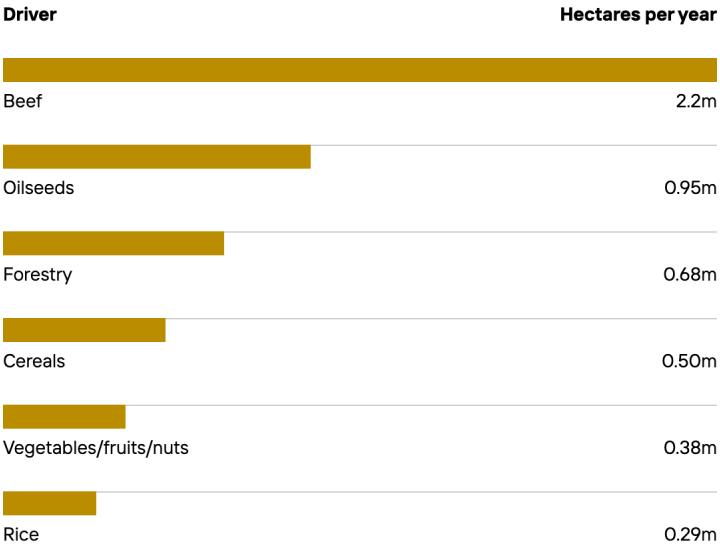
Source: EPA, "Global Greenhouse Gas Emissions Data"

> "Food-system emissions amounted to 18 Gt CO_2 equivalent per year globally, representing 34% of total GHG emissions. The largest contribution came from agriculture and land use/land-use change activities (71%), with the remaining from supply chain activities: retail, transport, consumption, fuel production, waste management, industrial processes and packaging"

Crippa, M., E. Solazzo, D. Guizzardi, F. Monforti-Ferrario, F. N. Tubiello, and A. Leip. "Food systems are responsible for a third of global anthropogenic GHG emissions." Nature Food 2, no. 3 (2021): 198-209.

Conversion of land for agriculture is a major driver of deforestation

Figure 61: What are the drivers of tropical deforestation?

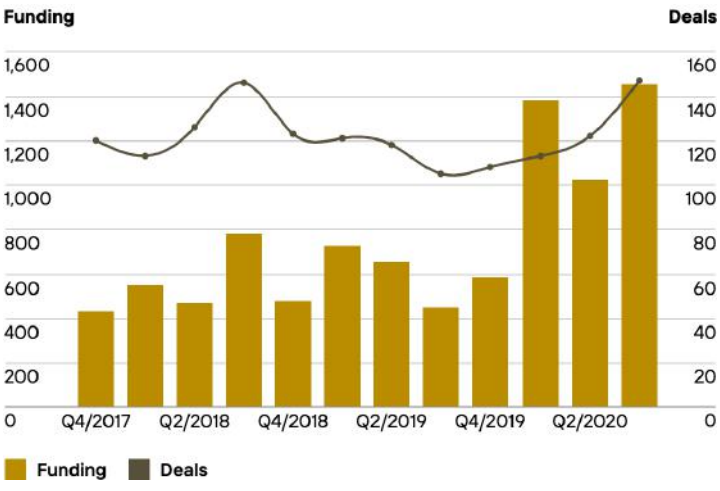


Source: Our World in Data, "Cutting down forests: what are the drivers of deforestation?"

We are seeing increased investment in food and beverage

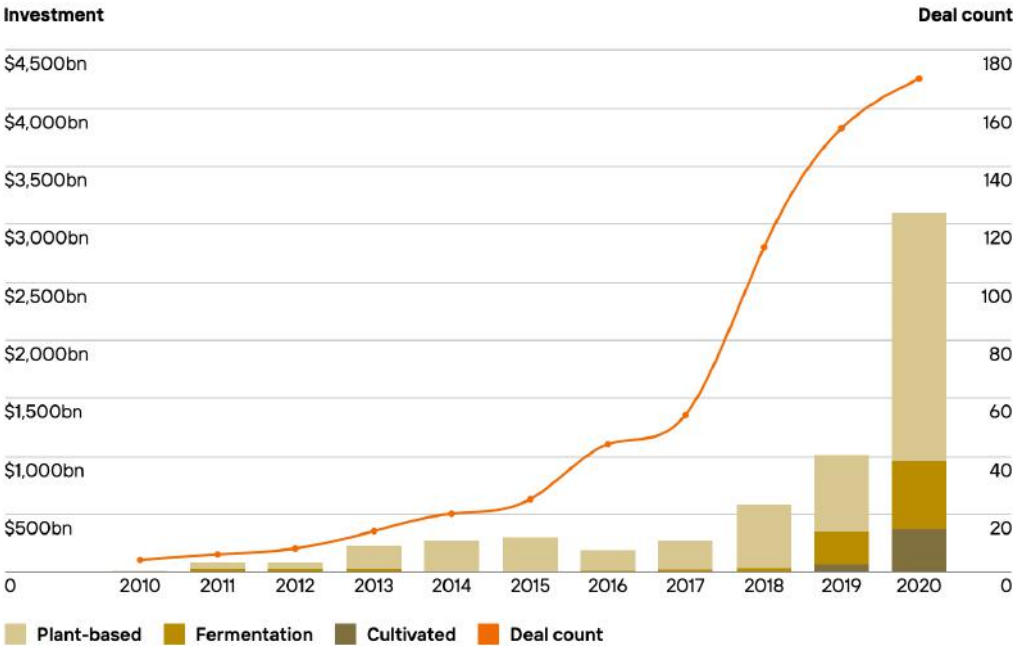
Financing hit an all-time record in the third quarter of 2020. One of the hottest areas for investment is the alternative-protein space.

Figure 62: Food and beverage deals and financing, global, 2017-2021



Source: Generation analysis of CB Insights data

Figure 63: Investment in alternative proteins, global, 2010-2020

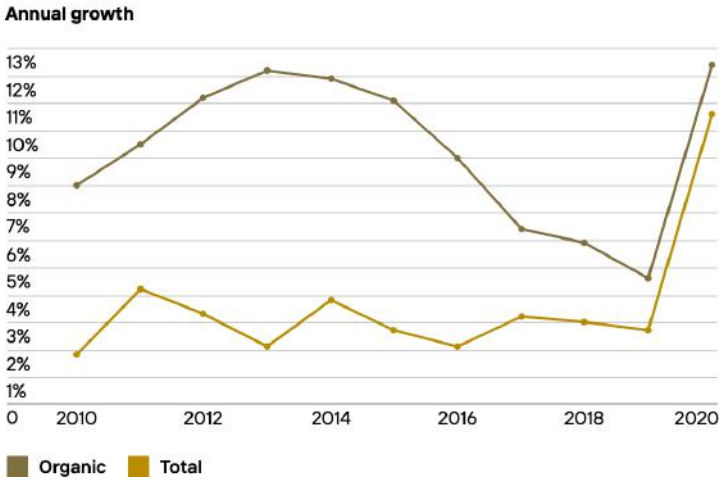


Source: Good Food Institute, "State of the Industry Report: Plant-Based Meat, Eggs, and Dairy"

There is a clear uptick in demand for more sustainable products

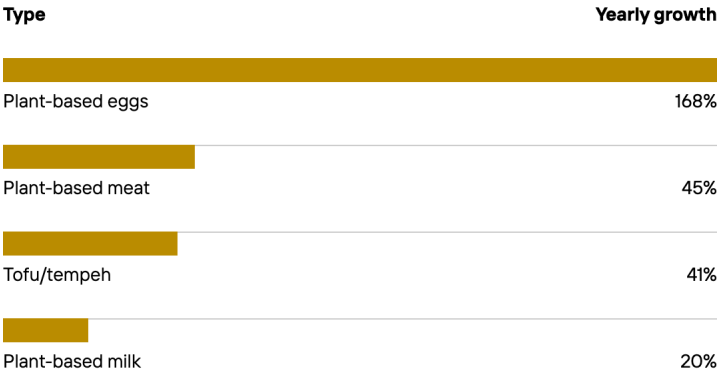
Sales of organic food proved resilient in 2020, despite the shock of the pandemic. Has the pandemic made more consumers recognise the value of sustainable food?

Figure 64: Annual growth in spending on food, organic and total, US, 2010-2020



Source: Fertoz, "The Organic Trade Association Report High Demand for Organic Foods in 2020"

Figure 65: Growth of plant-based foods, US, 2020

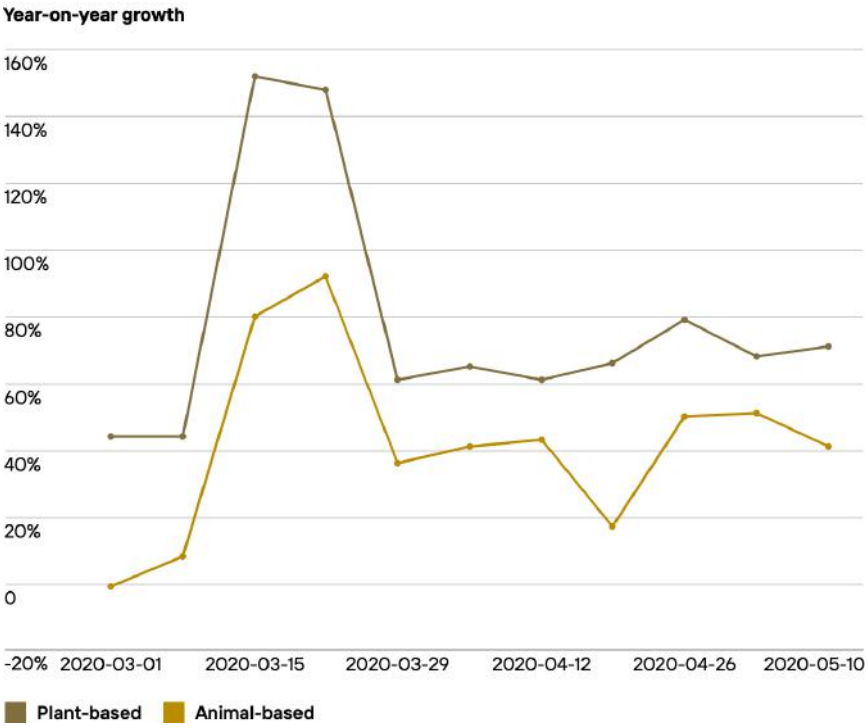


Source: Good Food Institute, "Plant-based food retail sales reach $7 billion"

There has been rising interest in plant-based food during the pandemic

Growth in plant-based meats continues to outpace growth in animal-based products.

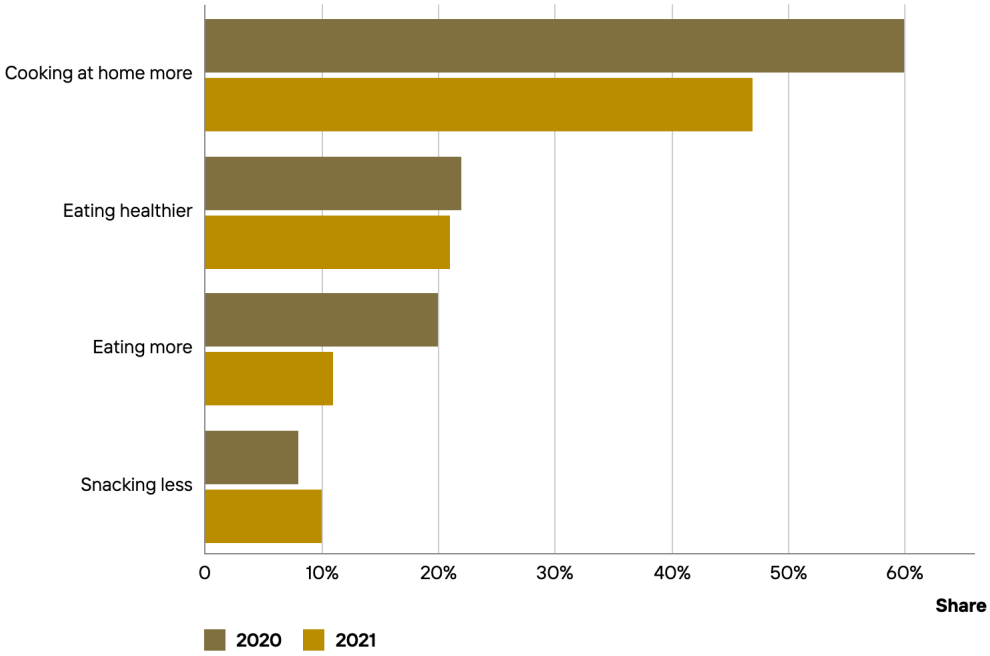
Figure 66: Sales growth of plant-based and animal-based meats, 2020



Source: Good Food Institute, "U.S. plant-based meat sales growth accelerates despite COVID-19"

This is part of a broader shift in diets and food choices

Figure 67: Changes to eating and food preparation due to COVID-19, US

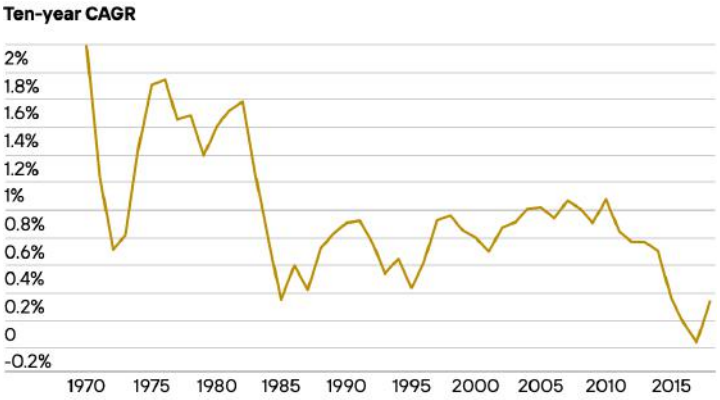


Source: International Food Information Council, "2021 Food & Health Survey"

We are only at the beginning of disruption in the food industry

Global consumption of beef is barely growing, but it is not yet falling.

Figure 68: Compound annual growth rate in beef production, 1971-2018



Source: Generation analysis of FAO/OECD data

2.3 A raft of natural solutions for net zero and biodiversity

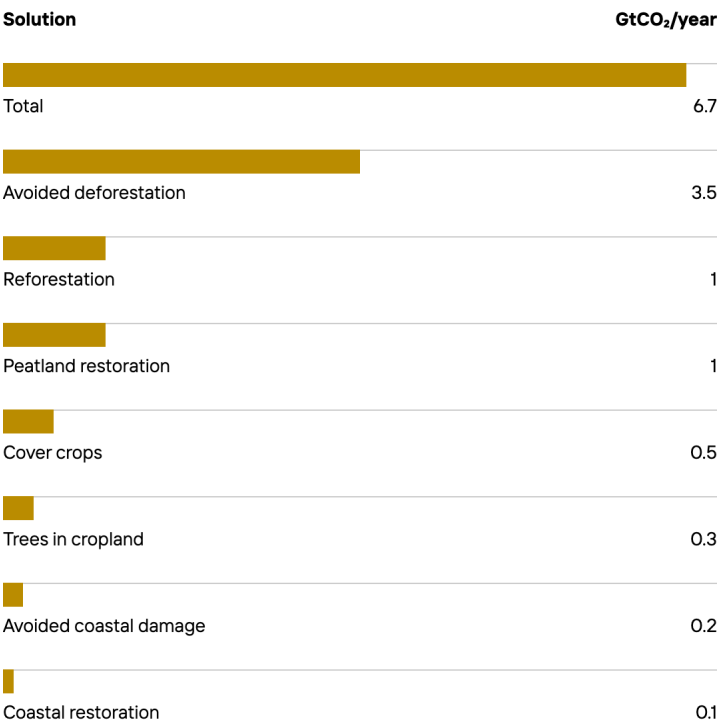
Achieving 1.5°C and net zero will probably require some level of carbon removal through nature-based solutions

Many 1.5°C scenarios make use of CO_2 removals at a huge scale. There are risks here. Over-dependence on removals via natural solutions, for instance, would have unsustainable impacts on land use.

Yet natural climate solutions will play a vital role in tackling the climate crisis as well as protecting biodiversity. Nature-based solutions could deliver one-third of emissions reductions required by 2030. This includes the critical goal of ending deforestation.

Agriculture is often a key sector for nature-based solutions. For instance, planting cover crops in arable lands that have an off-season fallow period often increases the carbon sink capacity of the agroecosystem (see Lugato et al., 2020).

Figure 69: Abatement potential of natural climate solutions by 2030, global



Source: WEF/McKinsey, "Nature and net zero"

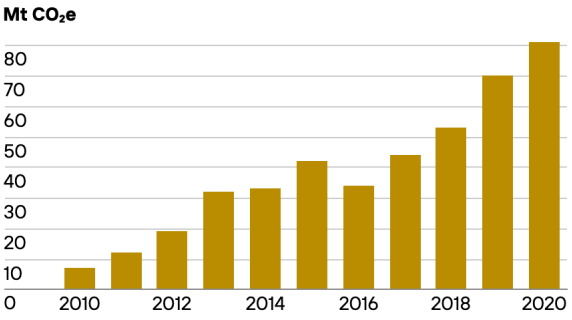
> We estimate a practical potential of close to 7Gt CO_2 per year from NCS projects, sufficient to deliver around one-third of that target and to achieve carbon removal in the near term and at lower cost than technological solutions"

World Economic Forum/McKinsey "Nature and net zero", May 2021

Demand for NCS credits is growing rapidly in line with corporates' net-zero ambitions

Demand for NCS credits has increased rapidly over the past decade.

Figure 70: Voluntary carbon credits retired by project type, 2010-2020



Source: WEF/McKinsey, "Nature and net zero"

There are huge challenges for nature-based solutions

They include:

01. Ensuring that companies place more emphasis on cutting emissions over carbon removals, though both are required. Some companies are leaning on offsets or removals to deliver the bulk of their net-zero commitments.

02. Effective long-term governance over carbon removals, and monitoring and reporting programmes. Recent studies have shown (again) how difficult this is — look at the examples of the California offset scheme and the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

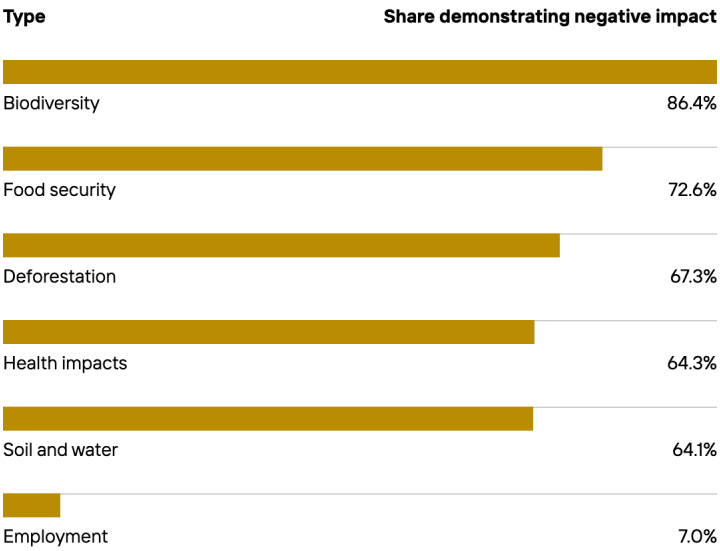
03. Getting the guardrails right for nature-based solutions is key to ensure sustainability and deliver real climate and other critical ecological benefits. Financial innovation can't run ahead of safeguards and governance.

Many scenarios rely on biomass energy with carbon capture and storage at huge scale

Bioenergy with carbon capture and storage (BECCS) is the process of extracting bioenergy from biomass and capturing the carbon, thereby removing CO_2 emissions from the atmosphere.

Studies highlight the massive implications for food, soil and forests. A growing body of research shows that BECCS on a large scale could have negative impacts on core dimensions of human and ecosystem wellbeing. Due to its land-use impact, widespread use of BECCS could lead to increased food prices as a result of competition between agriculture and other land uses.

Figure 71: Share of studies on BECCS demonstrating negative effects, by type of impact



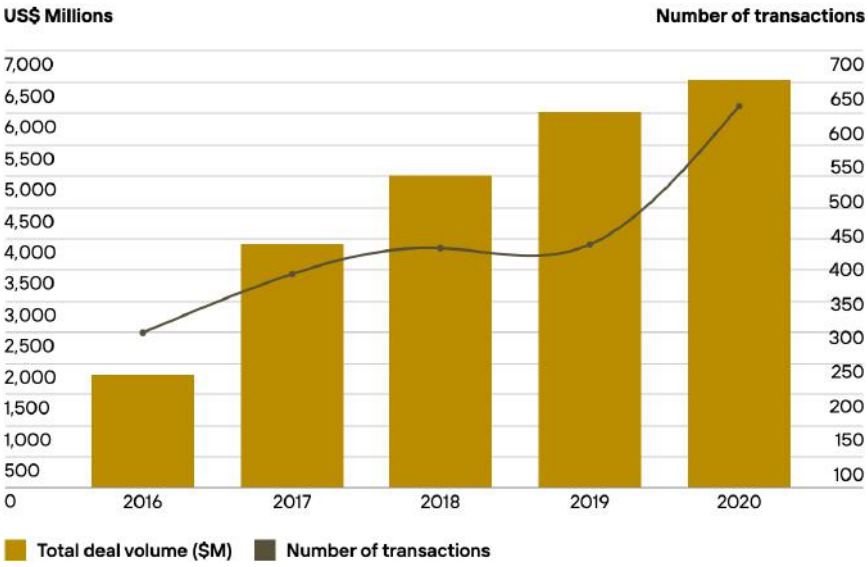
Source: Oil Change International and Reclaim Finance, "NGFS scenarios: Guiding finance towards climate ambition or climate failure?"

> "Large-scale deployment of land-based carbon-dioxide removal would have far-reaching implications for land and water availability [...] and may impact food production, biodiversity and the provision of other ecosystem services"
>
> IPCC

It's not only a climate story. There is growing business and investor interest in the wider role of natural solutions

Deals and investment are rising rapidly in the "natural solutions" space. There is also rising investor focus on protecting biodiversity and promoting regenerative practices, going beyond a narrow focus on climate outcomes.

Figure 72: Investment volumes in natural solutions, 2016-2020

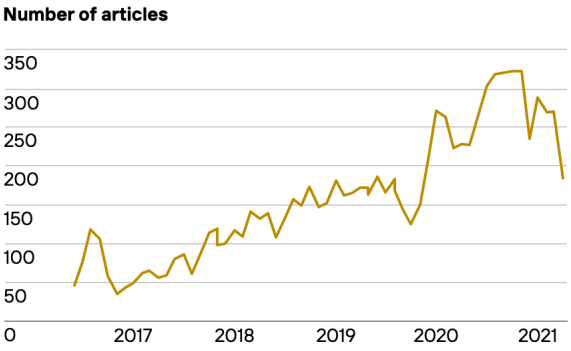


Source: Generation analysis of CB Insights data

Use of "bio-based" and similar terms is taking off in consumer and industrials sectors

Media mentions of "bio-based" and similar terms are rising quickly.

Figure 73: Media mentions of "bio-based" and similar terms, 2016-2021



Source: CB Insights data

Natural solutions for construction are proliferating

Long-lived wood products that are harvested from sustainably managed forests have been around for decades but are being applied in a wider variety of buildings, helping to displace emissions-intensive concrete and steel and storing carbon often for many decades.

Other nature-inspired solutions for construction are emerging too, such as the production of bio-cement using bacteria, though these are yet to achieve scale.

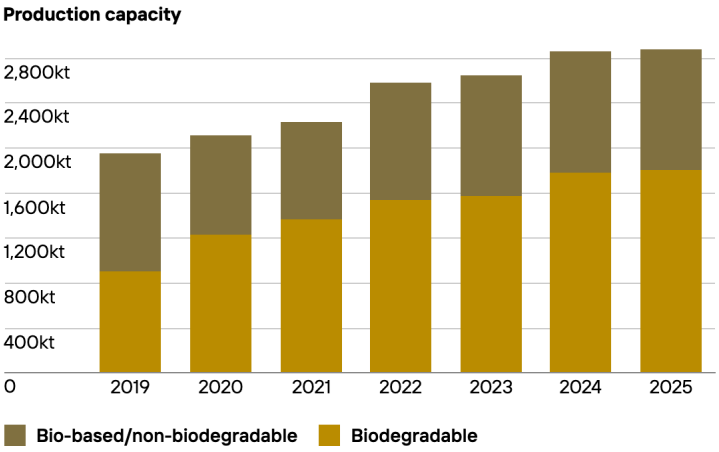
American Framing, Pavilion of the United States at the 17th International Exhibition of Architecture La Biennale di Venezia, photo: American Framing, 2021

Bioplastics are also taking off

Bioplastics production capacities are rising rapidly. Biodegradable plastics could play an important role in tackling the marine plastic crisis, but they will need to both scale up and prove their environmental performance.

That said, there is reason for caution. Roughly 40% of these bioplastics are not biodegradable and it's only a minuscule percentage of the overall production at the moment. Emissions are also generated in the production of plastics. There is also the question of waste management at the end of usable life.

Figure 74: Global production capacities of bioplastics, 2019-2025



Source: European Bioplastics, "Bioplastics market data"

Companies are making "nature-positive" commitments backed by real resources

Business for Nature has identified over 1,200 examples of companies taking action for nature. Some recent notable examples include:

- Unilever is setting aside EUR €1 billion to fund nature regeneration projects, including achieving a deforestation-free supply chain, promoting regenerative agriculture, and transitioning to biodegradable ingredients by 2023.

- Nestlé is committed to 50% of its agricultural ingredients coming from regenerative agriculture by 2030.

- Microsoft has pledged to be net-negative for current emissions by 2030 and then remove historical emissions by 2050. Its carbon removals will come from sequestration in nature, especially in the short term.

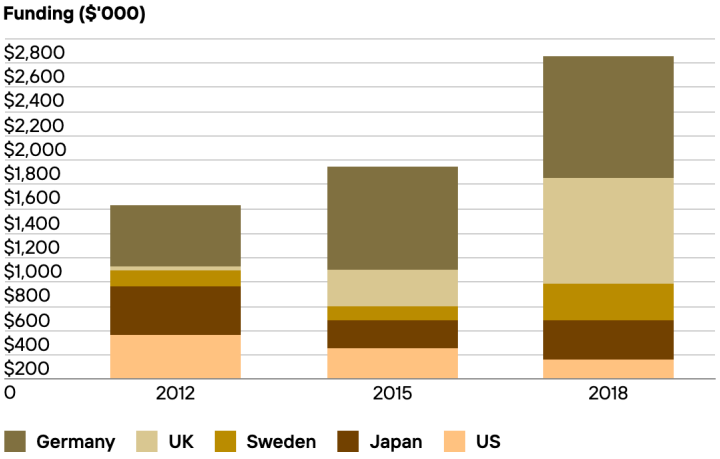
These are ambitious goals, but questions remain over the credibility and stringency of some nature-positive commitments.

Governments will play a key role in helping natural solutions to scale up quickly

Overseas development-aid funding for natural solutions is increasing rapidly. Sub-Saharan Africa is a particular beneficiary of such funding.

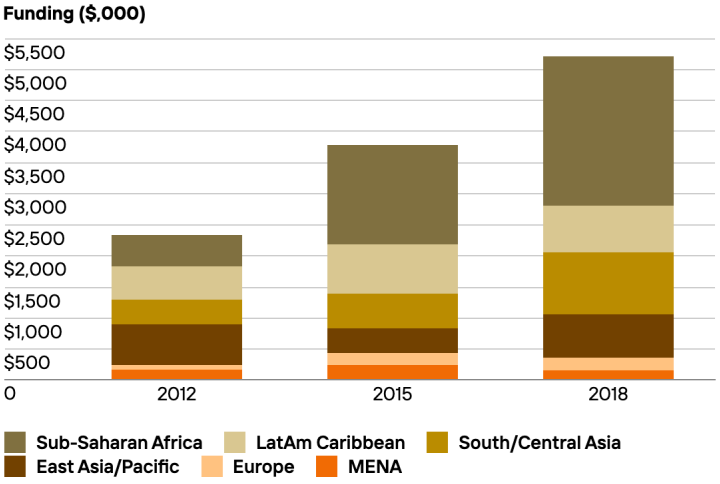
To put this in context, the biodiversity financing gap has been estimated at between $598 billion and $824 billion per year by the Paulson Institute.

Figure 75: Overseas development aid funding for nature-based solutions for adaptation, 2012-2018



Source: World Resources Institute, "Public international funding of nature-based solutions for adaptation: a landscape assessment"

Figure 76: Funding for nature-based adaptation, received by region, 2012-2018



Source: World Resources Institute, "Public international funding of nature-based solutions for adaptation: a landscape assessment"

> "Nature-based solutions (NbS) can be used for a variety of objectives, including climate change mitigation and/or adaptation, biodiversity conservation, and disaster risk reduction"

World Resources Institute, "Public international funding of nature-based solutions for adaptation: a landscape assessment", March 2021

03 Energy

3.1 Key trends

Despite growing momentum, a huge acceleration is required to transform energy and industrial systems in line with a 1.5°C pathway. As the International Energy Agency has confirmed, keeping to this goal means no new fossil-fuel projects. This transition will create many jobs, but more focus is needed on ensuring a just transition.

Energy systems must transform for 1.5°C

Overseas coal finance is being phased out

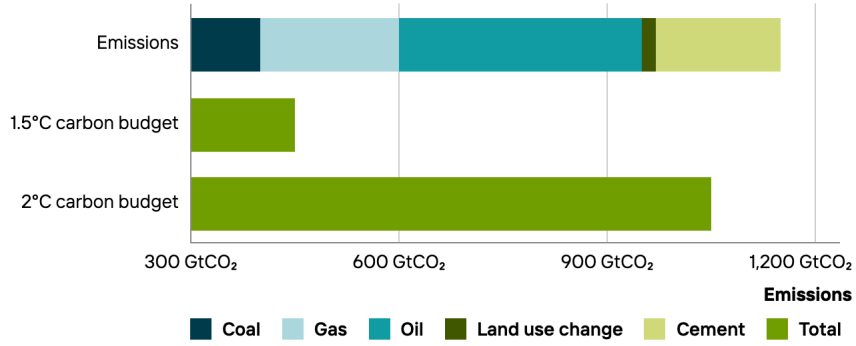
Low carbon electricity has overtaken fossil fuel power

Clean technologies are the key to energy access

Radical changes to energy systems are required to limit global temperature rise to 1.5°C

Potential emissions from developed fossil-fuel reserves exceed carbon budgets in order to maintain a sustainable climate. Recent announcements have only closed the gap to 1.5°C by 11-14%.

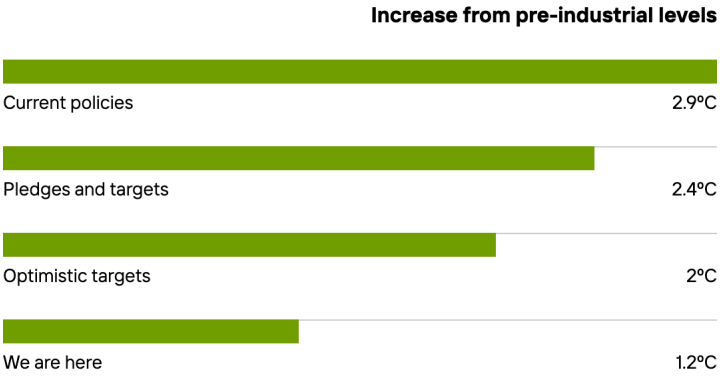
Figure 77: Emissions from developed fossil-fuel reserves, compared with carbon budgets within range of Paris goals



"Developed reserves" refers to those reserves that are expected to be recovered from existing wells and installed facilities or, if facilities have not been installed, that would involve a low expenditure (for example, when compared to the cost of drilling a well) to put the reserves on production.

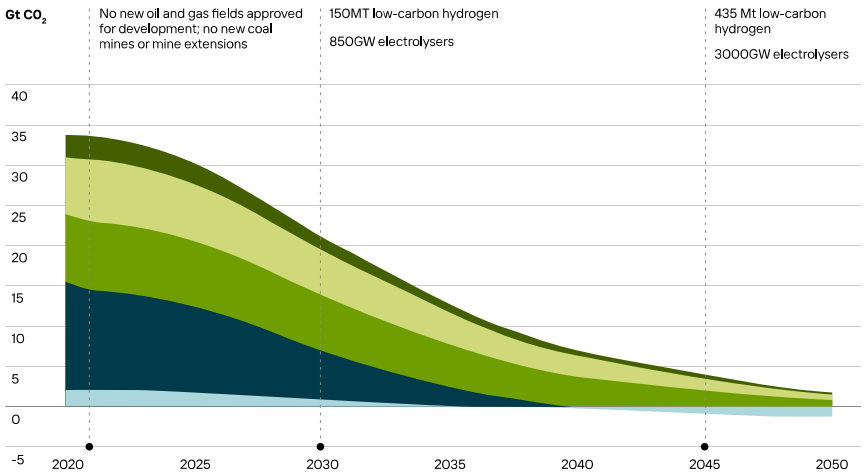
Source: Oil Change International; Reclaim Finance, "NGFS scenarios: guiding finance towards climate ambition or climate failure?"

Figure 78: Global-warming projections to 2100



Source: Climate Action Tracker, "Climate summit momentum: Paris commitments improved warming estimate to 2.4°C"

Figure 79: Clear steps to a 1.5°C world were set out by the IEA for the first time



Buildings	No new sales of fossil fuel boilers	Universal energy access All new buildings are zero-carbon-ready	Most appliances and cooling systems sold are best in class	50% of existing buildings retrofitted to zero-carbon-ready levels	50% of heating demand met by heat pumps **2050** More than 85% of buildings are zero-carbon-ready
Transport		60% of global car sales are electric	50% of heavy truck sales are electric No new ICE car sales	50% of fuels used in aviation are low-emissions	
Industry		Most new clean technologies in heavy industry demonstrated at scale	All industrial electric motor sales are best in class	Around 90% of existing capacity in heavy industries reaches end of investment cycle	**2050** More than 90% of heavy industrial production is low emissions
Electricity and heat	No new unabated coal plants approved for development	1020GW annual solar and wind additions Phase-out of unabated coal in advanced economies	Overall net-zero emissions electricity in advanced economies	Net-zero emissions electricity globally Phase-out of all unabated coal and oil power plants	**2050** Almost 70% of electricity generation globally from solar PV and wind
Other			4Gt CO_2 captured		**2050** 7.6Gt CO_2 captured

Source: IEA, "Net Zero by 2050"

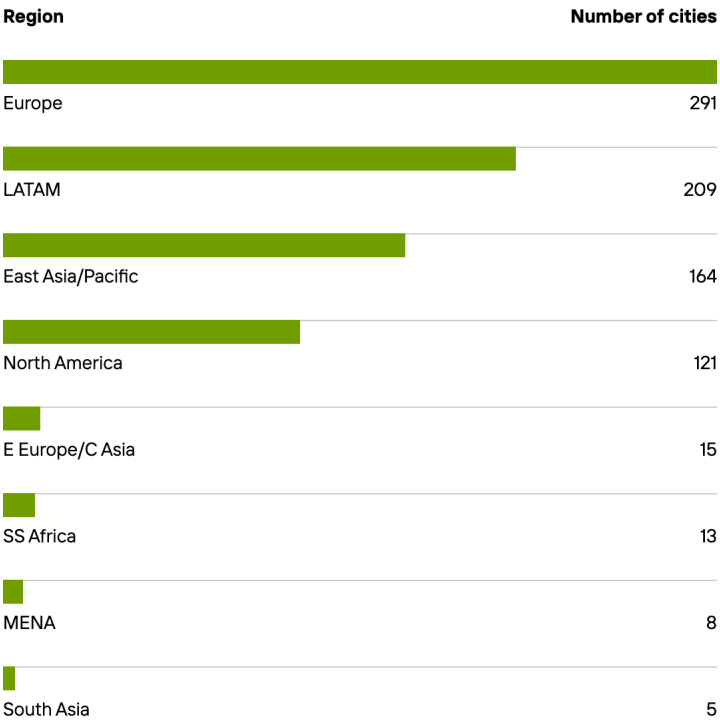
> "Even if global coal use were phased out overnight, developed oil and gas reserves would still push the world beyond 1.5°C"

Oil Change International/Reclaim Finance, "NGFS scenarios: Guiding finance towards climate ambition of climate failure?"

Net-zero targets continue to proliferate

Net zero targets are being set at all kinds of scales and types of organisations. There are now hundreds of cities with such targets.

Figure 80: Cities with net-zero targets

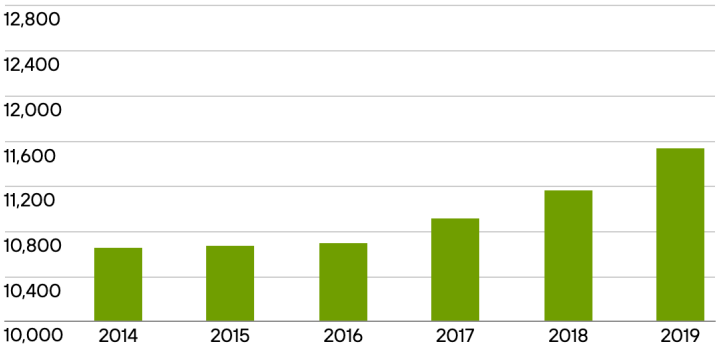


Source: NewClimate Institute; Data-Driven EnviroLab, "Navigating the nuances of net-zero targets"

Emissions have quickly rebounded towards and beyond pre-COVID-19 levels

The initial lockdowns in March/April 2020 put a huge dent in emissions, but they have quickly come back to near pre-pandemic levels as economies have reopened. In the first quarter of 2021 China's CO_2 emissions grew at their fastest pace in more than a decade, increasing by 15% year-on-year, new analysis for Carbon Brief shows.

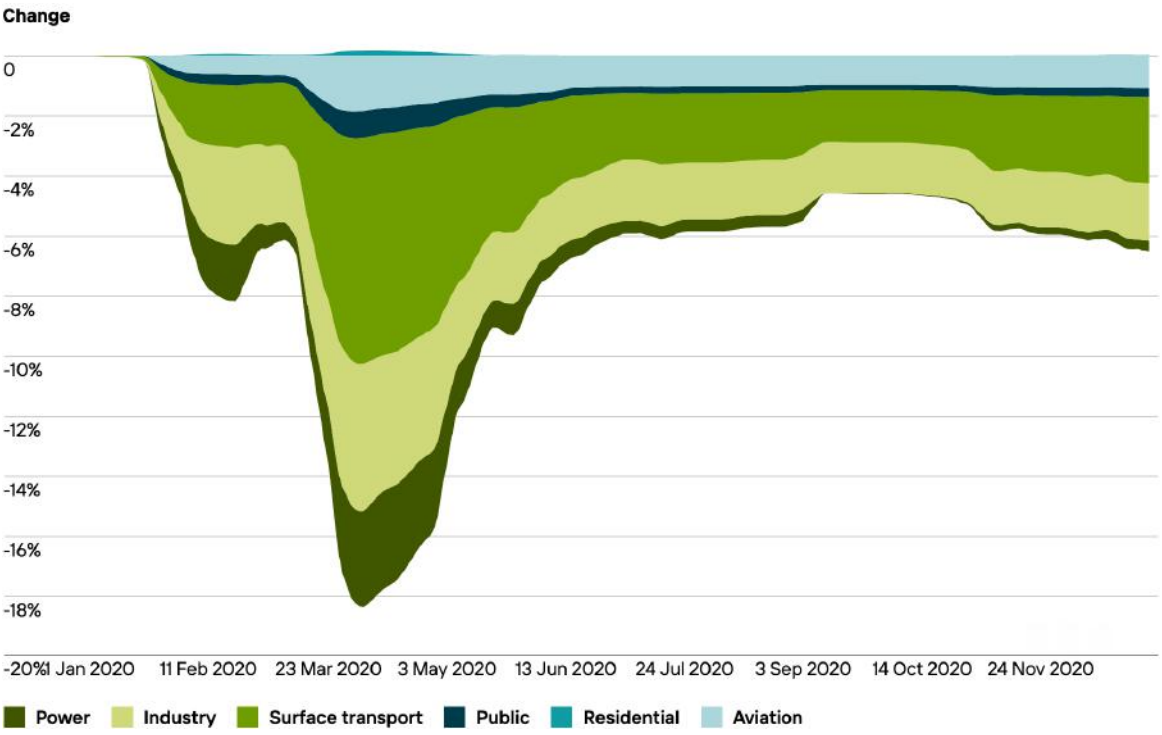
Figure 81: CO_2 emissions from fossil fuel and industrial purposes in China, 2014-2021



Half-year and quarterly figures are expressed at an annual rate.

Source: Carbon Brief: "Analysis: China's CO_2 emissions surged 4% in second half of 2020"

Figure 82: Change in emissions of CO_2, daily, global, 2020

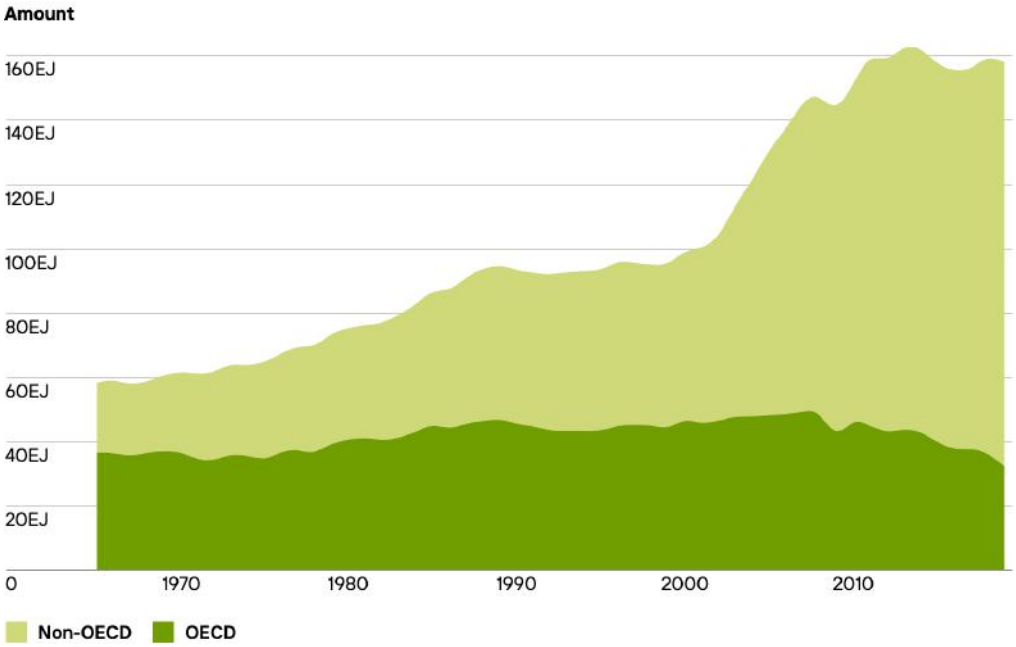


Source: Le Quéré, Corinne, Robert B. Jackson, Matthew W. Jones, Adam JP Smith, Sam Abernethy, Robbie M. Andrew, Anthony J. De-Gol et al. "Temporary reduction in daily global CO_2 emissions during the COVID-19 forced confinement." Nature Climate Change 10, no. 7 (2020): 647-653.

Coal consumption is plateauing globally but needs to fall rapidly to meet climate goals

Though some countries continue to invest in coal, global demand is now clearly at a tipping point, and is in decline.

Figure 83: Coal consumption, global, 1965-2019

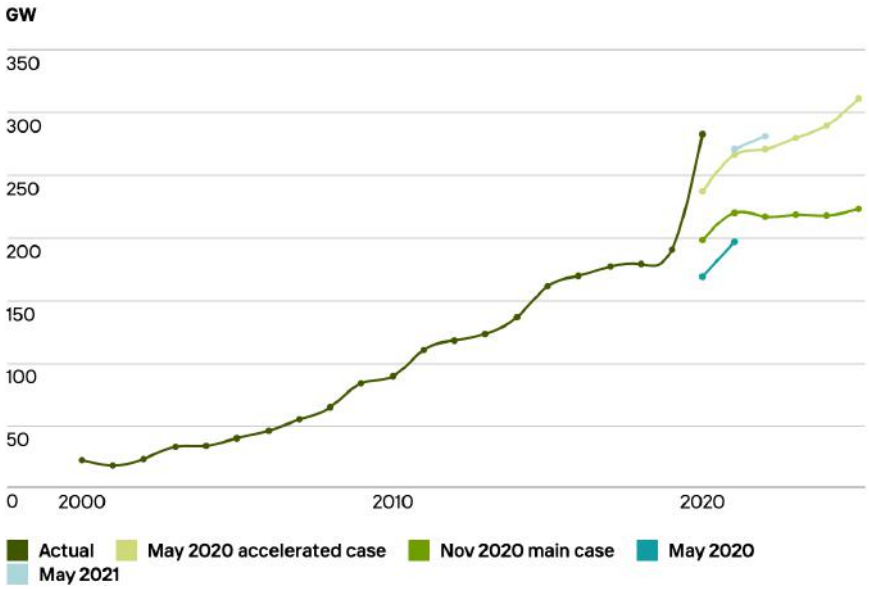


Source: BP, "Statistical Review of World Energy"

Renewables hit a tipping point in 2020

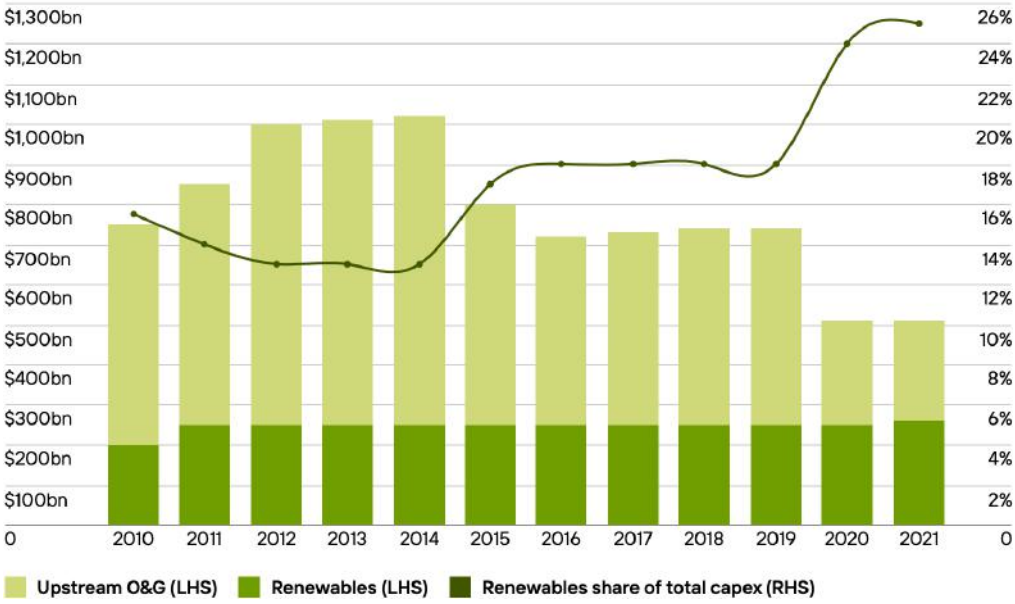
Renewables were the only source of electricity generation to grow last year, despite the pandemic. The International Energy Agency raised its forecasts for wind and solar capacity growth by 25% in a single year. Estimates also suggest that renewables investment will surpass upstream oil and gas investment in 2021.

Figure 84: Capacity of wind and solar energy, global, 2000-2025



Source: Carbon Brief, based on IEA data, 'Exceptional new normal': IEA raises growth forecast for wind and solar by another 25%

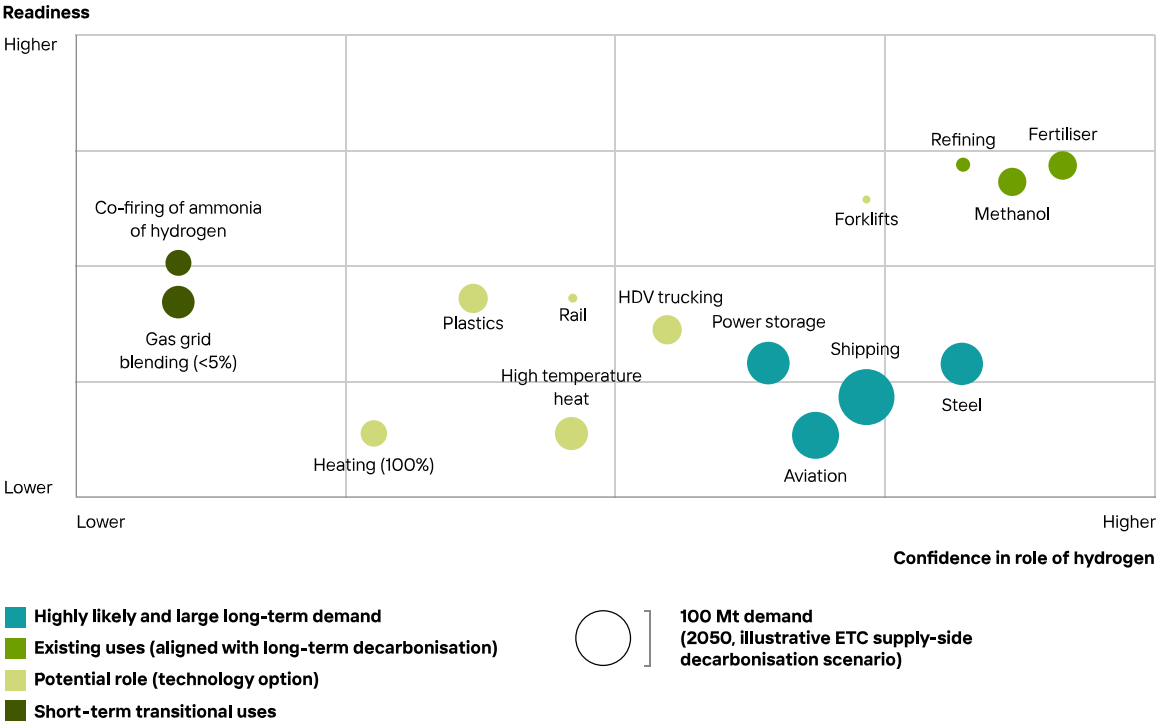
Figure 85: Energy-supply capex, by type, global, 2010-2021



Source: Goldman Sachs: "Carbonomics: the green engine of global recovery"

Green hydrogen is key to decarbonising many harder-to-abate sectors, including aviation, steel and shipping

Figure 86: Early 'take-off' for clean hydrogen

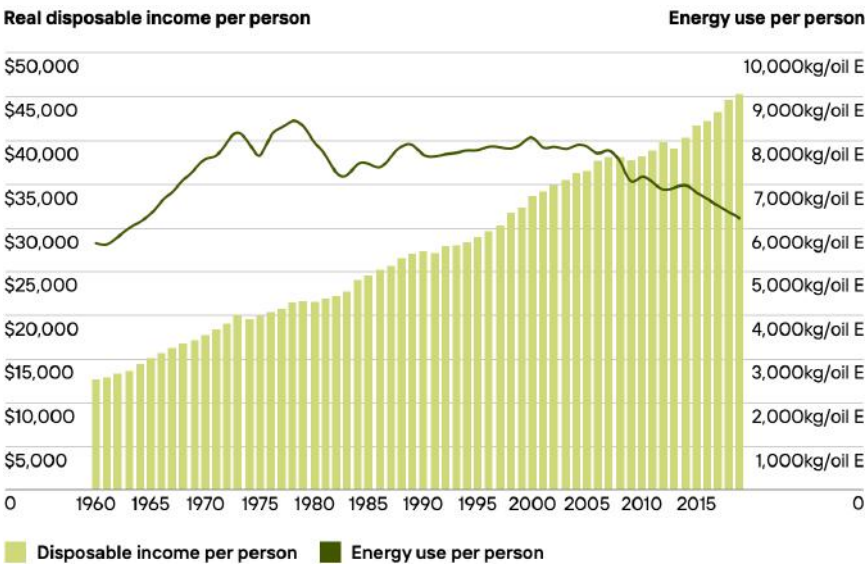


Source: Energy Transitions Commission, "Making the Hydrogen Economy Possible: Version 1.0 April 2021 Accelerating Clean Hydrogen in an Electrified Economy"

We also need to see a step change in energy efficiency

US GDP is on a long-term rising trend even as primary energy consumption declines, a sign of gradual improvements in energy efficiency.

Figure 87: Disposable income and energy use per person, US, 1960-2019



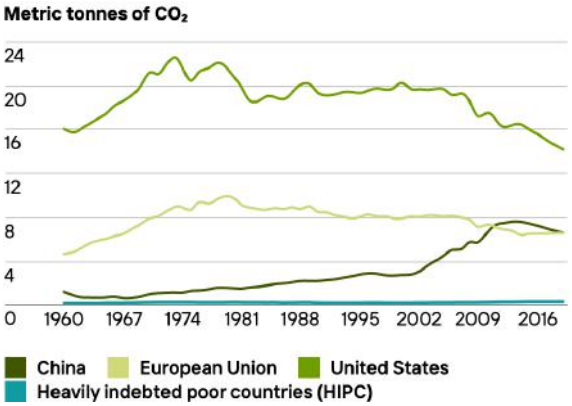
Source: Generation analysis of World Bank and Federal Reserve Bank of St Louis data

Richer people account for most emissions today and in the past

The distribution of energy consumption remains along income lines, though the historical responsibility for emissions is contested terrain.

According to the Global Carbon Project, for fossil fuel-related CO_2 emissions between 1850 and 2019, the US is responsible for 25% and China for 13%. But if you shorten the timeframe to 1990-2019, then China is responsible for 21% and the US for 19%. China's annual emissions are now larger than all OECD countries combined.

Figure 88: CO_2 emissions per person, selected countries, 1960-2020



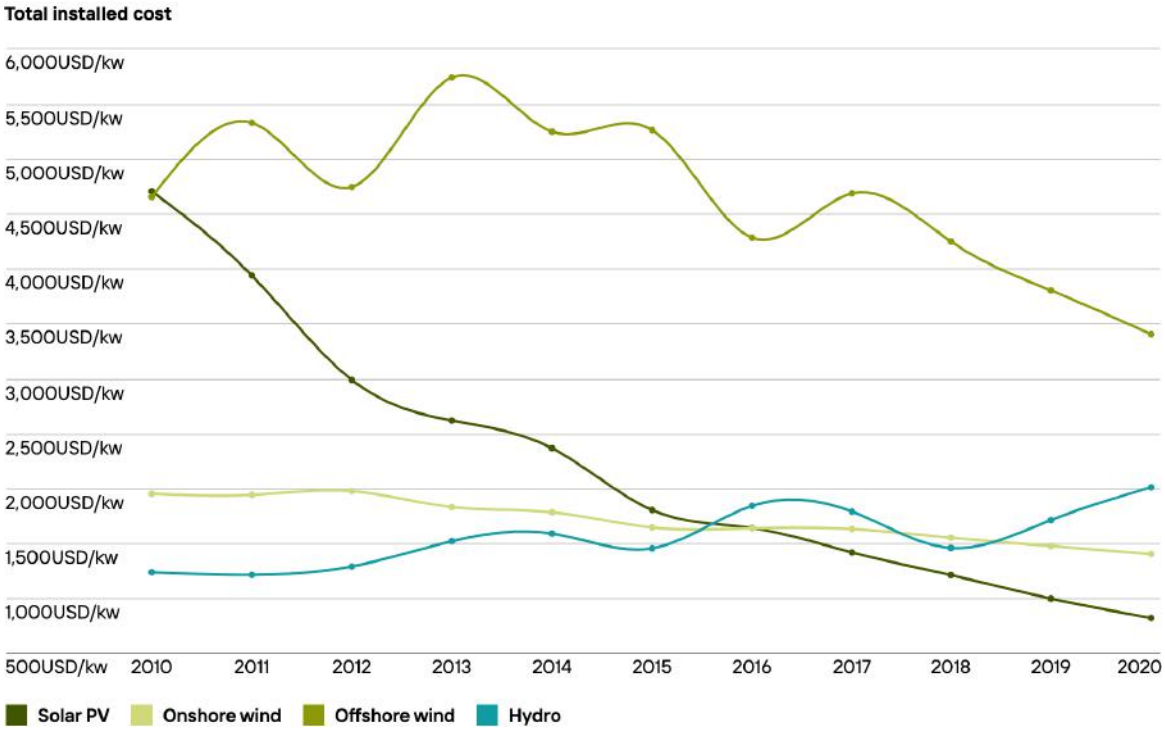
Source: World Bank, "CO_2 emissions (metric tons per capita)"

3.2 Accelerating the transition to zero-carbon energy

The cost of renewables continues to fall

The cost reductions in photovoltaic technology and wind are astonishing.

Figure 89: Total installed cost of energy, by technology, 2010-2020

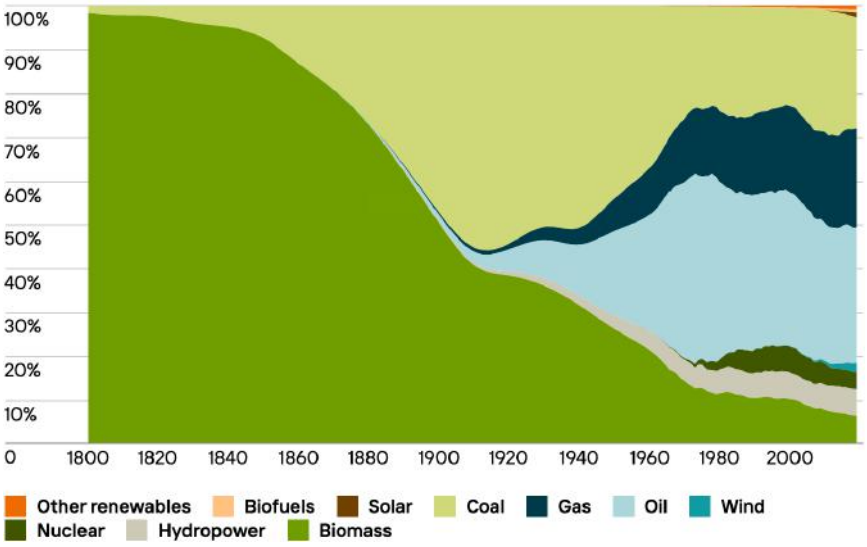


Source: IRENA, "Global LCOE and Auction values"

Renewables are meeting an ever-growing share of energy consumption

Renewables are still small, but account for a fast-rising share of global energy consumption.

Figure 90: Global primary energy consumption by source, 1800-2019

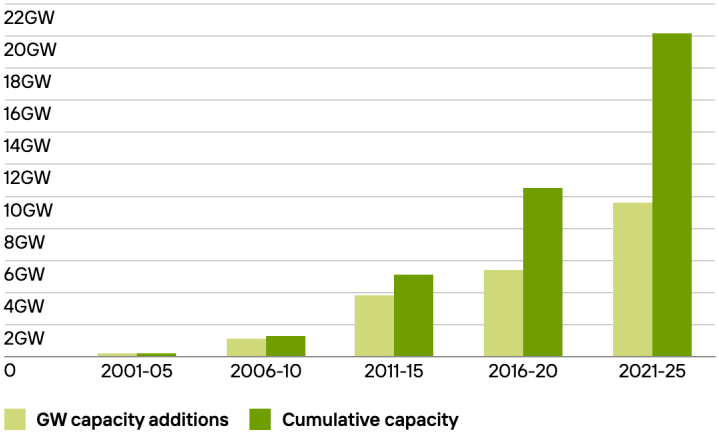


Source: Our World in Data, "Global primary energy consumption by source", based on Vaclav Smil and BP Statistical Review of World Energy.

The pace must accelerate ~5x over the next decade to meet net-zero goals

Though daunting, this rate of change has already been seen in some markets. The rate of deployment in UK offshore wind has increased from an average of 250MW/yr across 2005-2010, to 1200MW/yr over the last five years.

Figure 91: Wind-power deployments, UK, 2001-2025

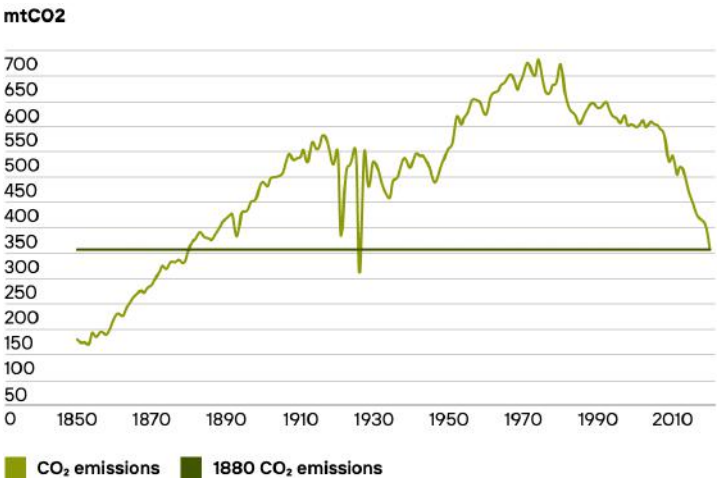


Source: Offshore Energy, November 17th 2020, "UK offshore sector needs collaboration to capitalize on renewable energy"

UK CO_2 emissions are back to 1880s levels

The UK is now halfway to net zero, compared with emissions in 1990, a drop largely achieved via reduced coal consumption.

Figure 92: CO_2 emissions, UK, 1850-2020

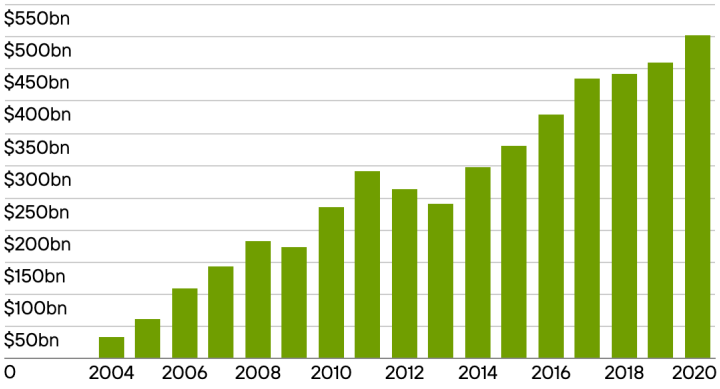


Source: Carbon Brief, "Analysis: UK is now halfway to meeting its 'net-zero emissions' target"

Energy transition investments are growing, enabling ever-higher penetration of renewables on the grid

There are, however, question marks over whether developing countries are receiving enough investment for energy transition.

Figure 93: Energy-transition investment, global, 2004-2020



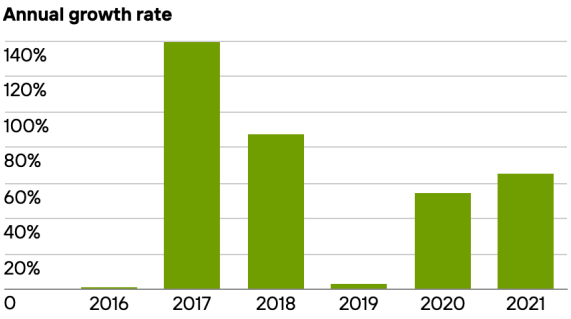
Source: BNEF, "Energy Transition Investment Trends"

> "There is no shortage of money worldwide, but it is not finding its way to where it is most needed. Governments need to give international public finance institutions a strong strategic mandate to finance clean energy transitions in the developing world"

Fatih Birol, IEA Executive Director

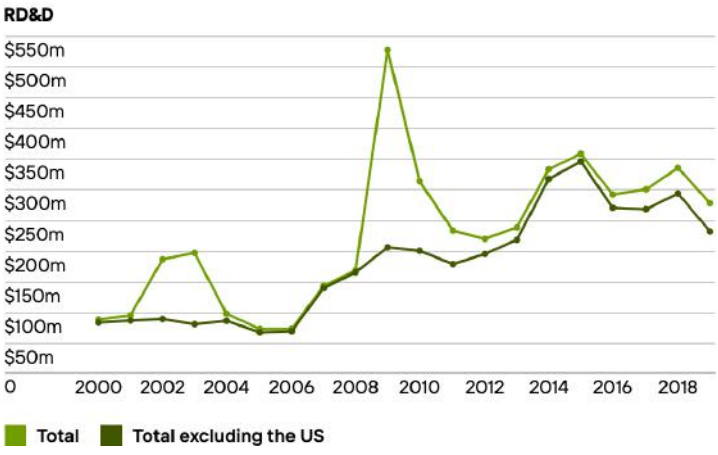
The energy-storage market is growing, especially in Europe, though not as fast as it once was

Figure 94: Energy-storage market, capacity growth rate, Europe, 2015-2021



Source: Renewables Now, March 23rd 2021, "European energy storage to see strong growth in 2021"

Figure 95: Research, development and design (RD&D) in energy storage, rich countries, 2000-2019

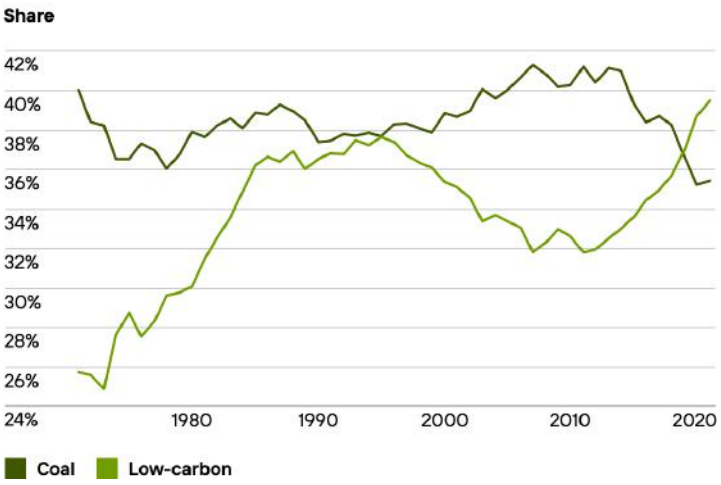


Source: Generation analysis of OECD and IEA data

Low-carbon electricity supply has surpassed coal, an important recent tipping point

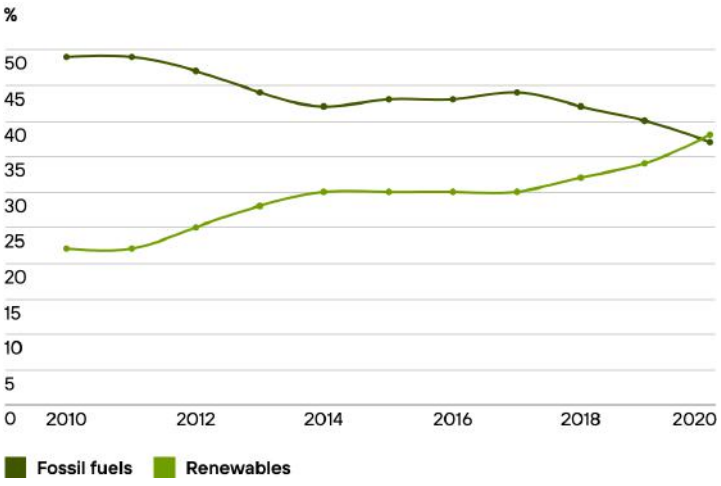
For the first time ever, low carbon energy (renewables plus nuclear) accounts for a higher share of global electricity supply than coal. In the EU, renewables now contribute more to the electricity mix than all fossil fuels combined.

Figure 96: Share of low-carbon sources and coal in world electricity generation, 1971-2021



Source: IEA, "Share of low-carbon sources and coal in world electricity generation, 1971-2021"

Figure 97: Electricity production by type, EU, 2010-2020

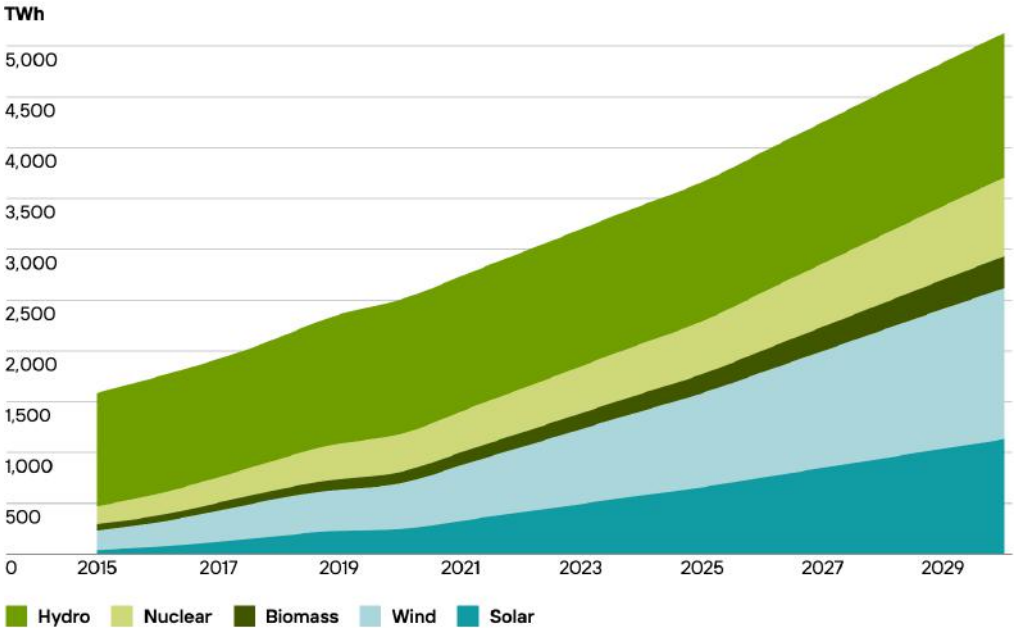


Source: EU Power Sector in 2020, Ember and Agora Energiewende

China is embracing renewables and will peak coal consumption in about 2025

2020 was a tipping point for wind power in China. China's renewable-energy generation is expected to soar over the next few decades.

Figure 98: China's projected non-fossil power generation by source, 2015-2030

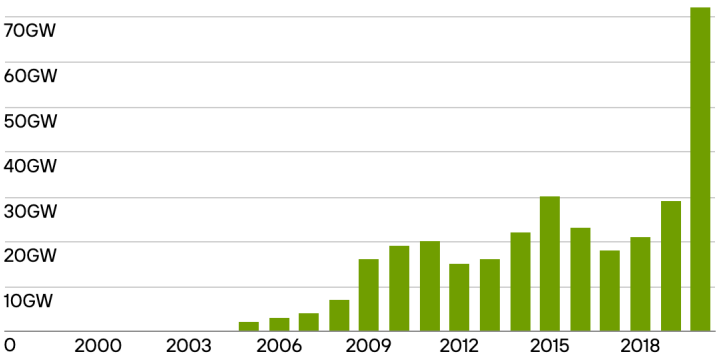


Source: Carbon Brief, "Analysis: China's new 2030 targets promise more low-carbon power than meets the eye"

> "China will strictly control coal-fired power generation projects, and strictly limit the increase in coal consumption over the 14th five-year plan period [2021-2025] and phase it down in the 15th five-year plan period"

President Xi Jinping, Leaders Summit on Climate, 2021

Figure 99: Wind-power additions, China, 2000-2020



Source: Bloomberg, 20th January 2021, "China blows past clean energy record with wind capacity jump"

Coal continues to fall away rapidly in the US

Industrial coal consumption has fallen by 75% since the 1970s and 50% in the past six years. Coal power stations are being retired in their dozens.

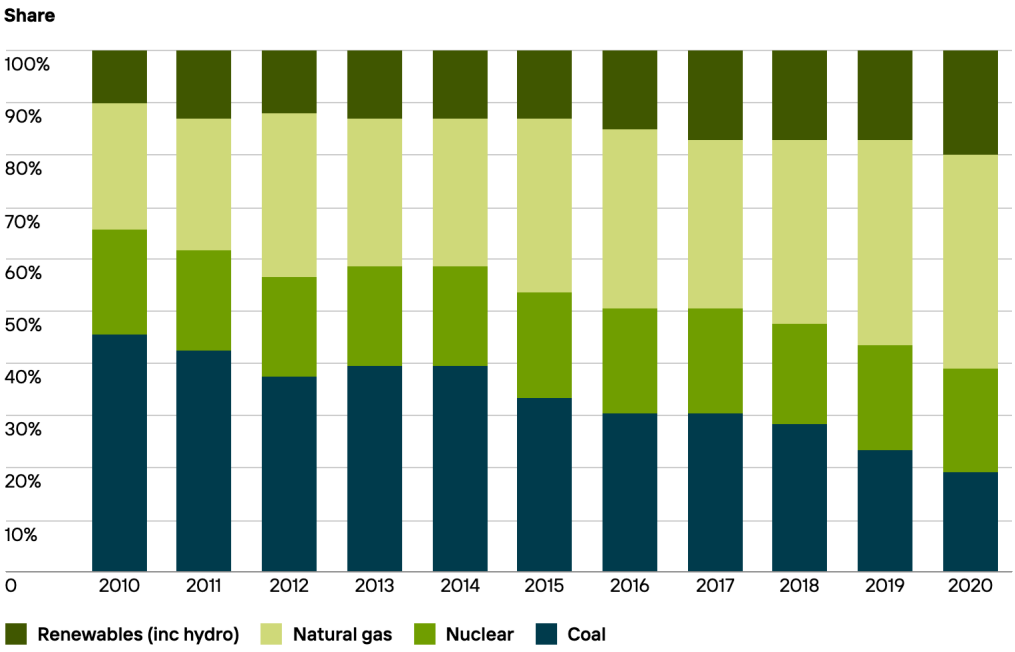
Figure 100: Industrial coal consumption, US, 2014-2020

Source: EIA, "Current Issues & Trends"

Coal is being replaced by renewables and fossil gas

Coal is being slowly squeezed out of the United States's energy supply.

Figure 101: Electricity generation, US, by fuel type, 2010-2020



Source: Statista, "Distribution of electricity generation in the United States from 2007 to 2020, by fuel type"

International pressure on coal phase-out continues to grow

Over the past year, significant progress has been made towards ending overseas coal finance. The UK announced that it would end international support for fossil fuels in December 2020, including export finance, aid funding and trade promotion. It said very few exceptions would be made (and few if any will be made for coal).

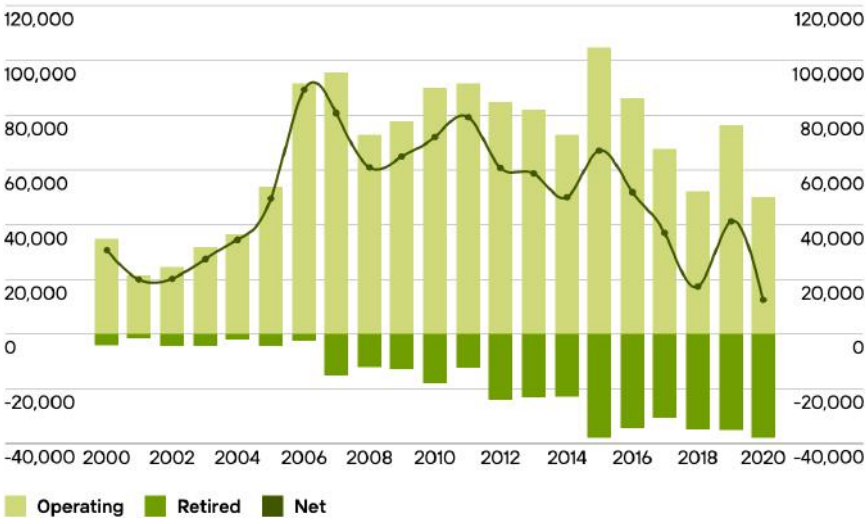
In the months since, first South Korea and then Japan and the rest of the G7 countries, plus the EU, agreed to end international support for coal in 2021. This leaves only China as a major financier of coal projects without such a commitment.

Countries are also stepping up their domestic commitments to phase out coal. Globally, coal retirements are accelerating, but in 2020 there was still a net-capacity addition.

> Recognising that continued global investment in unabated coal power generation is incompatible with keeping 1.5°C within reach, we stress that international investments in unabated coal must stop now and commit to take concrete steps towards an absolute end to new direct government support for unabated international thermal coal power generation by the end of 2021"

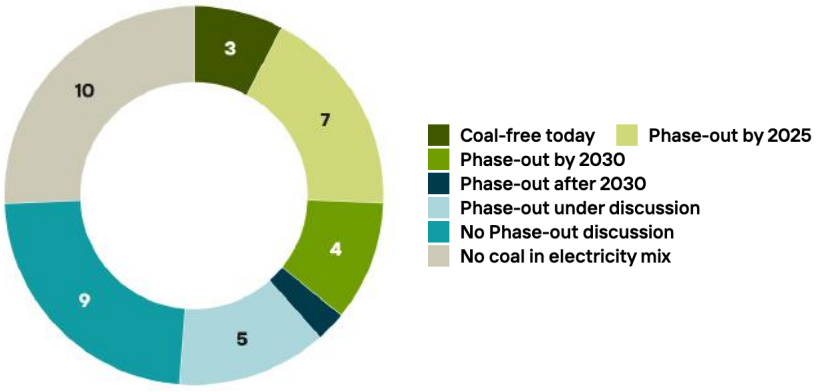
President Xi Jinping, Leaders Summit on Climate, 2021

Figure 102: Coal-power additions and retirements, global, 2000-2020



Source: Global Energy Monitor coal plant tracker

Figure 103: Coal phase-out timelines in European countries

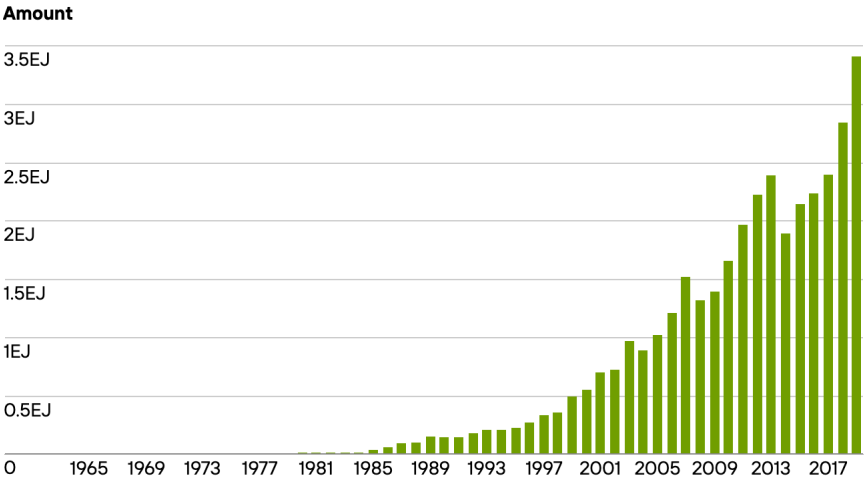


Source: Europe Beyond Coal: "Overview: National coal phase-out announcements in Europe"

Some regions remain very coal-reliant

Indonesia and Vietnam remain reliant on coal. That said, there is some cause for optimism. Both countries have recently cancelled a significant amount of coal and, Vietnam in particular, built a huge amount of new solar capacity last year. The Indonesian government will only allow the completion of coal plants that are already under construction or have reached their financial close, Energy and Mineral Resources Ministry director-general Rida Mulyana told a parliamentary hearing in May.

Figure 104: Coal consumption, Indonesia, 1965-2019

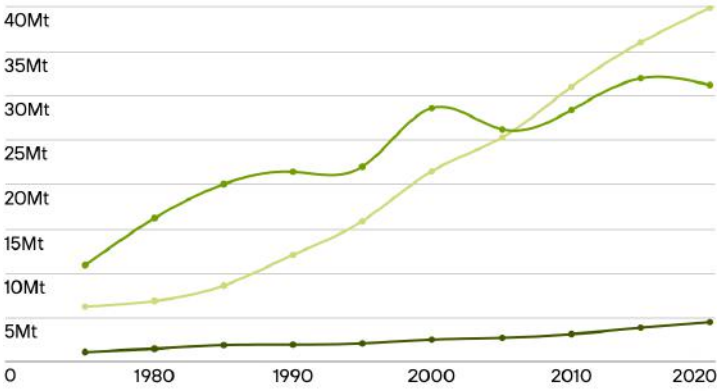


Source: BP, "Statistical review of world energy"

Demand for hydrogen is soaring

Global demand for pure hydrogen is rising steadily. Hydrogen consumption reached an all-time high in 2020. The most attractive use cases seem to be industrial processes that require temperatures of 1,000°C and higher. The emphasis, however, needs to be on green hydrogen: the current approach to generating hydrogen relies almost entirely on fossil fuels.

Figure 105: Demand for pure hydrogen, global, 1975-2020



Source: IEA, "Global demand for pure hydrogen, 1975-2018"

Further investments in hydrogen are on the way

After declining during the global financial crisis, hydrogen investments across the rich world are rising again.

Figure 106: Research, development and design (RD&D) in hydrogen, rich world, 2004-2019

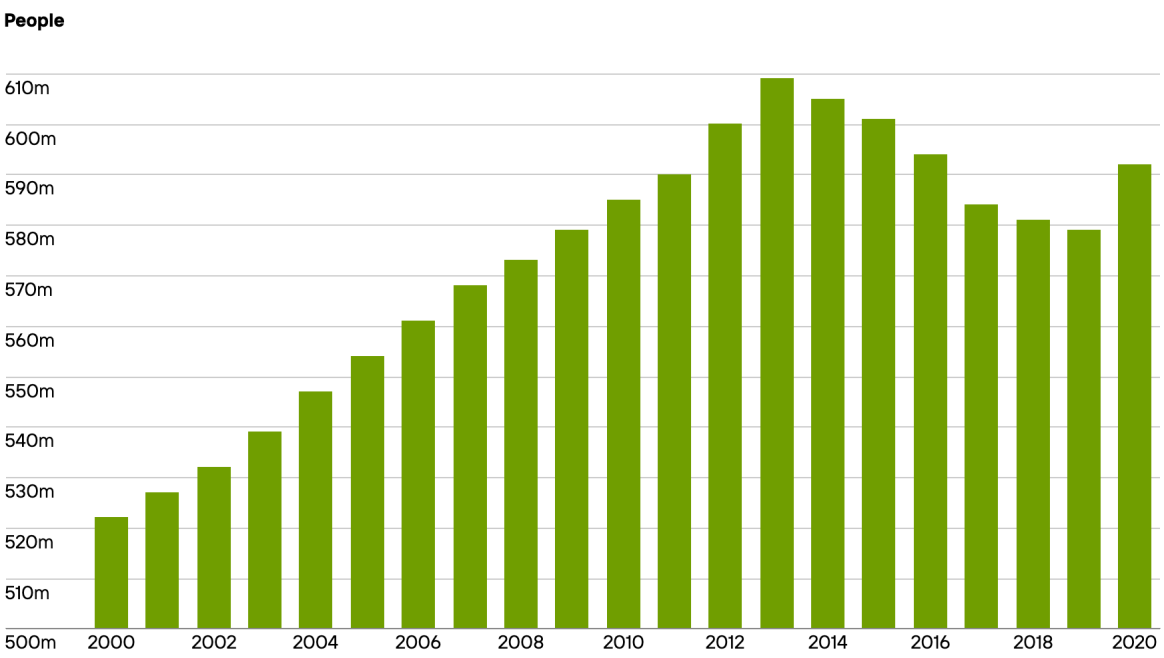
Source: Generation analysis of OECD and IEA data

3.3 New frontiers in energy access

At a global level, the pandemic has hit energy access

In Africa about 10m-20m extra people lost access to energy in 2020, as incomes declined and poverty rates rose.

Figure 107: Population without access to electricity in Africa, 2000-2020



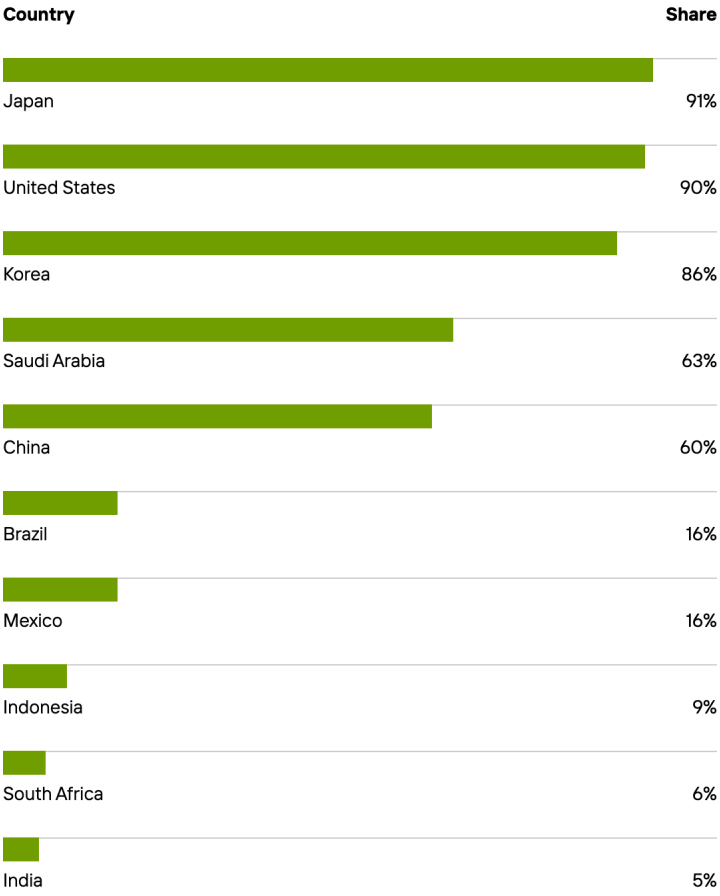
2020 is an estimated figure

Source: IEA, "Population without access to electricity in Africa, 2000-2020"

Billions of people have no access to cooling

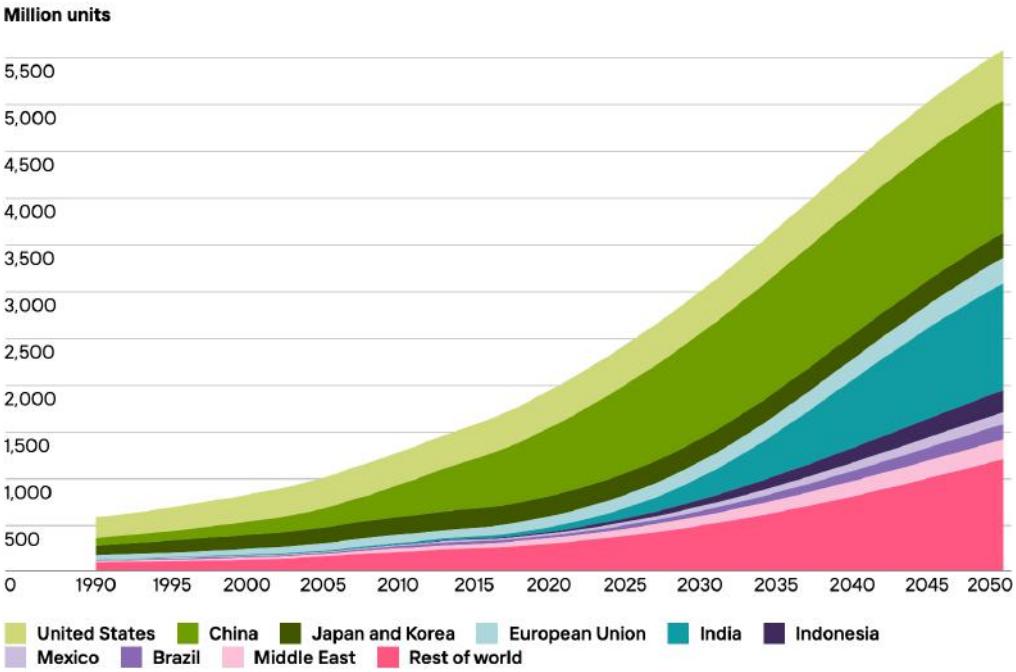
In addition to the impact on health and quality of life, this is a drag on productivity. People in this position are disproportionately poor and living in some of the fastest-warming areas of the world.

Figure 108: Households with air-conditioning units, latest data



Source: IEA, "Percentage of households equipped with AC in selected countries, 2018"

Figure 109: Global air-conditioner stock, 1990-2050



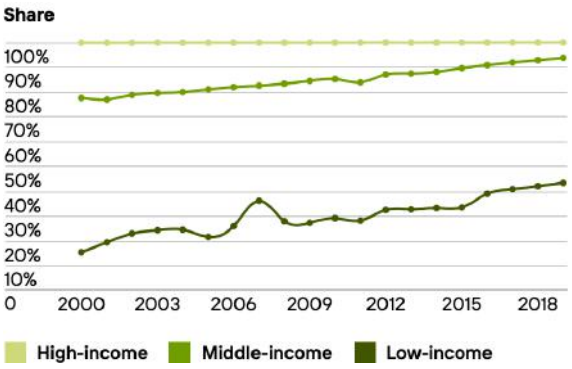
There is of course a potential emissions downside of this rapid growth in air-conditioning, unless we phase out HFCs and radically improve the efficiency of air conditioners. This can become a devastating feedback loop, whereby warming leads to more demand for air-conditioning which in turn creates more demand for air-conditioning.

Source: IEA, "The future of cooling"

Over time, energy access and affordability have been improving

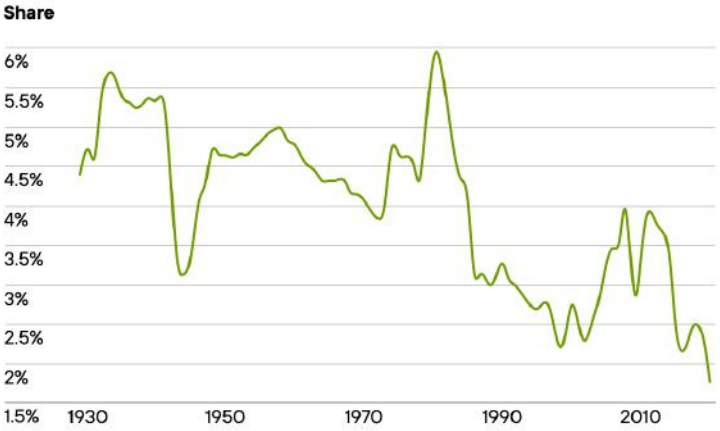
Practically everybody in the rich world has access to electricity, and in rich countries such as the US, the share of people's total expenditure devoted to energy has been in long-term decline. The share of people with access to electricity is rising fast in poorer countries but there is a long way to go.

Figure 110: Access to electricity (% of population), 2000-2019



Source: World Bank, "Access to electricity (% of population)"

Figure 111: Share of total expenditure devoted to gasoline and energy, US, 1929-2020

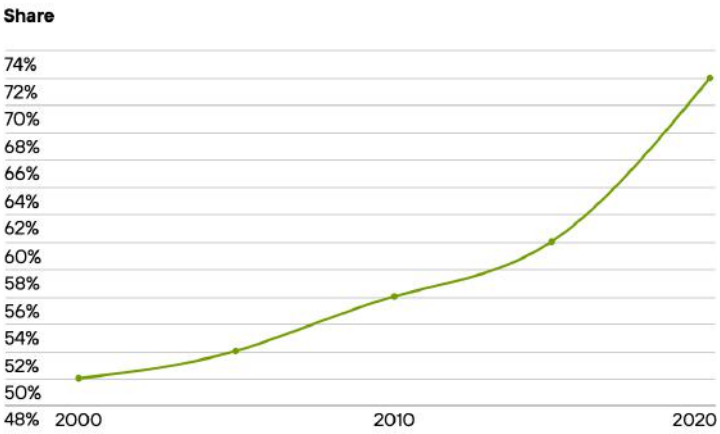


Source: Generation analysis of BEA data

Access to cleaner fuels has also increased at a global level

A growing share of the global population has access to clean fuels.

Figure 112: Share of people with access to clean cooking fuel, global, 2000-2020

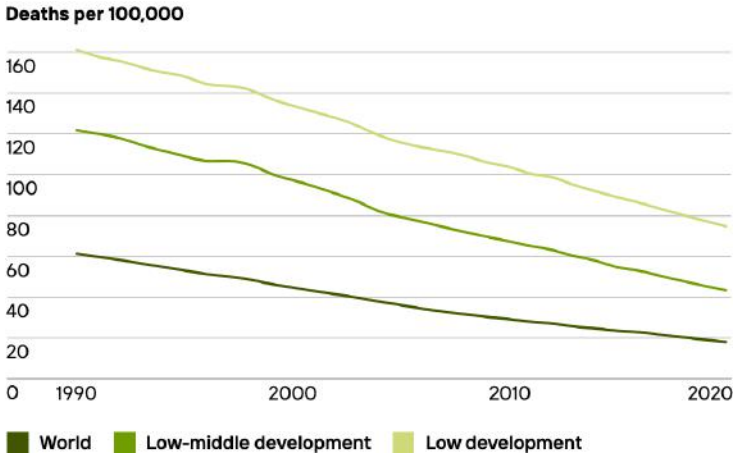


Source: Generation analysis of IEA, "Access to clean cooking"

Efficient electric cooking could be a game changer for indoor air quality

Electric cooking is already cheaper than firewood and charcoal in some settings and costs are coming down.

Figure 113: Death rate from indoor air pollution, 1990-2020

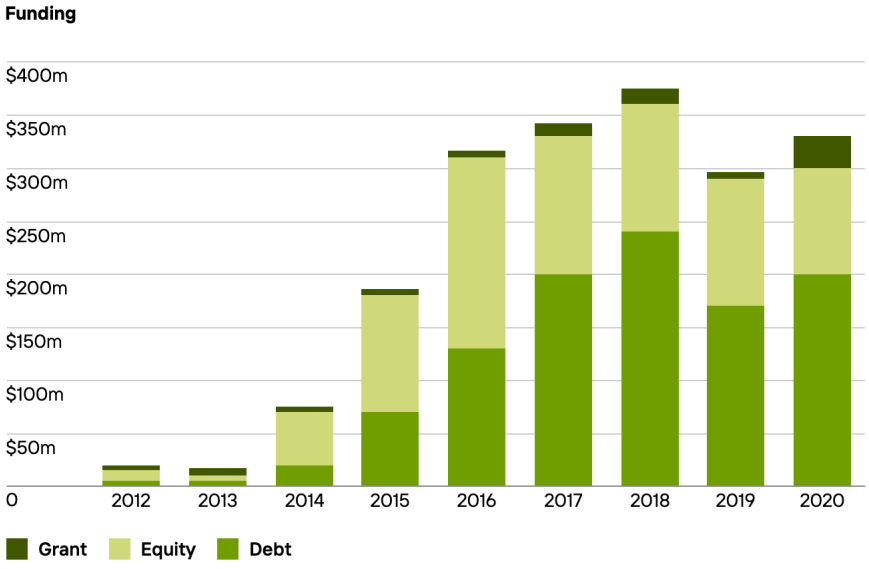


Source: Our World in Data, "Indoor air pollution"

Off-grid solar investment is rising

This is likely to increase global access to energy.

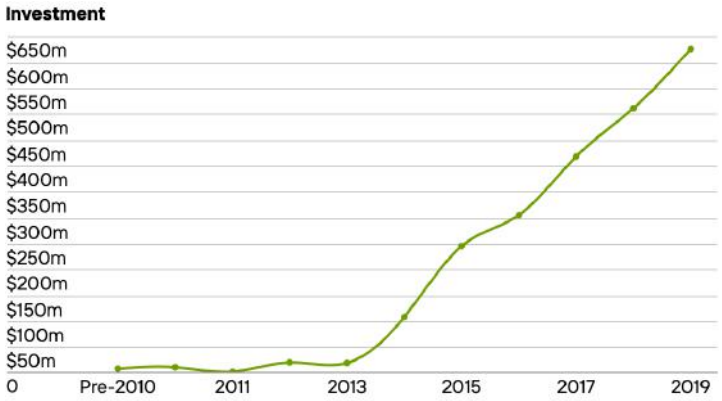
Figure 114: Capital flows to off-grid solar, 2012-2020



Source: GOGLA, "2020: Off-grid solar investment remains robust during COVID-19 pandemic"

Off-grid investment is rising

Figure 115: Corporate investment into off-grid energy access companies, pre-2010-2019

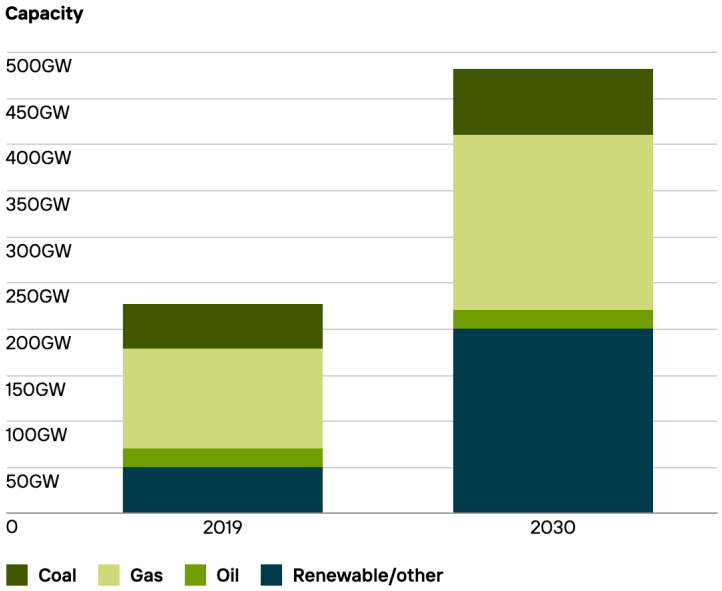


Source: Wood Mackenzie; Energy 4 Impact, "Strategic investments in off-grid energy access"

There is concern that fossil gas could play a big role in Africa's energy expansion

Despite the cost and climate advantages of renewables, there is a risk that rising energy demand in African countries will be met by gas or other fossil fuels.

Figure 116: Africa's current and predicted energy mix, 2019 and 2030



Source: Alova, Galina, Philipp A. Trotter, and Alex Money. "A machine-learning approach to predicting Africa's electricity mix based on planned power plants and their chances of success." Nature Energy 6, no. 2 (2021): 158-166.

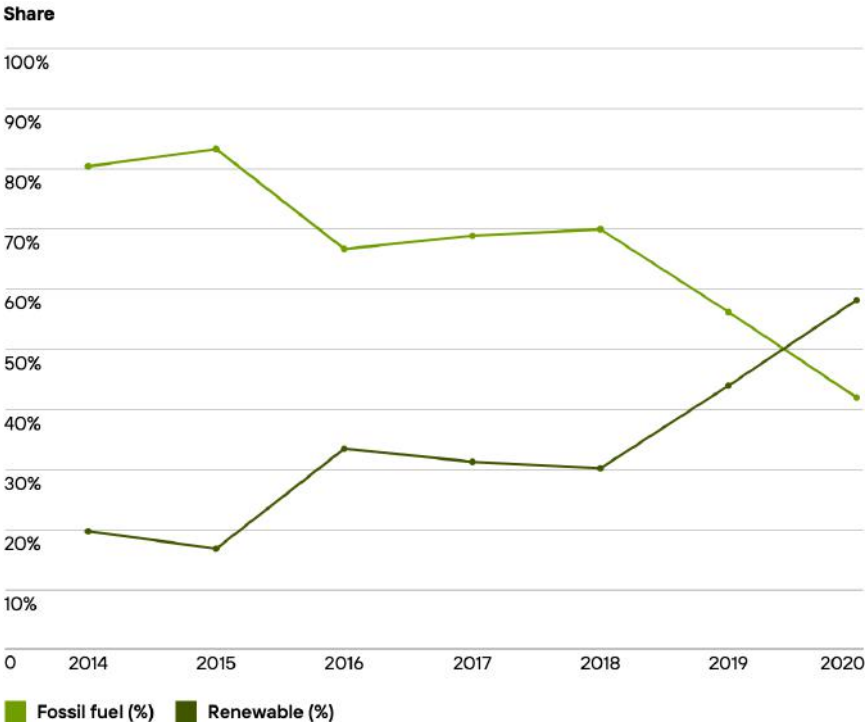
> African decision-makers need to act quickly if the continent wants to avoid being locked into a carbon-intense energy future"

Alova et al, 2021

China's overseas investments are key to how energy systems evolve globally

Clean energy accounted for over half of energy investments in China's Belt & Road initiative in the first half of 2020. Coal investments are still a big concern.

Figure 117: Energy investments, Belt and Road Initiative, 2014-2020 (first half only)



Source: Green BRI Centre, "Brief: Investments in the Chinese Belt and Road Initiative (BRI) in 2020 during the COVID-19 pandemic"

04 Health & Wellbeing

4.1 Key trends

Mental health and wellbeing has always been important, but the pandemic has given new impetus to action by companies, governments and individuals. More research is needed to evaluate the claims made around wellbeing and mental health by companies. In part obscured by our focus on the pandemic, important healthcare innovations are coming through that promise to save many lives.

Health and wellbeing are on all our minds

People want access to better mental health services and new wellbeing products are taking off

There is rapid innovation in mRNA technology, liquid biopsy and artificial intelligence

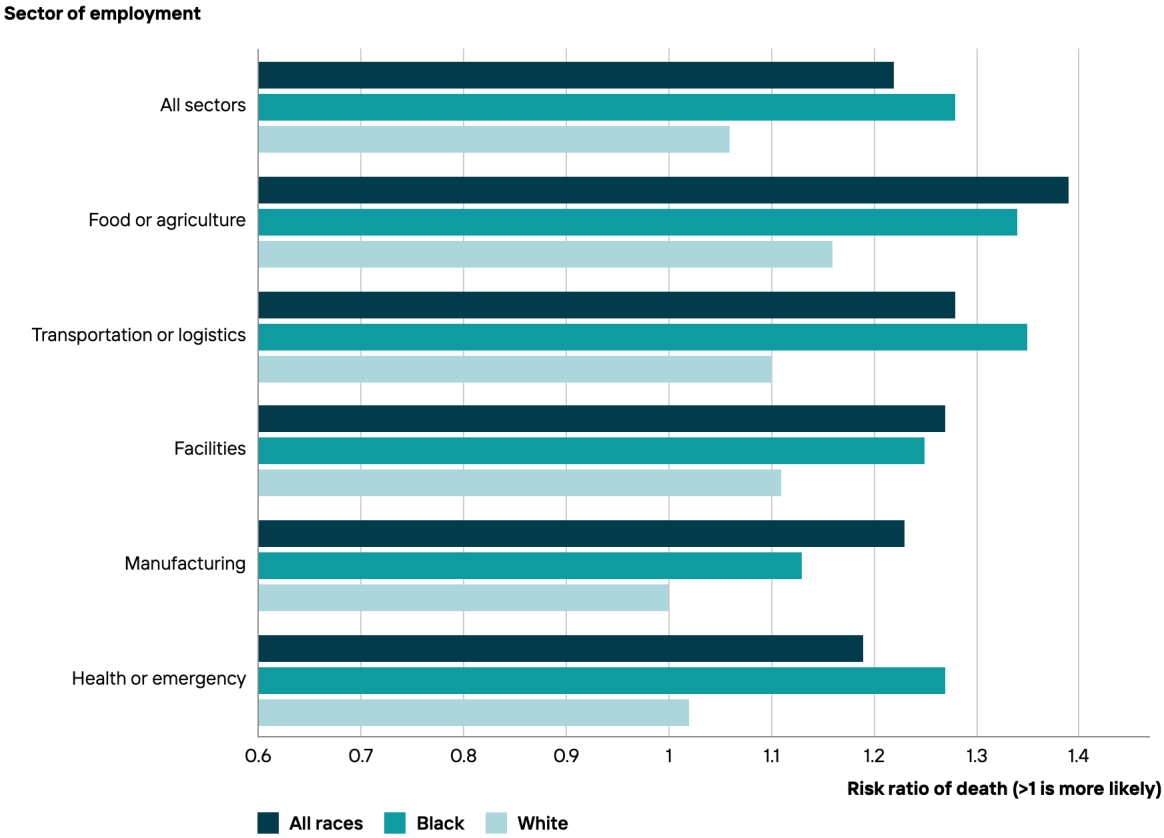
These promise to save many lives in future and expand affordable access

The pandemic had very unequal health impacts

The pandemic has been a public-health disaster. According to the best estimates the pandemic has led to 10m extra deaths so far. Many more will follow.

These costs were not shared equally. Take the example of California, on which there is high-quality research. The average working-age Californian saw their risk of death rise by 22% during the pandemic. Line cooks saw their risk of death rise by 60%, while bakers saw their risk rise by 50%.

Figure 118: Risk ratios for mortality, pandemic time vs non-pandemic time, California



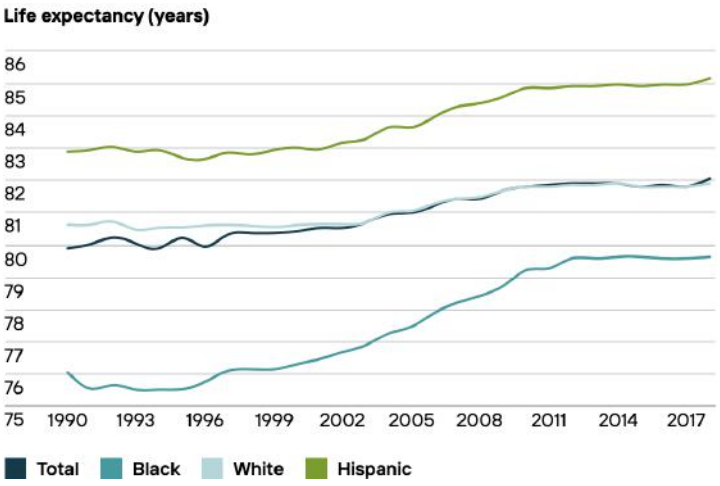
Among California residents 18–65 years of age, by occupational sector and race/ethnicity, March to October 2020.

Source: Chen et al., Excess mortality associated with the COVID-19 pandemic among Californians 18–65 years of age, by occupational sector and occupation: March through October 2020

Continuing a longstanding trend of health inequalities

Many countries have longstanding health inequalities, whereby people of different races/ethnicities, and different income groups, have different life expectancies.

Figure 119: Average life expectancy at age 25, US, women, by race, 1990-2018

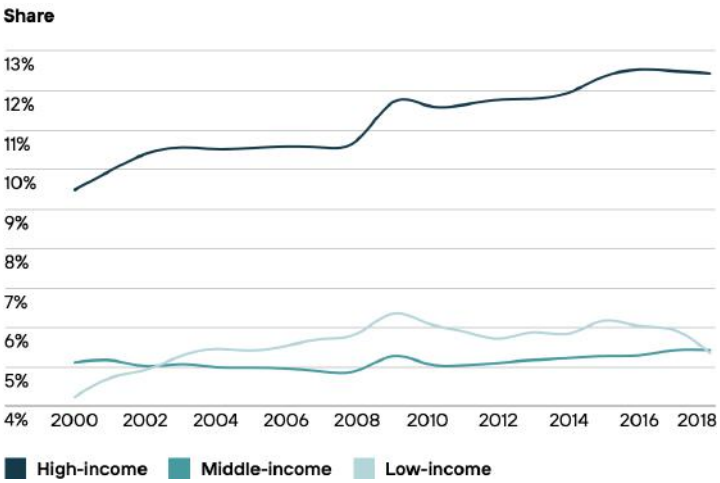


Source: Anne Case and Angus Deaton, "Life expectancy in adulthood is falling for those without a BA degree, but as education gaps have widened, racial gaps have narrowed", PNAS, 2021.

Before COVID-19, access to healthcare was broadening at a global level, but the trend was reversing in some countries

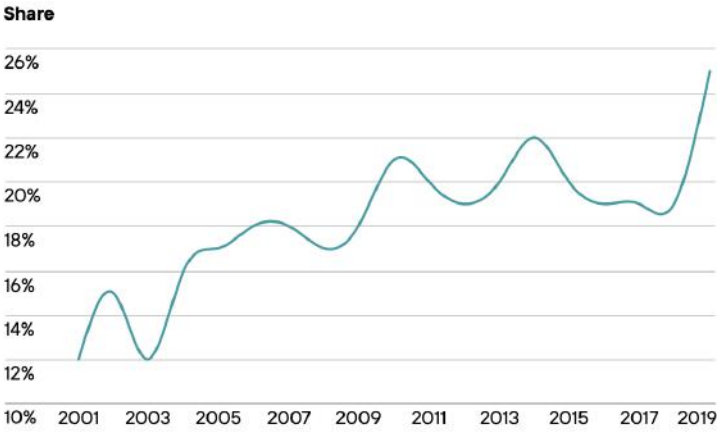
A growing share of Americans, even before the pandemic, reported that they were putting off medical treatment for economic reasons. In part because of demographic reasons, health-care spending globally continues to rise.

Figure 120: Health spending relative to GDP, global, by country-income level, 2000-2018



Source: World Bank, "Current health expenditures (% of GDP)"

Figure 121: Reports of postponing medical care due to costs, US, 2001-2019



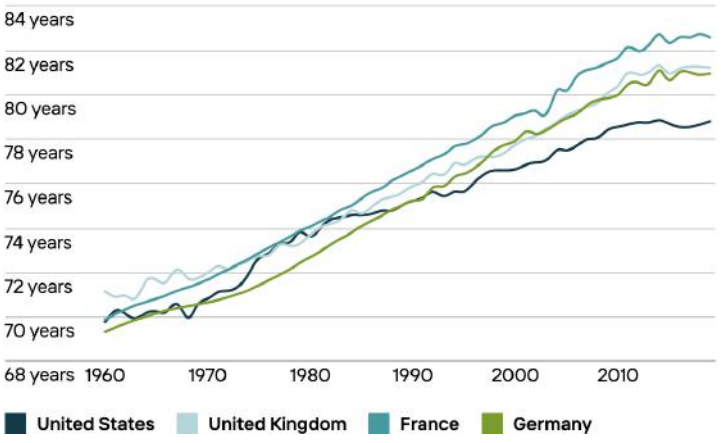
Percentage of people who have put off treatment for serious condition.

Source: Gallup, "More Americans delaying medical treatment due to cost"

2020 was not the first year that life expectancy fell in some countries

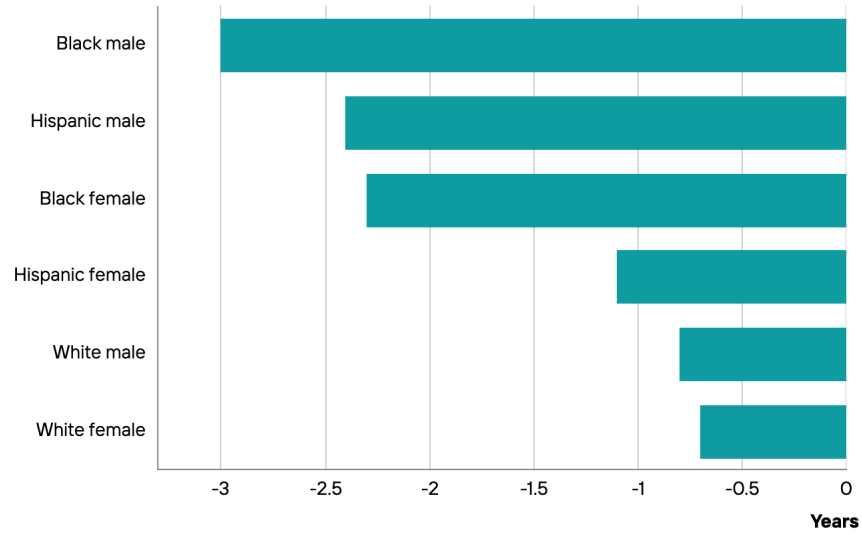
Increases in rich-world life expectancy have slowed or even reversed in recent years.

Figure 122: Life expectancy at birth, selected countries, 1960-2019



Source: World Bank, "Life expectancy at birth"

Figure 123: Change in life expectancy at birth, years, US, 2019-2020

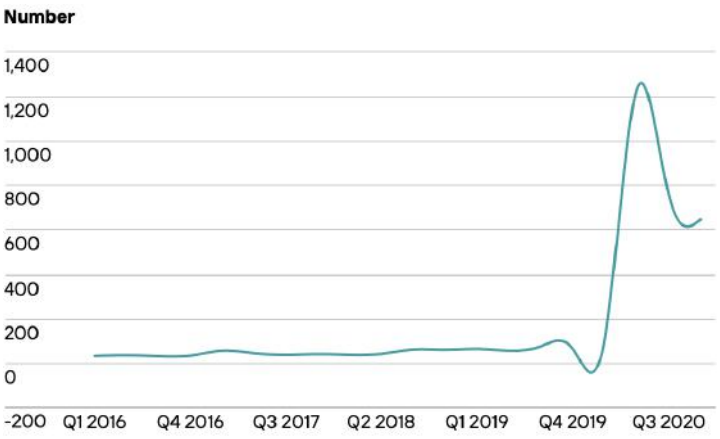


Source: CDC cited in NPR, "American Life Expectancy Dropped By A Full Year In 1st Half Of 2020"

Some COVID-19-induced changes will be permanent and could help improve health outcomes

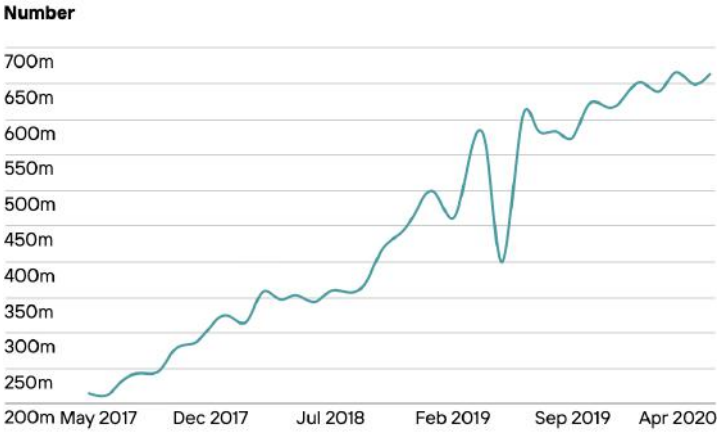
Following the pandemic, telehealth is at a tipping point. It will see permanent changes, with higher usage and adoption. This will in turn help improve access to healthcare for underserved populations.

Figure 124: Earnings calls mentions of telehealth, 2016-2020



Source: Generation analysis of CB Insights data

Figure 125: Mental-wellness app sessions, global, 2017-2020

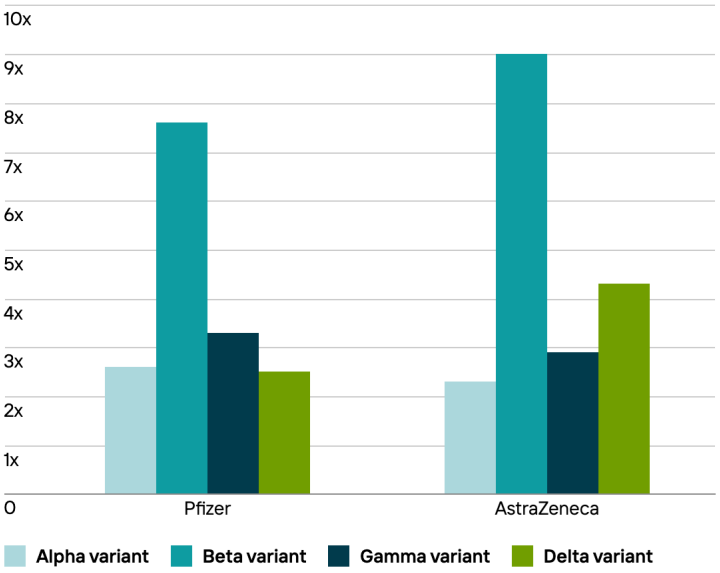


Source: Apptopia, "Calm records 120% more app sessions than Headspace during quarantine"

Long-term investment in scientific research has allowed the development of effective COVID-19 vaccines

Live virus-neutralising antibody activity is strong for both main UK vaccines in relation to different variants, though single doses appear less effective against the Delta variant.

Figure 126: Reduction in efficacy of different vaccines against COVID-19 variants



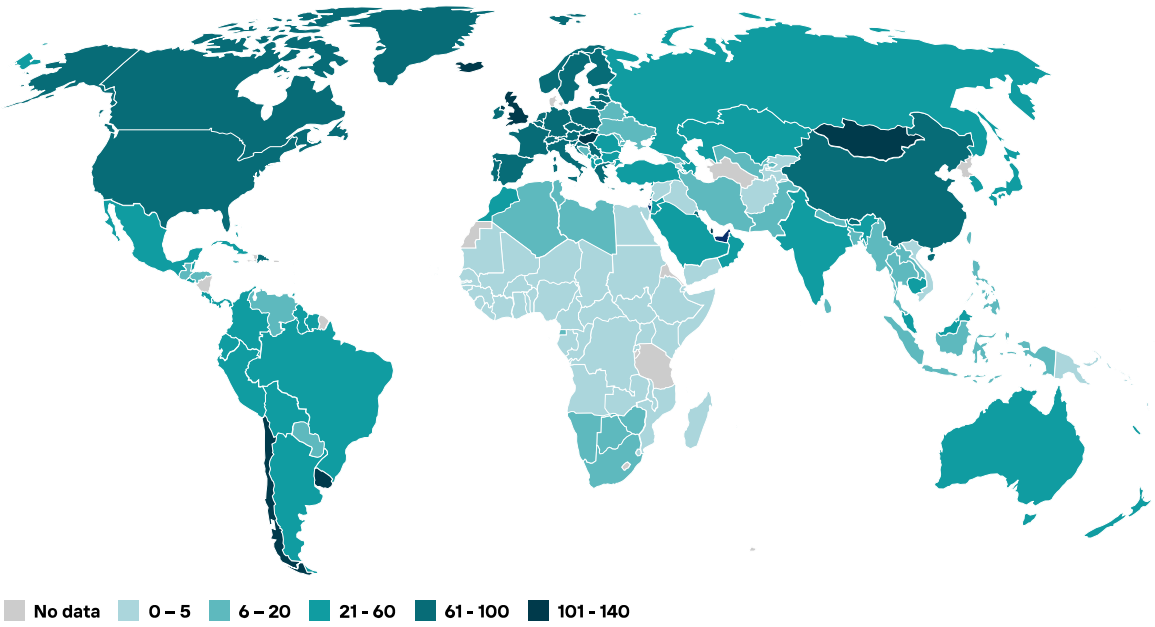
Source: Covid Data Review

Ensuring vaccine availability in developing countries is a global priority

As the virus rages in poor countries, ensuring vulnerable groups in poorer countries get access to vaccines is a global priority.

In addition to the devastating human cost from COVID-19, failure to mount a major international vaccine response could cast a long shadow over climate negotiations later this year.

Figure 127: COVID-19 vaccine doses administered per 100 people, 30 June 2021



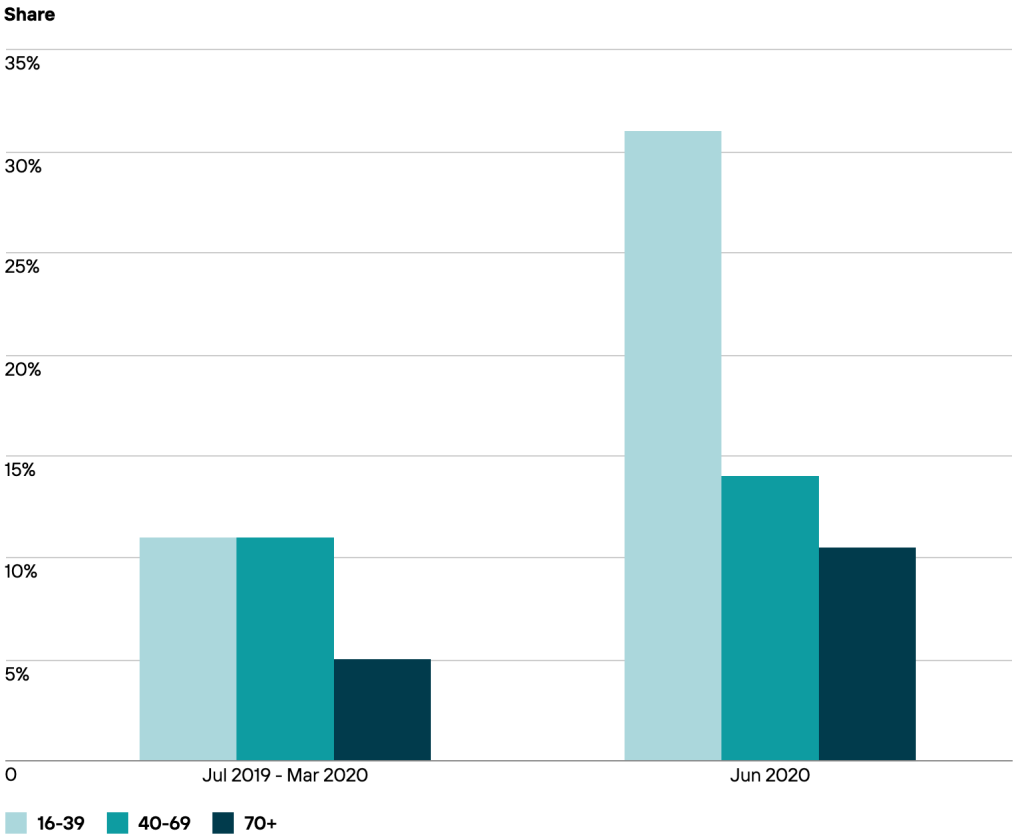
Source: Our World in Data

4.2 Wellbeing and mental health in the wake of COVID-19

The path to mental recovery will be long and difficult

Mental health was an underappreciated but crucial issue long before the pandemic. COVID-19, however, has led to a tipping point in societal recognition of its importance. The mental health effects of the pandemic are likely to last for some time, with unpredictable consequences.

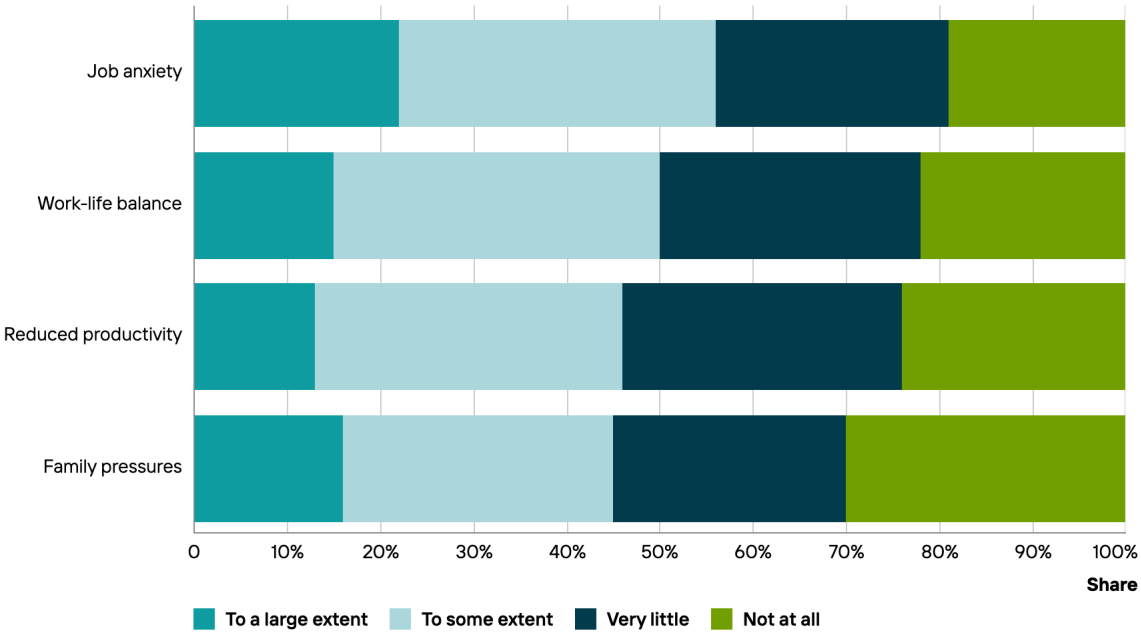
Figure 128: Prevalence of moderate to severe symptoms of mental illness, Great Britain, 2019-2020



Source: Office for National Statistics, "Coronavirus and depression in adults, Great Britain: June 2020"

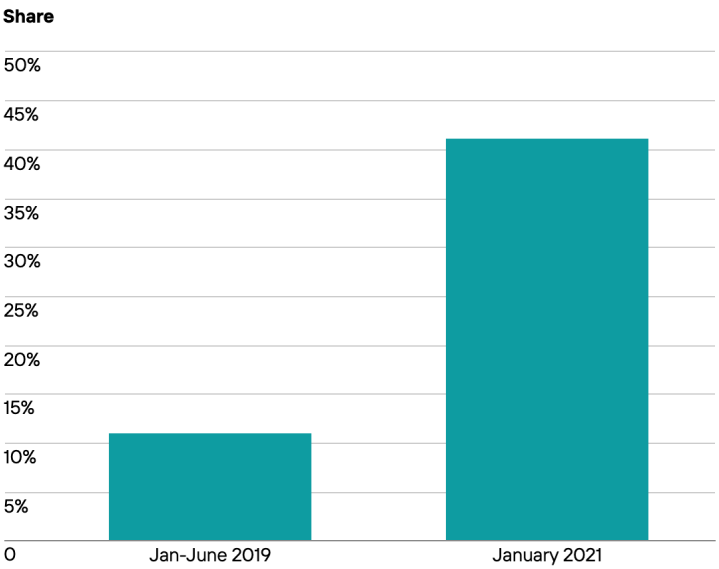
There is rising incidence of anxiety and depression

Figure 129: Prevalence of symptoms of mental illness as a result of the pandemic, global, 2020



Source: IPSOS Mori, "The COVID-19 pandemic's impact on workers' lives"

Figure 130: American adults reporting symptoms of anxiety disorder and/or depressive disorder, 2019-2021

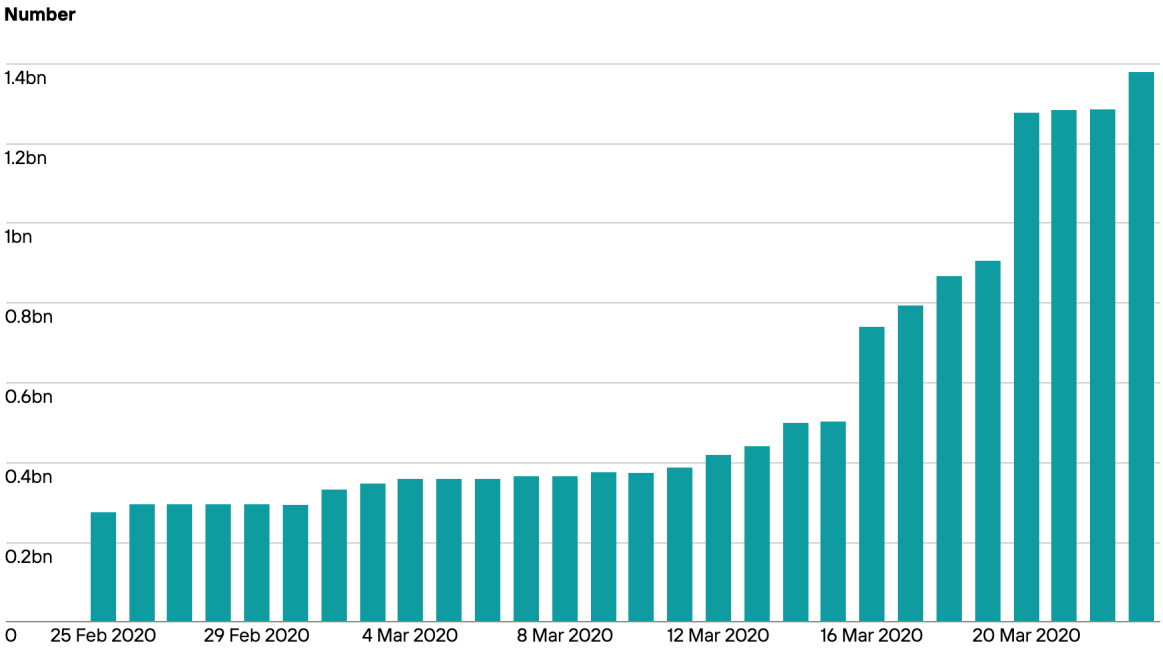


Source: Kaiser Family Foundation, "The Implications of COVID-19 for Mental Health and Substance Use"

Younger people have been more deeply affected, especially in poor families

Many millions of children have missed out on vast amounts of education in the past year. Access to online learning was stratified by income group. The burdens of child care, and subsequent mental-health challenges, fell disproportionately on women/mothers, which may have reversed some of their economic gains.

Figure 131: Learners impacted by national school closure, 2020



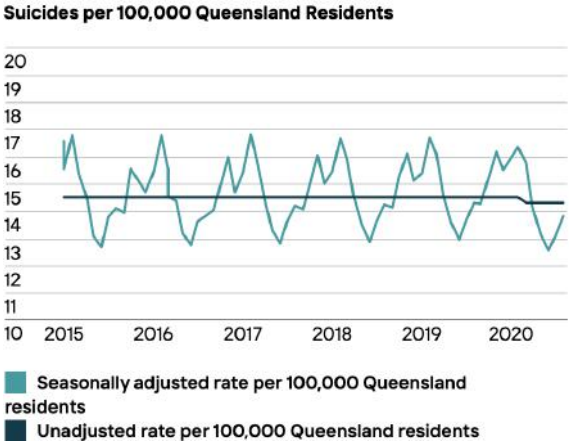
Source: UNESCO, "Education: From disruption to recovery"

One bright spot is that suicides fell in many countries in the pandemic

Not all countries saw a decline in suicides in 2020, but many did. The data below covers Queensland, Australia, which has especially reliable data.

Experts are, however, concerned that this may be a temporary effect and many risk factors remain. In some countries, such as Japan, there has been a rise in suicides in later phases of the pandemic.

Figure 132: Suicide rate, Queensland, 2015-2020



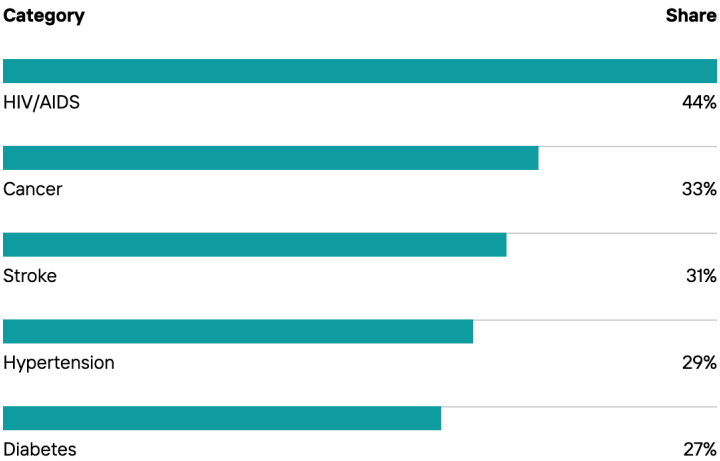
Source: Leske, Stuart, Kairi Kõlves, David Crompton, Ella Arensman, and Diego De Leo. "Real-time suicide mortality data from police reports in Queensland, Australia, during the COVID-19 pandemic: an interrupted time-series analysis." The Lancet Psychiatry 8, no. 1 (2021): 58-63.

"Parity of esteem" between physical and mental health is one way to think about the gaps

Many countries have strategies that point to the need to invest a greater share of healthcare spending on mental health, as opposed to physical health.

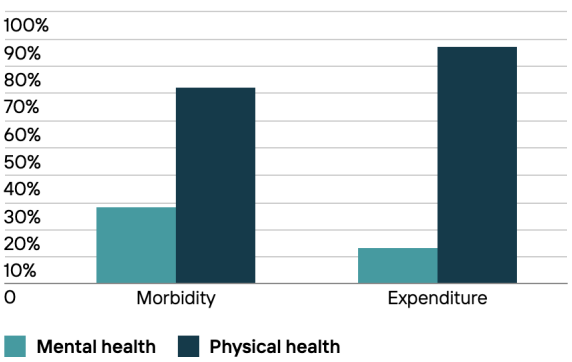
The evidence suggests that spending across many types of mental health interventions is a cost-effective way to improve patient outcomes. Preventative interventions, including school-based learning programmes, appear to be particularly beneficial.

Figure 133: Percentage of people affected by depression with various illnesses, UK



Source: NHS, "A call to action: achieving parity of esteem: transformative ideas for commissioners"

Figure 134: Mental and physical health, contribution to morbidity and expenditure, UK



Mental health accounts for 28% of morbidity but only gets 13% of expenditure.

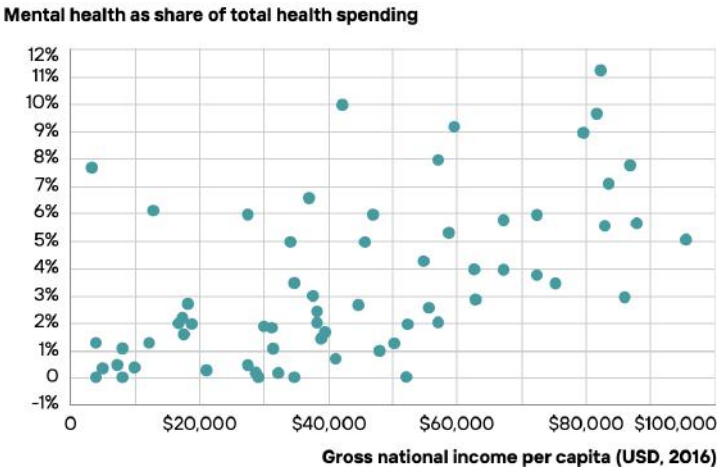
Source: Generation analysis of NHS data

Parity of esteem is a long way off in the vast majority of countries

Few countries spend very much on provision of mental-health services. The median spend on mental health is about 2% of total healthcare spending. Even in wealthier countries, the share is typically below 10%.

There is minimal provision of mental-health services in most poor countries.

Figure 135: Mental-health expenditure (as share of total health expenditure) and gross national income

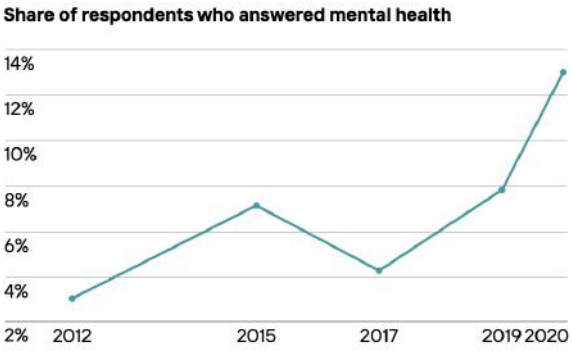


Source: WHO, "Mental Health Atlas 2017"

People have rising expectations over access to mental-health services

In the United States, about 15% of people consider mental health to be the top health issue facing the country, a figure which has doubled in the past five years.

Figure 136: "What would you say is the single-biggest health issue facing the nation?", US, 2012-2020



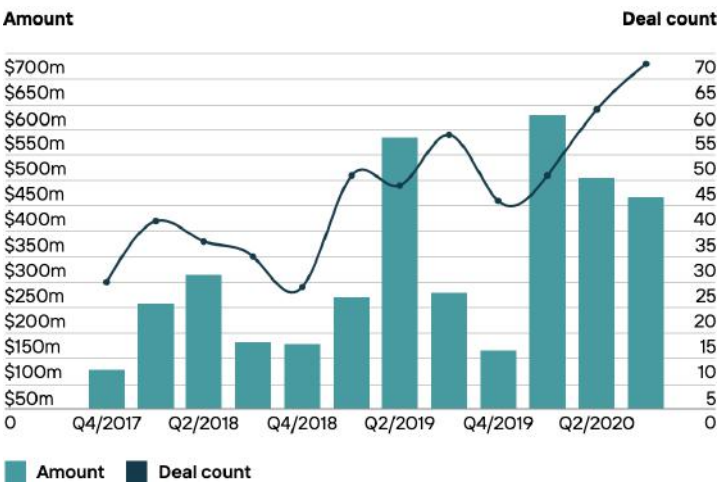
Source: Research America ,"The impact on mental health during a pandemic"

There is growing interest in solutions that promise to enhance wellbeing

Deal volumes have continued to increase in the mental-health space and total funding has risen sharply.

It is important to verify the effectiveness of these solutions as they continue to scale.

Figure 137: Mental-health funding and deal count, Q4'17-Q3'20

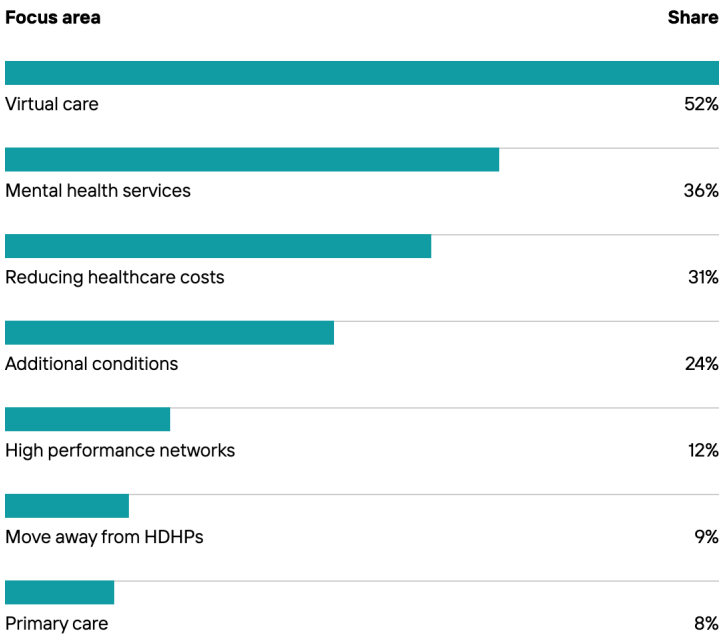


Source: CB Insights, "State Of Healthcare Q3'20 Report: Sector And Investment Trends To Watch"

The corporate sector is also taking employee wellness more seriously

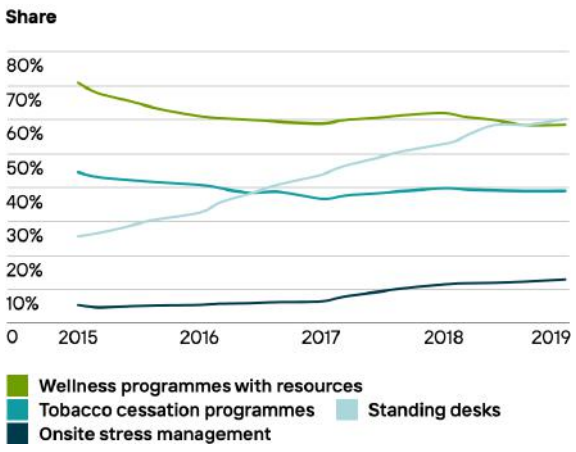
Corporates were offering new wellness programmes in the lead-up to the pandemic. Digital and mental-health offerings are the next frontier for 2021 and beyond. The question is whether these programmes are making a meaningful difference to employees' wellbeing, or whether they are merely PR.

Figure 138: Top focus areas for employee wellbeing, 2021



Source: Wellbeing 360, "2021 Employee Wellbeing Survey – Employer Healthcare Strategies For Better Workplace Wellness"

Figure 139: Programmes employers have in place to improve employee wellbeing



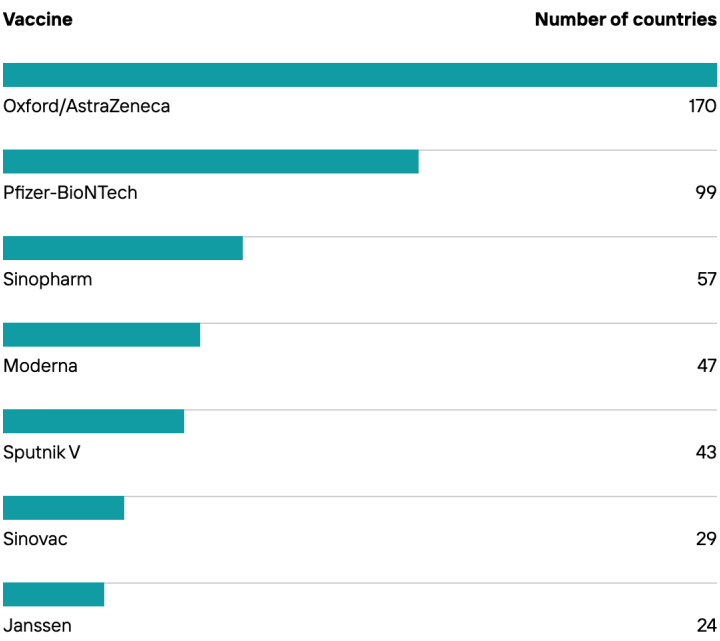
Source: HR Executive, "How employers are rethinking employee wellbeing"

4.3 New breakthroughs with huge potential to save lives

Vaccines against COVID-19 were developed very rapidly

There are nearly 300 COVID-19 vaccines in pre-clinical or clinical development. The scale-up of manufacturing capacity and roll-out of vaccinations has not been as fast as we would have liked, but was nonetheless an impressive achievement.

Figure 140: Number of countries using vaccine, by type of vaccine, March 2021

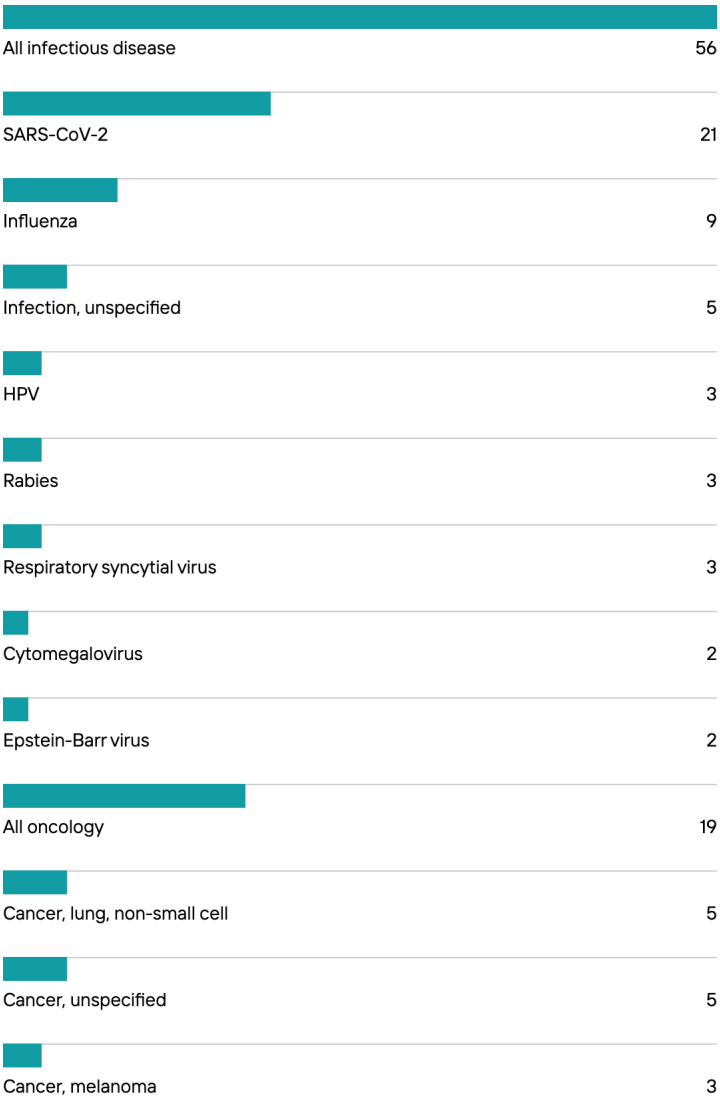


Source: BBC, 11th June 2021, "Covax: How many Covid vaccines have the US and the other G7 countries pledged?"

mRNA technology will have uses far beyond COVID-19

COVID-19 is of course the focus at the moment, but the technology is being applied to many other health challenges too.

Figure 141: Number of mRNA vaccine programmes, as of December 2020

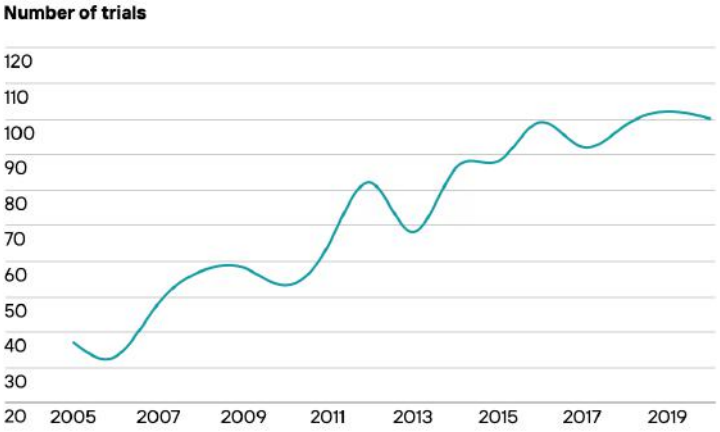


Source: PharmaIntelligence, "To infinity and beyond: how far can mRNA vaccine technology go?"

And mRNA trials are trending up

The total number of mRNA trials is near an all-time high.

Figure 142: mRNA clinical trials are trending up



Source: clinicaltrials.gov

Medical breakthroughs are proliferating

This index tracking global medical innovations has risen strongly in recent months.

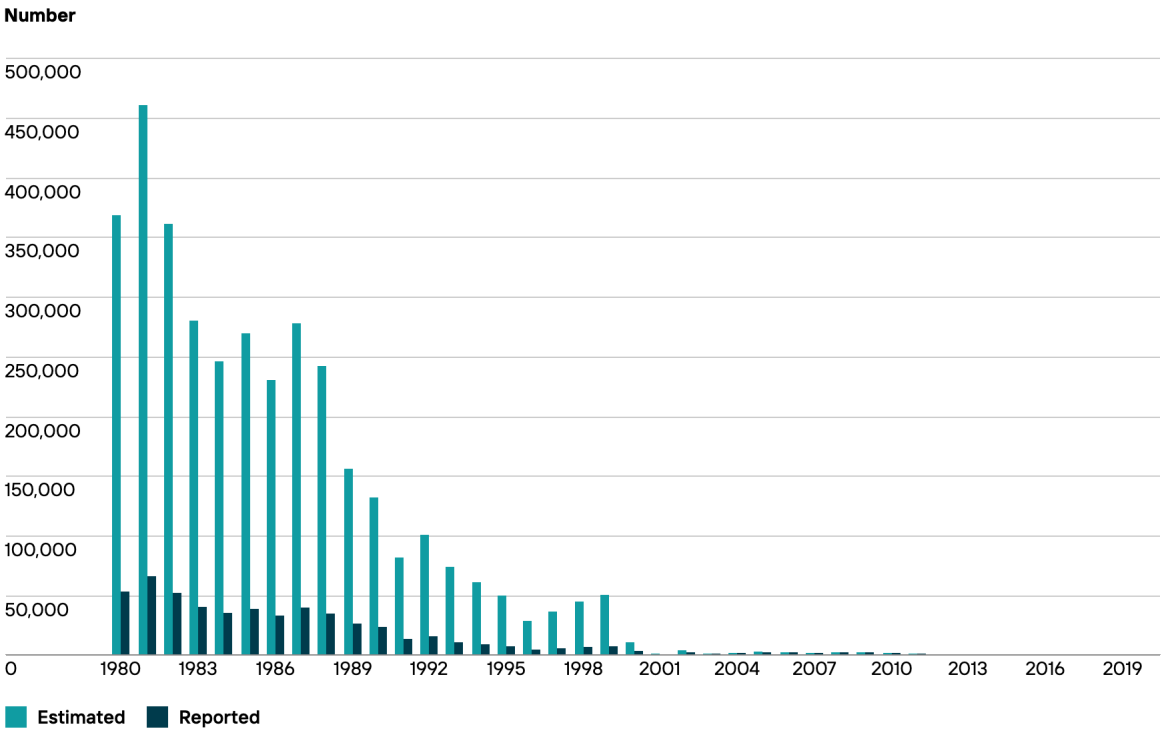
Figure 143: ALPS Medical Breakthroughs ETF price, 2020-2021

Source: ETF Trends

There were other big health wins in 2020

In 2020 wild polio was eradicated in Africa, though pockets of concern do still remain.

Figure 144: Reported and estimated polio cases, globally, 1980-2020



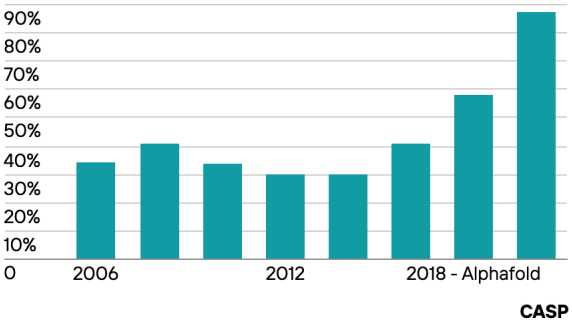
Source: Generation analysis of Our World in Data, "Polio"

Breakthroughs in "protein folding" and malaria vaccines are also hugely promising

Researchers from the University of Oxford reported findings from a Phase IIb trial of a candidate malaria vaccine, R21/Matrix-M, which demonstrated high-level efficacy of 77% over 12 months of follow-up.

Breakthroughs were made elsewhere. Unfolded or misfolded proteins contribute to the pathology of many diseases. But accuracy of protein-folding massively improved last year.

Figure 145: Median free-modelling accuracy, 2006-2020



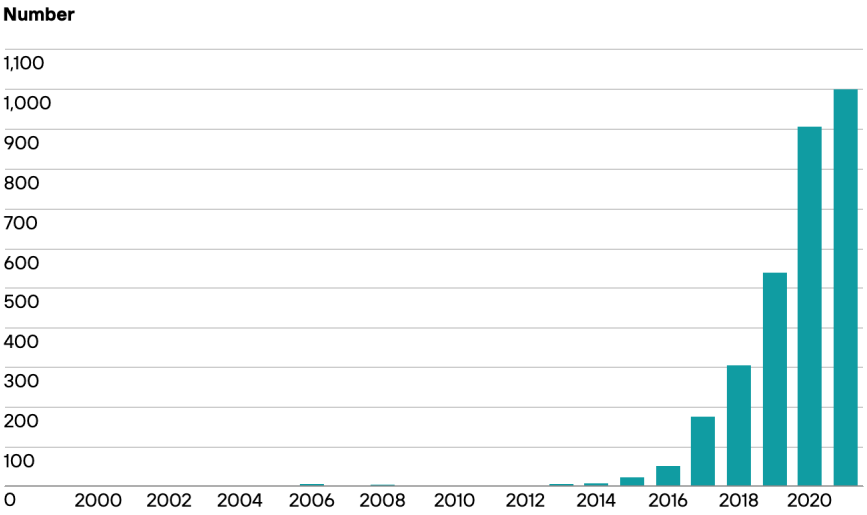
The main metric used by CASP to measure the accuracy of predictions is the Global Distance Test (GDT) which ranges from 0-100. In simple terms, GDT can be approximately thought of as the percentage of amino acid residues (beads in the protein chain) within a threshold distance from the correct position.

Source: Deepmind, "AlphaFold: a solution to a 50-year-old grand challenge in biology"

Liquid biopsy continues to take off

Liquid biopsy refers to the sampling and molecular analysis of the biofluids of circulating tumour cells, extracellular vesicles, nucleic acids, and so forth. The ability to detect and characterise tumours in a minimally invasive and repeatable way could have huge clinical implications, in particular in terms of early cancer diagnosis.

Figure 146: Patent filings relating to "liquid biopsy", global, 2000-2021



Source: Generation analysis of Google Patents

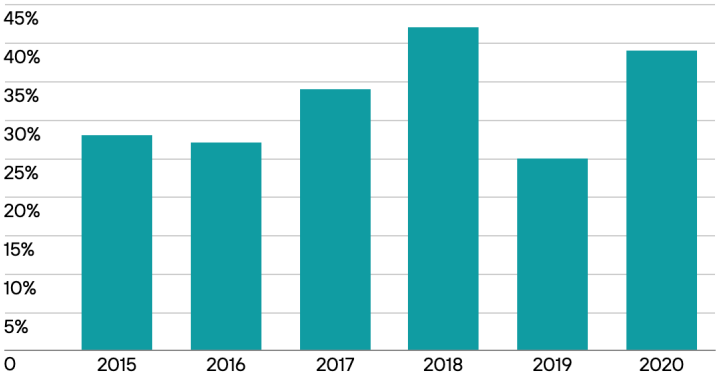
Personalised medicine is also growing rapidly

Personalised medicines continue to grow rapidly, allowing treatments to be more targeted to individuals.

Figure 147: Monthly news mentions, direct-to-consumer health, 2015-2019

Source: CB Insights, "9 Direct-To-Consumer Telehealth Startups To Watch"

Figure 148: Personalised medicines as share of total FDA approvals, 2015-2020



Source: Personalized Medicine Coalition, "Personalized Medicines Top One-Third of All New Drug Approvals in 2020 for Third Time in Last Four Years"

Will COVID-19 set new precedents for technology cooperation on other diseases, and beyond healthcare?

There have been calls from international organisations and some governments to address trade-related obstacles to vaccine production and access, to save lives and accelerate the economic recovery.

WTO Director-General Okonjo-Iweala

Director-General Okonjo-Iweala has called on WTO members, other international organisations and vaccine manufacturers to address trade-related barriers in the scale-up of vaccine production and distribution. Image: WTO

> "This is a global health crisis, and the extraordinary circumstances of the COVID-19 pandemic call for extraordinary measures"

US Trade Representative, Katherine Tai

05 Mobility & Buildings

5.1 Key trends

What would the regenerative city look like? We find evidence of structural changes unleashed in recent months that provide new opportunities for sustainable solutions, from sustainable and healthy buildings to electrified mobility of all shapes and sizes.

City halls are experimenting with many schemes with the goal of crafting neighbourhoods that work for communities rather than cars. This is essential to create equitable living environments. As it stands, disadvantaged communities (particularly as defined by race) lack access to many of the amenities of a sustainable city: they are less likely to have Zoom-able jobs, and their neighbourhoods have less green space but greater proximity to pollution.

City halls are crafting neighbourhoods that work for communities rather than cars

Sustainable and healthy buildings, electrified mobility and re-wilding will play key roles in the regenerative city

As electric vehicles approach price parity, sales of internal combustion vehicles will be phased out by 2030

Fundamental assumptions about how we live and work in cities were put to the test by COVID-19

Tourist hotspots such as Venice saw stunning improvements in environmental quality, as tourists stayed away. Cities emptied out as offices closed and people left for the suburbs and rural areas.

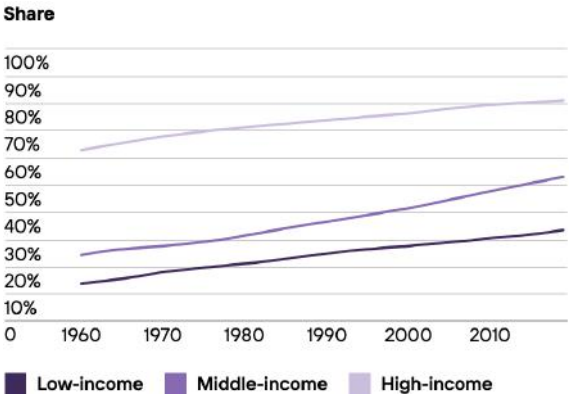
New York City, March 2020. Image: Reuters/Carlo Allegri/Alamy

Venice. Image: DVrcan/Getty

Some even question if the long-term trend towards urban living will endure

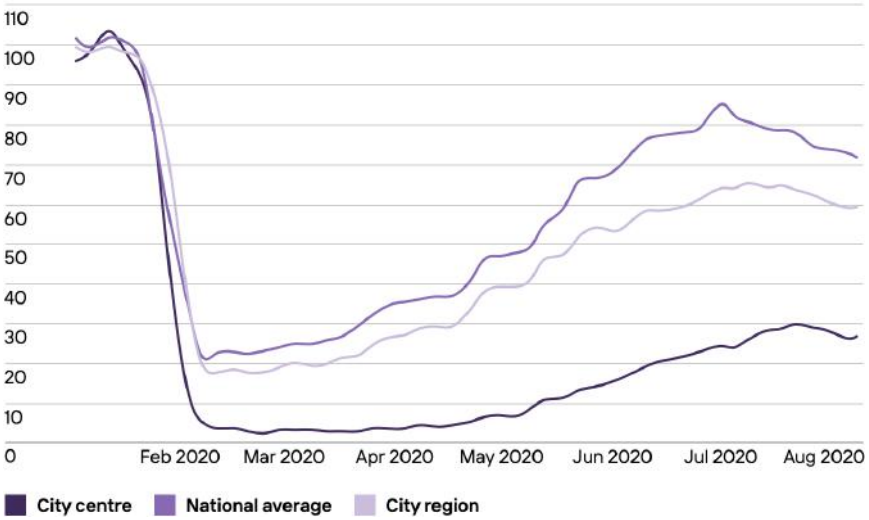
Before the pandemic, urban populations were growing rapidly. But cities have emptied out in the pandemic. Will people return?

Figure 149: Share of population living in cities, by country-income level, 1960-2019



Source: Generation analysis of World Bank data

Figure 150: Footfall in cities, global, 2020

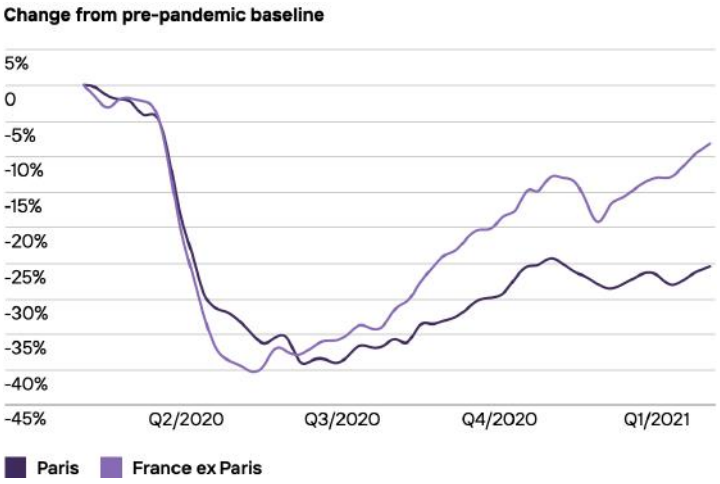


Baseline is average for same day of week, Jan 3rd to Feb 6th, 2020.

Source: FT, 15th October 2020, "From peak city to ghost town: the urban centres hit hardest by COVID-19"

In many countries, cities were hit especially hard by the pandemic

Figure 151: Job postings, Paris, 2020-2021

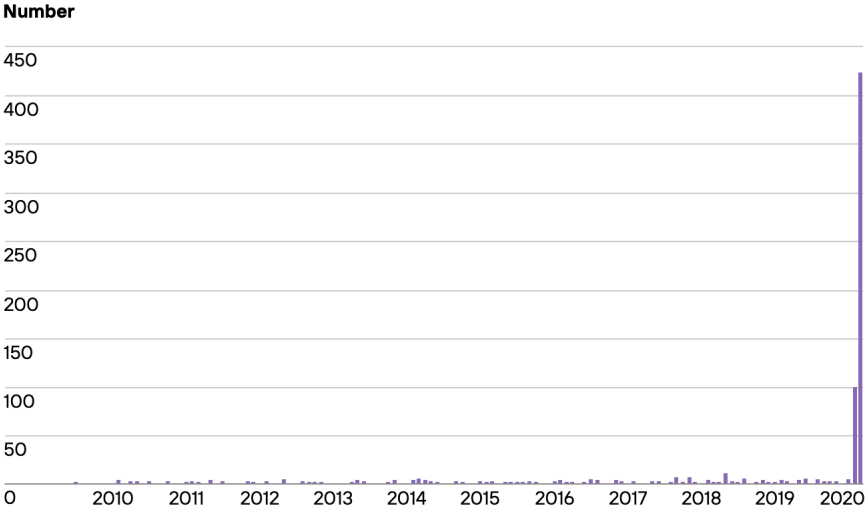


Source: Indeed, "After the Boom? COVID-19 and European City Labour Markets"

This has been a huge opportunity for experimentation in city life and how we live and work at home

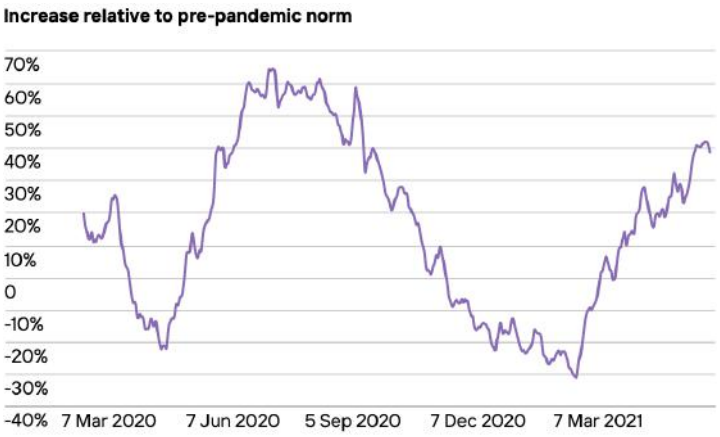
Before the pandemic about 5% of American working hours were done at home. In April-May that rose to 60%. People living in urban areas have a new appreciation of open space.

Figure 152: Public company transcripts mentioning working from home, 2009-2020



Source: Vox, "How coronavirus could force the work-from-home movement"

Figure 153: Visits to parks, America, 2020-2021

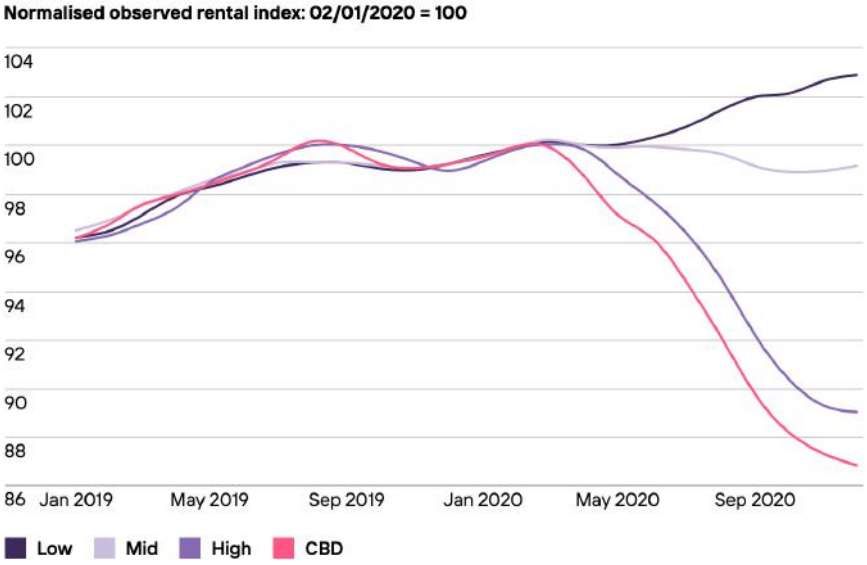


Source: Generation analysis of Google/Our World in Data data

With big changes in residential property markets

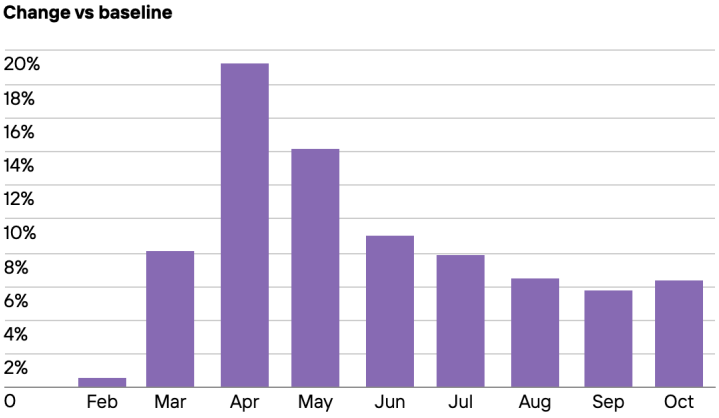
Rents in city centres fell sharply, even as rents in rural and suburban areas have performed strongly. People are spending more time at home.

Figure 154: Rental index for 12 largest metro areas, by density group, 2019-2020



Source: Arjun Ramani and Nicholas Bloom, "The doughnut effect of COVID-19 on cities"

Figure 155: Changes to time spent at home, selected countries, 2020

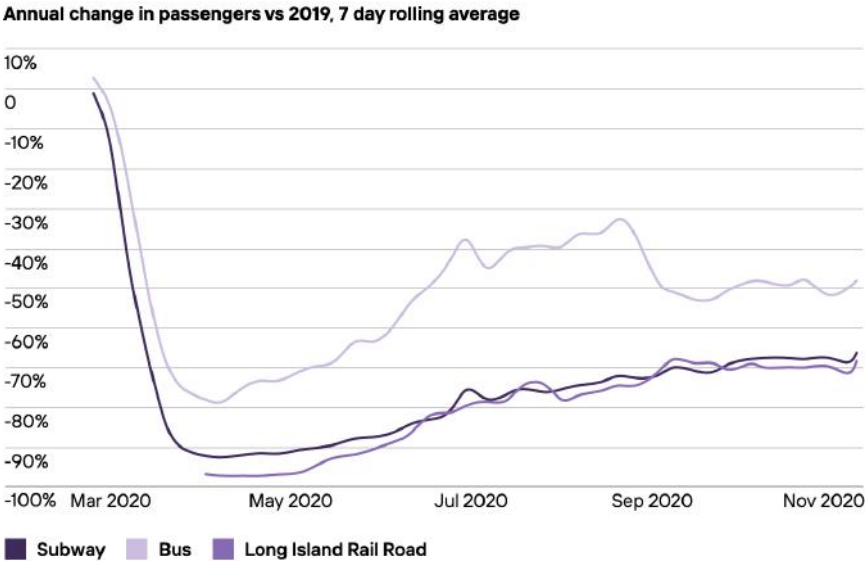


Source: IEA, "Changes to average time spent at home over selected countries, Feb-Oct 2020"

The pandemic has also turned transport upside down

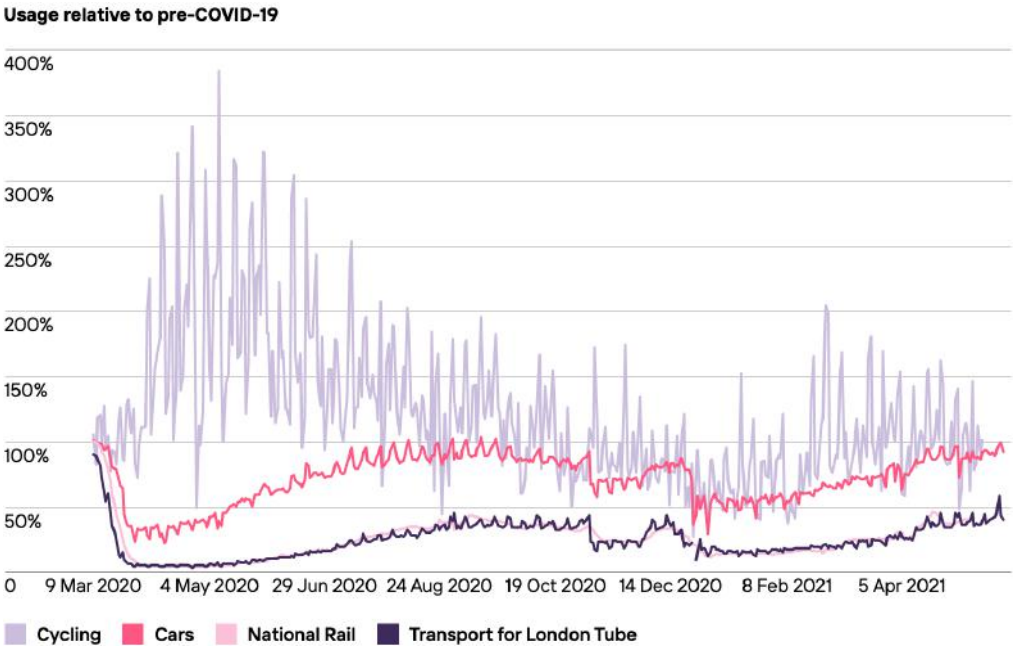
The early period in the pandemic saw big shifts in transport use. The changes are now less stark, but it is unclear if some changes will persist long-term. The World Bank argues that COVID-19 has created new momentum for cycling and walking. The evidence from Britain shows that this is clearly true.

Figure 156: Transport use, New York, 2020



Source: FT, 16th November 2020, "New York and the crisis in mass transit systems"

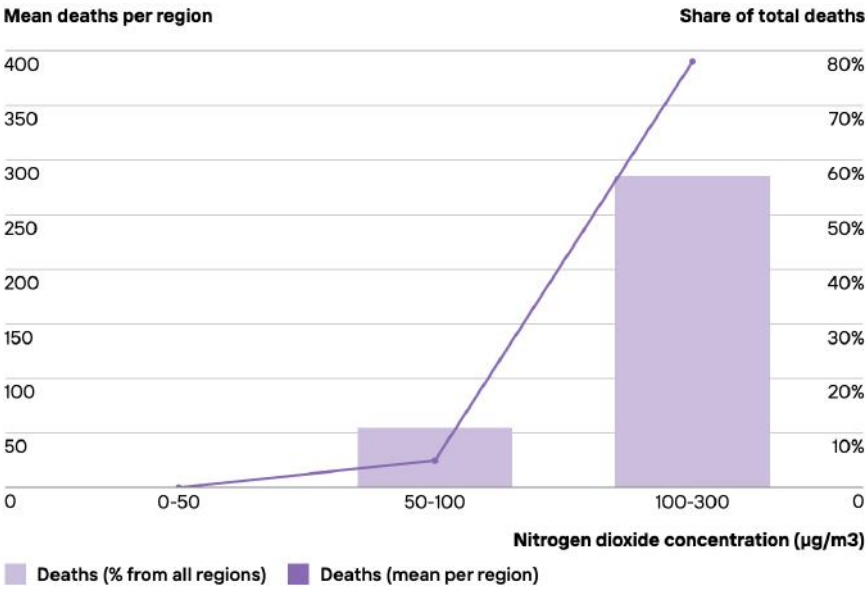
Figure 157: Transport usage, by type, Britain, 2020-2021



Source: Department for Transport, "Transport use during the coronavirus (COVID-19) pandemic"

The pandemic has brought home the importance of air quality to people's health and wellbeing

Figure 158: NO_2 concentrations and mortality from COVID-19, Italian and Spanish regions, 2020



Source: Ogen, Yaron. "Assessing nitrogen dioxide (NO_2) levels as a contributing factor to coronavirus (COVID-19) fatality." Science of the Total Environment 726 (2020): 138605.

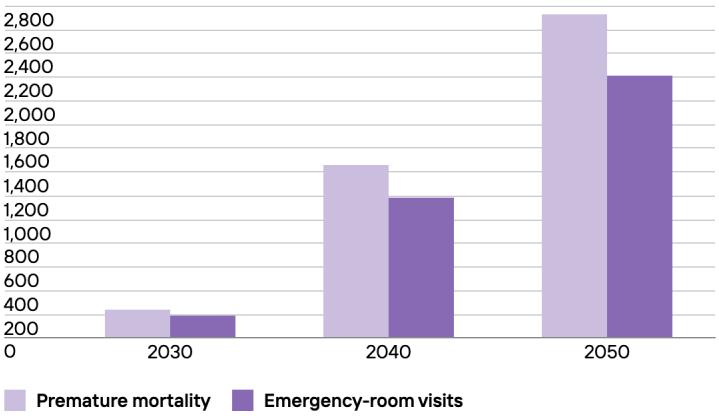
> Higher historical PM2.5 exposures are positively associated with higher county-level COVID-19 mortality rates"

Science, November 2020

Switching to electric vehicles would have huge health benefits globally

Large-scale adoption of zero-emission vehicles could reduce deaths by many thousands a year, as well as making a critical contribution to climate goals.

Figure 159: Annual reductions in negative health outcomes from 100% medium- and heavy-duty ZEV sales by 2040, US



Source: EDF, "Clean Cars, Clean Air, Consumer Savings"

> Vehicle tailpipe emissions were linked to around 361,000 premature deaths from ambient $PM_{2.5}$ and ozone worldwide in 2015"

International Council on Clean Transportation, 2019

5.2 Towards the regenerative city

What would a regenerative, net-zero city look like?

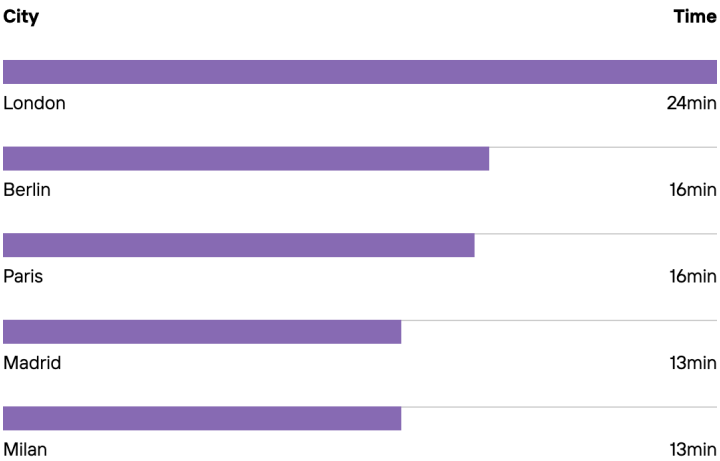
A post-COVID-19 wildscape to replace a shopping mall in Nottingham, UK, as proposed by the Wildlife Trust. Image credit: influence

The idea of the "15-minute city" has taken hold, but there is a long way to go

Paris Mayor Anne Hidalgo put the 15-minute city at the centre of her 2020 election campaign. In the past year, many cities have rolled out plans to make neighbourhoods more liveable and put people, rather than cars, at the centre.

Urban density makes walking a much easier choice for people. There is, however, wide variation in people's access to amenities across different cities.

Figure 160: How long does it take to walk/cycle to essential amenities?



Residents of London, Paris, Madrid, Berlin and Milan were asked how far they had to travel to green space, a shop that sells groceries, a medical facility, a school, a restaurant or café, and a leisure centre or gym.

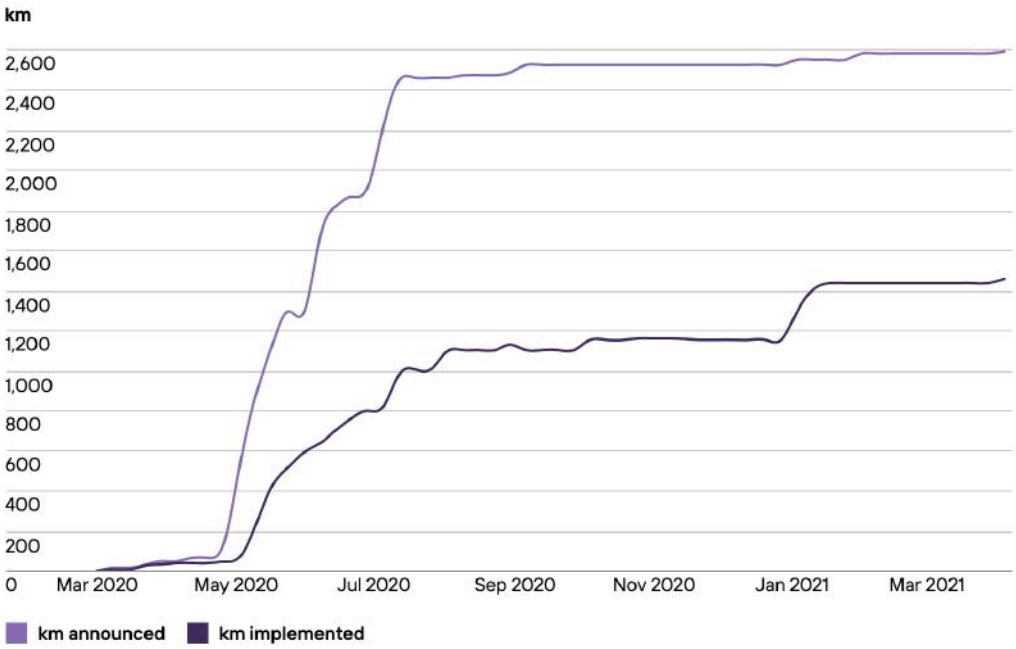
Source: Arup, "The fifteen minute vision: Future proofing our cities"

Bike lanes and traffic calming are proliferating across Europe

Over 2500km of new cycling routes and low traffic neighbourhood schemes have been announced in Europe since the pandemic began. 1500km of these have now been implemented.

Many of these schemes also incorporate rewilding (such as adding trees and plants and encouraging biodiversity) and have other objectives like enabling children to walk to school safely.

Figure 161: New cycling and liveable-streets projects, Europe, 2020-2021

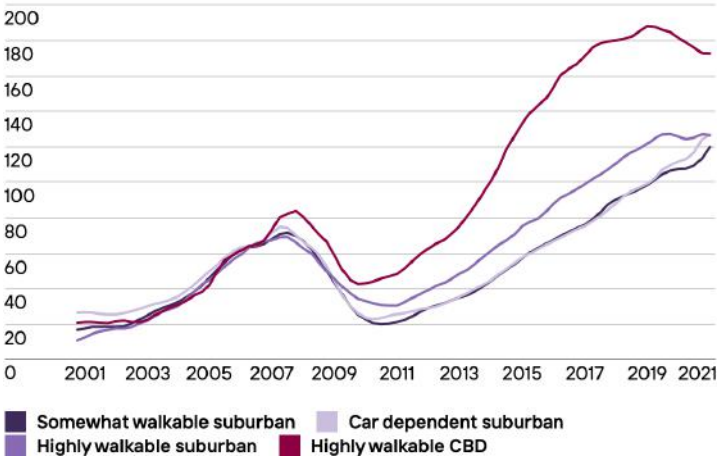


Source: ECF, "COVID-19 Cycling Measures Tracker"

Walkable cities are also more economically valuable

In some cities, areas where walking is easier have seen prices grow faster. However, the pandemic has closed the gap in recent months, as some people seek to relocate to more car-dependent suburban areas.

Figure 162: Walkability score and price indices, 2000-2021

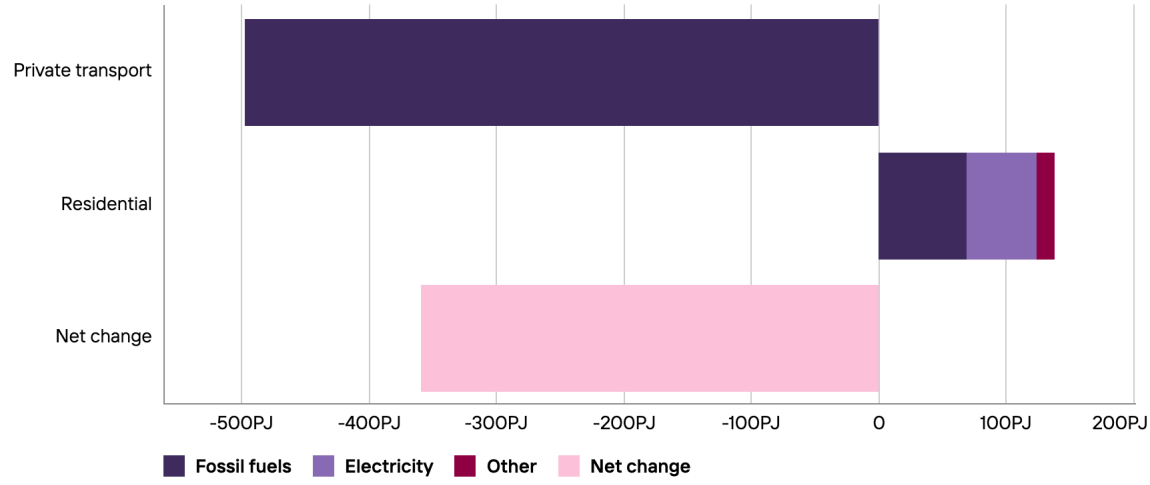


Source: wealthmanagement.com, "Investors Have Backed Away from "Walkability" in Making Multifamily Plays"

A large-scale shift to WFH could help reduce emissions in car-driving communities

While residential energy use would rise, a reduction in transport would more than offset this. This IEA home-working scenario is based on just one day of working from home, which it finds would save around 24mtCO_2 per year. Further savings could arise from a more comprehensive shift to home working, and via a reduction in long-distance travel for work. However, where people are using public transport to get to work, home-working actually leads to an increase in emissions.

Figure 163: Change in global final energy consumption by fuel in the "home-working" scenario

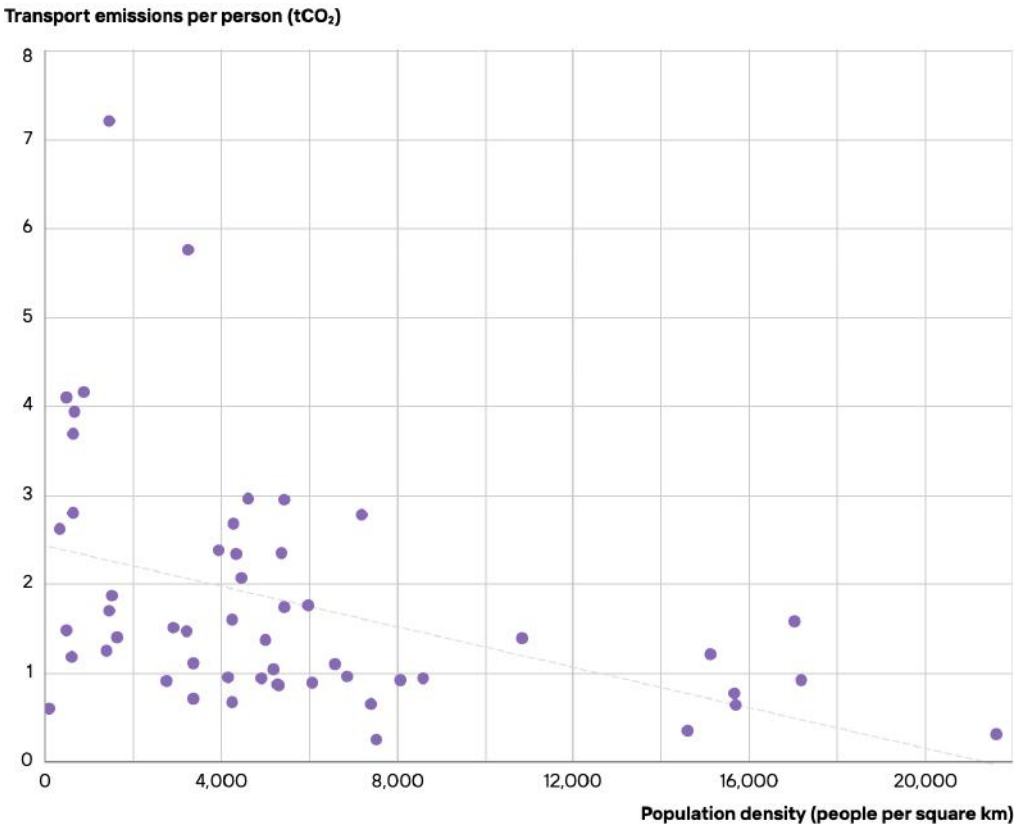


Source: IEA, "Change in global final energy consumption by fuel and CO_2 emissions in the "home-working" scenario"

City density enables lifestyles which are less resource-intensive

Urban areas are typically much more environmentally efficient than suburban or rural ones. The higher a city's density, the lower its emissions tend to be.

Figure 164: Relationship between population density and transport emissions, global cities, latest available data

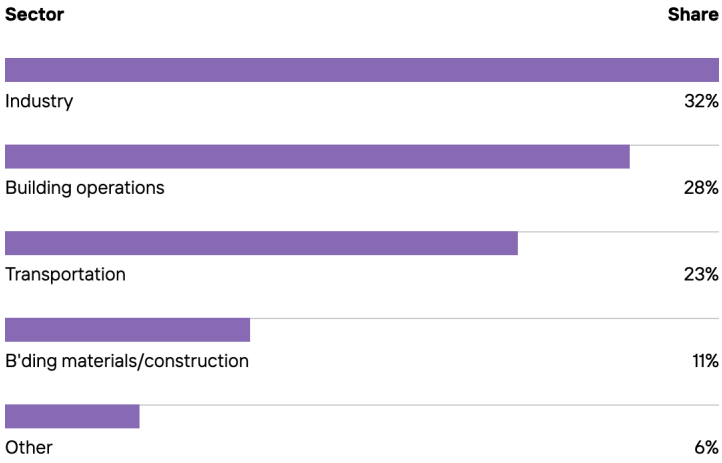


Source: Our World in Data, "Transport CO_2 emissions vs. population density of cities"

Even as cities continue to evolve, we need to tackle emissions from buildings

Buildings are responsible for over a third of global GHG emissions. New types of buildings, urban layouts and a faster pace of renovation all need to be leveraged to drive emissions down to net zero. "Embodied carbon" – the CO_2 emitted in producing materials – is a key issue. The importance of embodied carbon will rise over time as we decarbonise the energy we use in buildings.

Figure 165: Global energy-related CO_2 emissions by sector



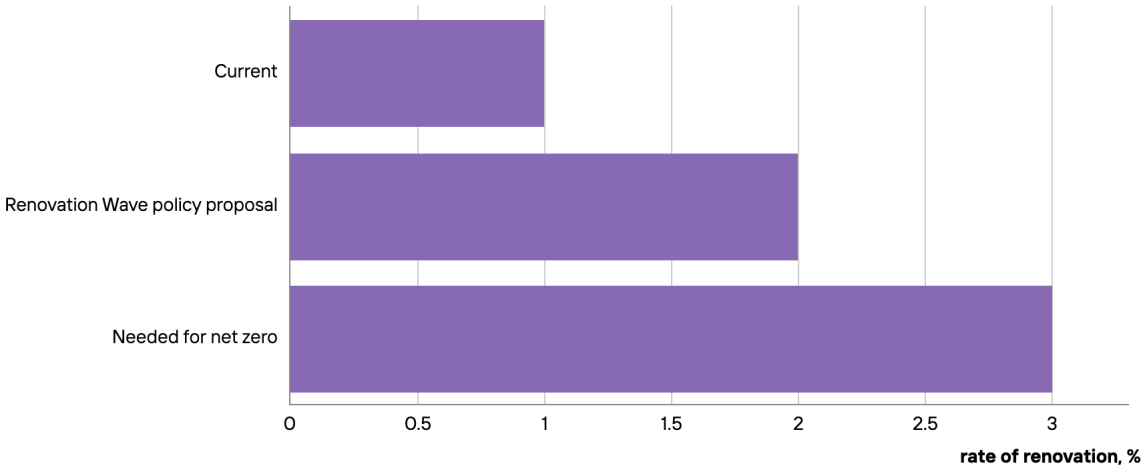
Source: Architecture 2030, "Buildings generate nearly 40% of annual global GHG emissions"

Deep renovation of buildings will need to accelerate

The EU is accelerating the renovation of buildings to achieve a wide range of social and environmental objectives: enhanced quality of life, fewer people in energy poverty, a reduction in greenhouse-gas emissions, improved material reuse and additional jobs.

Deep building renovation has big implications for solutions in the buildings space. Renovation rates need to increase by three times to align with net zero in the EU. In the UK, the deployment of heat pumps will need to ramp up more than ten times by 2030 to meet net-zero goals. Though daunting, this is well within what is technically possible.

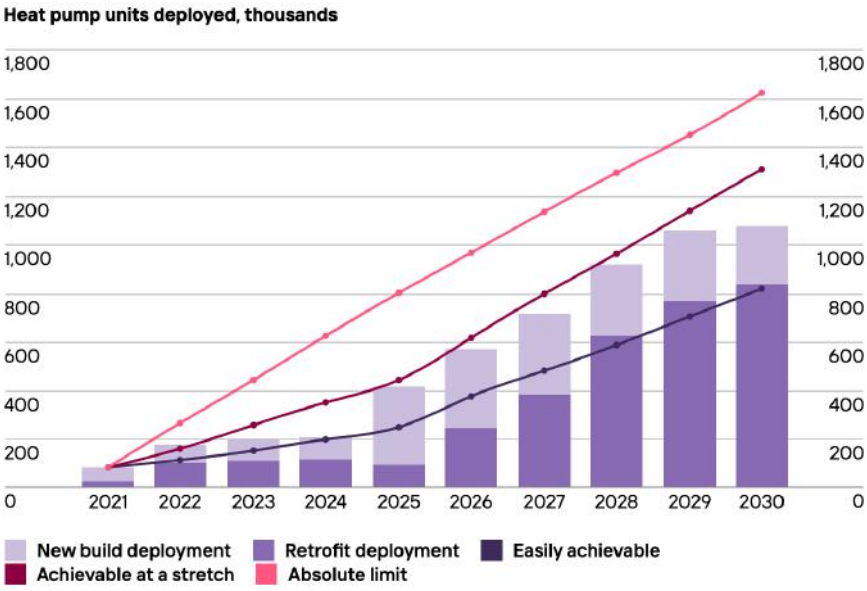
Figure 166: Annual rate of building renovation, Europe, different scenarios



The aim of the Renovation Wave is to at least double renovation rates from around 1% p.a. to 2% p.a. in the next 10 years and make sure renovations lead to higher energy and resource efficiency.

Source: BPIE, "The road to carbon neutrality"

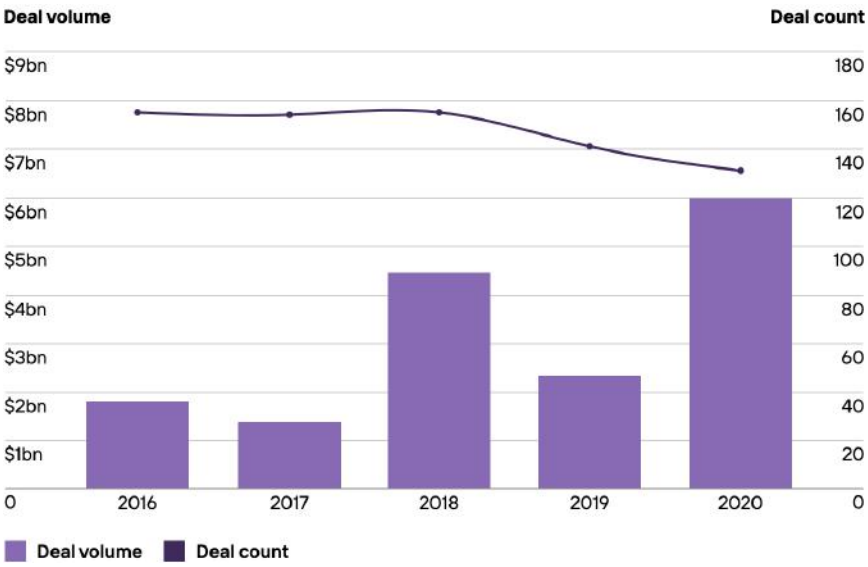
Figure 167: UK heat pump installation rates needed to meet net-zero goals



Source: Climate Change Committee, "Development of trajectories for residential heat decarbonisation to inform the Sixth Carbon Budget (Element Energy)"

Investment activity in buildings continues to heat up

Figure 168: Public and private investment in buildings, 2016-2020

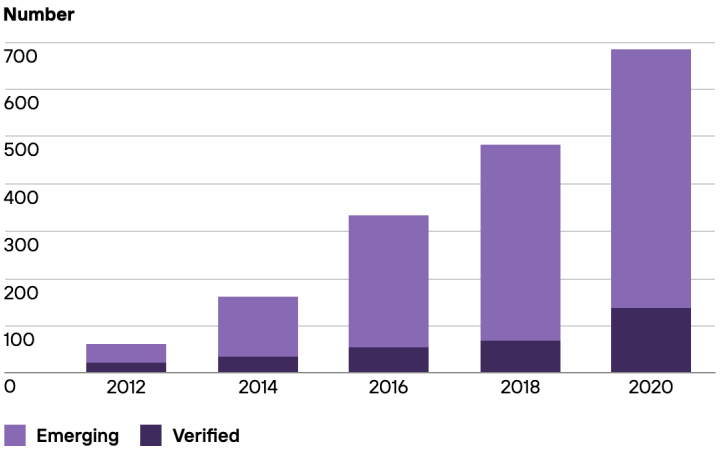


Source: Generation analysis of CB Insights data

Businesses are investing in improving their buildings, for both environmental and health benefits

These improvements are being made for many different reasons — employee wellbeing, health, productivity and environmental concerns among them. Systems for environmental performance are the most advanced, but even these need to get much smarter.

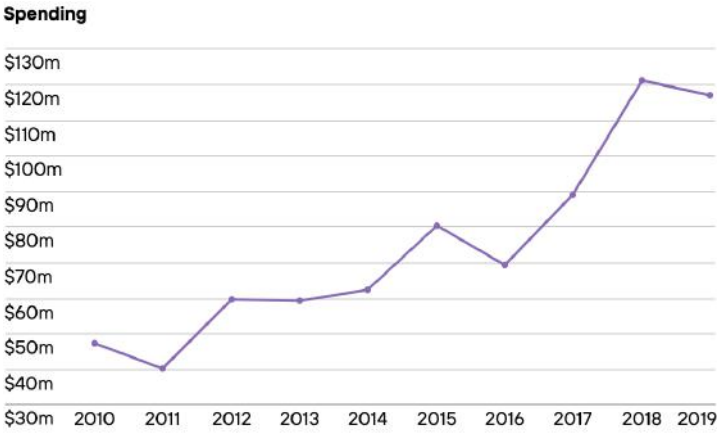
Figure 169: Net-zero buildings, US and Canada, 2012-2020



Source: New Buildings Institute, "2020 Getting to Zero Buildings List"

Milan, Italy. An ecological house with garden on every terrace that turns the building into a vertical wood. Image: Pierluigi Palazzi / Alamy

Figure 170: Real research, design and development (RD&D) spending on building design and envelope in the OECD, 2010-2019



Source: Generation analysis of OECD/IEA data

> While sustainability rating systems for buildings have been established for nearly 20 years, systems to specifically recognise healthy buildings are much more recent arrivals to the global scene"

McArthur, J. J., and Colin Powell. "Health and wellness in commercial buildings: Systematic review of sustainable building rating systems and alignment with contemporary research." Building and Environment 171 (2020): 106635.

Smart design and buildings operation will play a key role

Smart technology will play a key role in the sustainable buildings revolution, from the design of buildings and choice of materials, through to the operation of the building.

As well as integrating the whole building's value chain, technology can help to optimise the role of buildings in grid management, and integrate each building into the wider urban fabric.

> If we are to truly 'build back greener', digital technology and decarbonisation will have to be placed at the centre of every construction phase, from inception to operation"

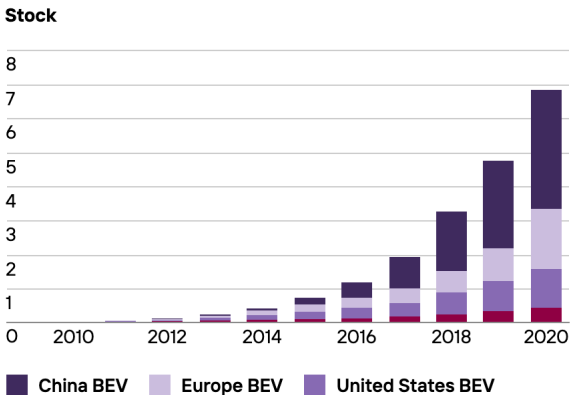
Schneider Electric

5.3 The race to electrified mobility reaches a tipping point

Electric vehicles continue to experience rapid growth

Over the past year, electric vehicles have hit the mainstream. There are now more than 7m electric vehicles on our roads and (as a chart further down shows) they can be plugged in at over 10m charging stations.

Figure 171: Stock of electric vehicles, global, 2010-2020

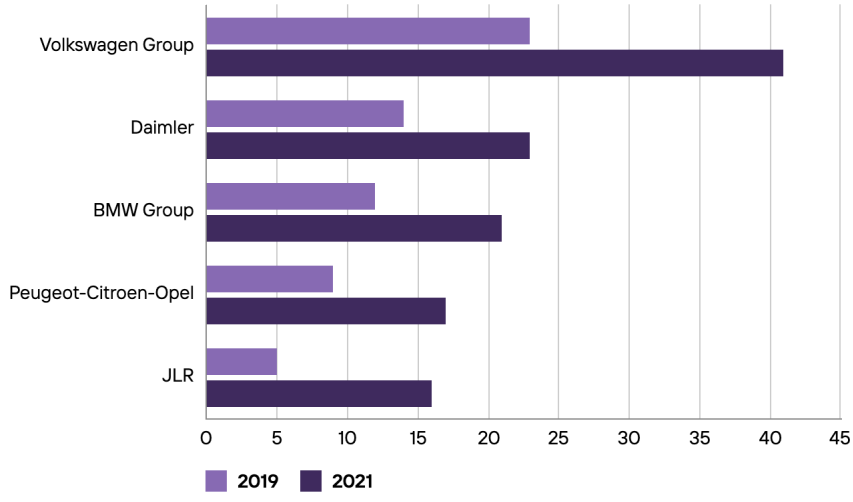


BEV = Battery Electric Vehicle. Using a wider definition of EVs that includes Plug-in Hybrid Electric Vehicles (PHEVs), the total stock is now over 10 million

Source: IEA, "Global electric passenger car stock, 2010-2020"

There is growing choice of electric vehicles on the market

Figure 172: Availability of electric-car models*, Europe

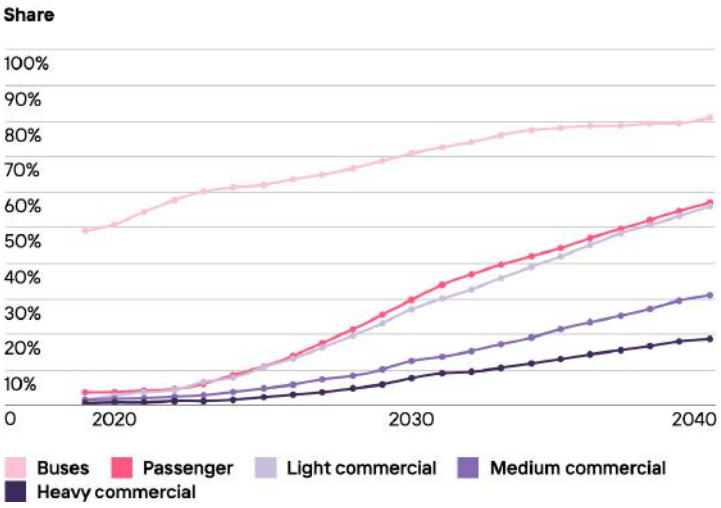


* Includes plug-in hybrid and fully electric models

Source: Statista, "Electric Car Models Set To Triple In Europe By 2021"

All types of road vehicles are shifting to electric

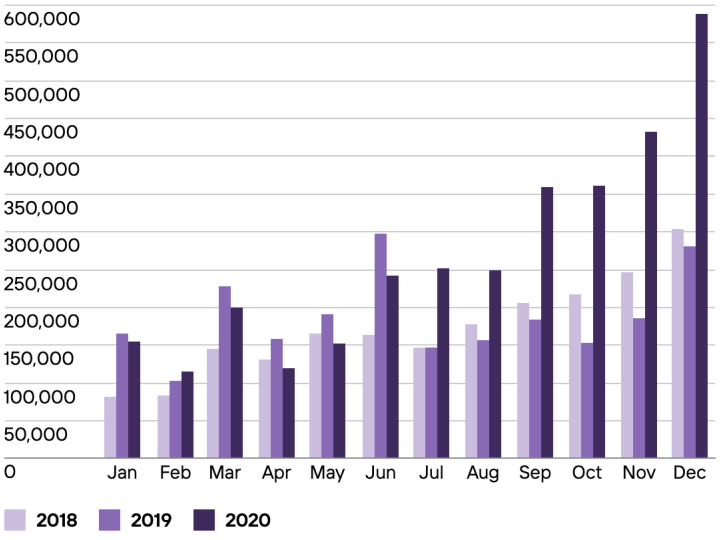
Figure 173: EV share of annual vehicle sales by segment, 2020-2040



Source: BNEF, "Electric Vehicle Outlook 2020"

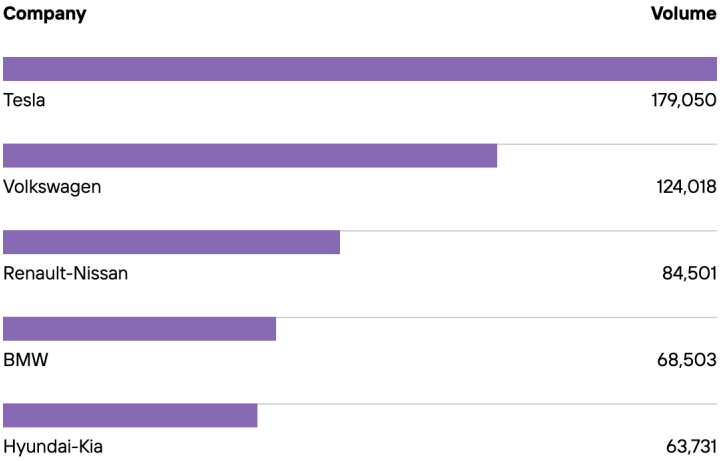
Sales of EVs have accelerated during the pandemic

Figure 174: Sales of plug-in electric vehicles, 2018-2020



Source: EV Volumes data

Figure 175: Global plug-in vehicle leaders, H1 2020

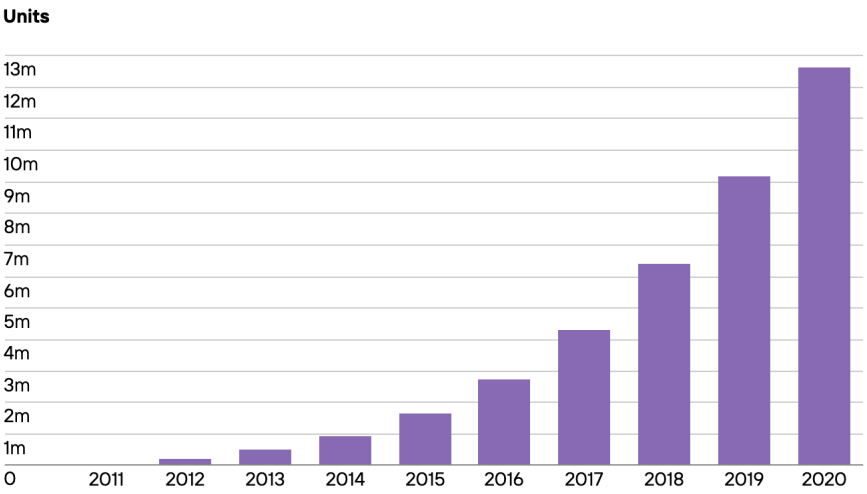


Source: CleanTechnica, "Global plugin vehicle leaders"

Installations of charging stations are soaring

In 2020 the world passed the milestone of 10m public charging stations.

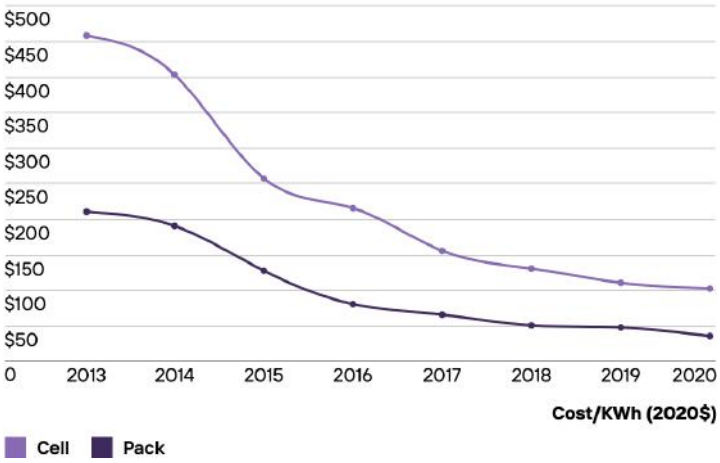
Figure 176: Number of vehicle-charging stations, global, 2011-2020



Source: Business Wire, "Global EV Charging Stations to Skyrocket by 2020, IHS Report Says"

Battery costs are collapsing

Figure 177: Volume-weighted average pack and cell price split (2020$/kWh), 2013-2020

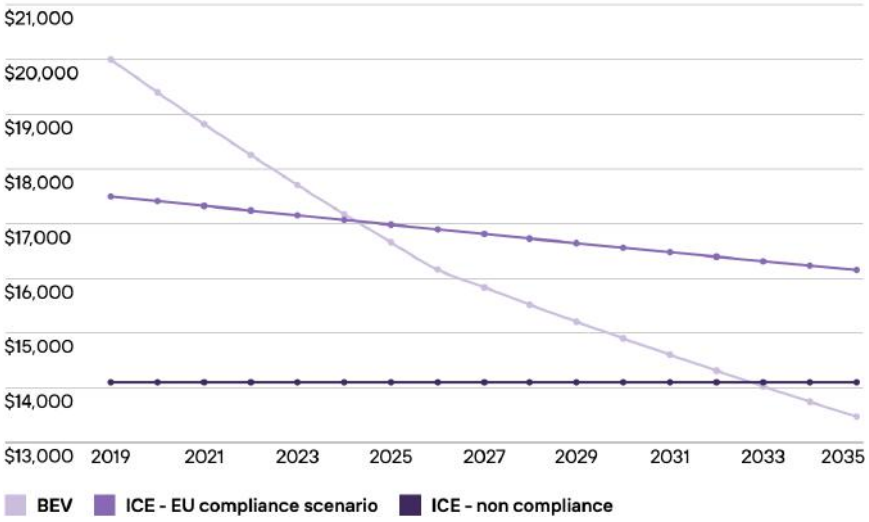


Source: Phillip CFD

"Price parity" between EVs and fossil-fuel/internal combustion engine cars is imminent

Today an EV is roughly the same price as an ICE car. By the 2030s EVs will be significantly cheaper, largely due to falling battery costs.

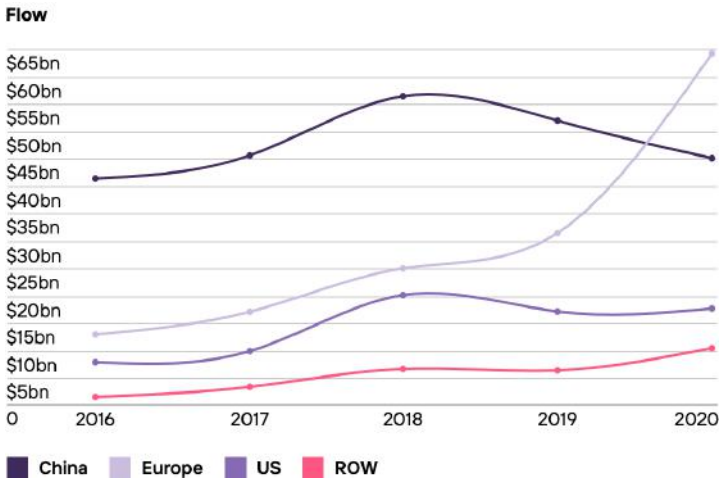
Figure 178: Total vehicle cost comparison, global, 2019-2035



Source: Roskill, "Automotive: Increasing CO_2 compliance cost could help some auto OEMs reach BEV-ICE price parity by 2023"

Europe and China are leading the way in electrifying transport

Figure 179: Investments in electrified transport, global, 2016-2020



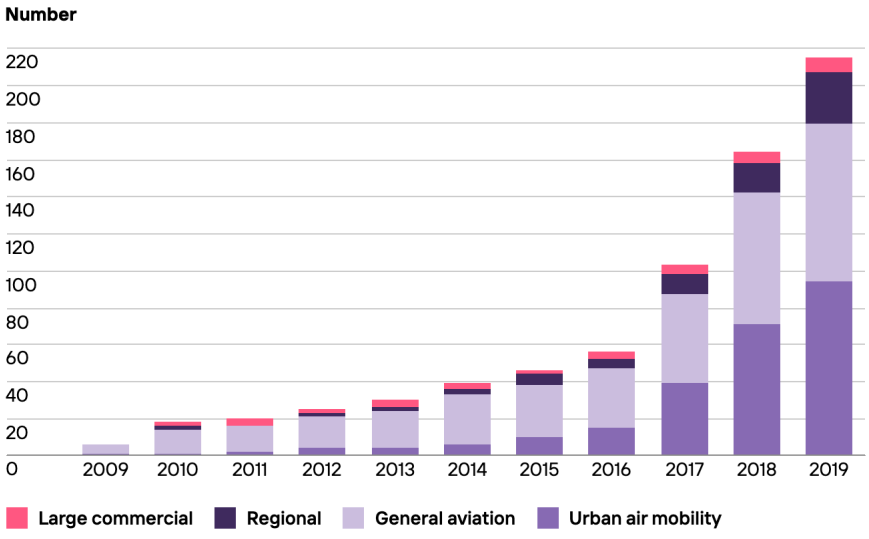
Source: Bloomberg, 19th January 2021, "Spending on Global Energy Transition Hits Record $500 Billion"

Could electric planes take off?

Although small in scale, the number of electrical aviation developments has been growing fast.

Sweden and France are banning short-haul airplane flights where trains are available. This could help create a niche for electric planes.

Figure 180: Electrically propelled aviation developments, 2009-2019



Source: Roland Berger, "The number of electrically propelled aircraft developments grew by ~30% in 2019"

06
Value Chains & Circularity

6.1 Key trends

Sustainability and resilience are two sides of the same coin. COVID-19 and trade tensions have provided insights on the potential impact of supply-chain shocks, including those arising from extreme weather events. In part due to rising commodity prices and growing consumer commitment to sustainability, there are signs of a rapid take-off in platforms supporting the circular economy, in particular for the exchange of second-hand goods.

Smart supply chains are essential for the shift to net zero, stopping human rights violations and ending deforestation.

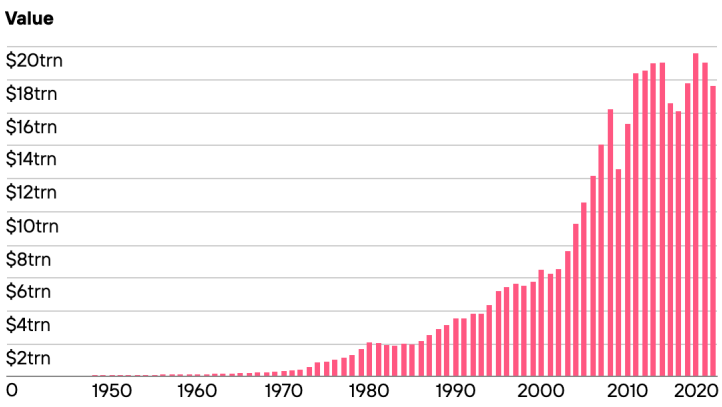
With rising commodity prices, scrutiny over resource-related impacts and carbon border charges, companies are rethinking their approach.

The circular economy is taking shape, from the marketplaces in second-hand goods to smarter logistics platforms.

The shock to the global trading system and supply chains comes at a critical moment for sustainability

Global trade volumes suffered in the past year, but were already well below expectations in the years leading up to the pandemic. Supply-chain concerns spiked in the early days of the pandemic and roared back in early 2021. Supply chains are being tested in multiple ways: the pandemic, the climate crisis, cybersecurity, and trade-policy conflicts as part of broader geopolitical disputes.

Figure 181: Value of global exports, 1948-2020



Source: World Trade Organisation, "Trade and tariff data"

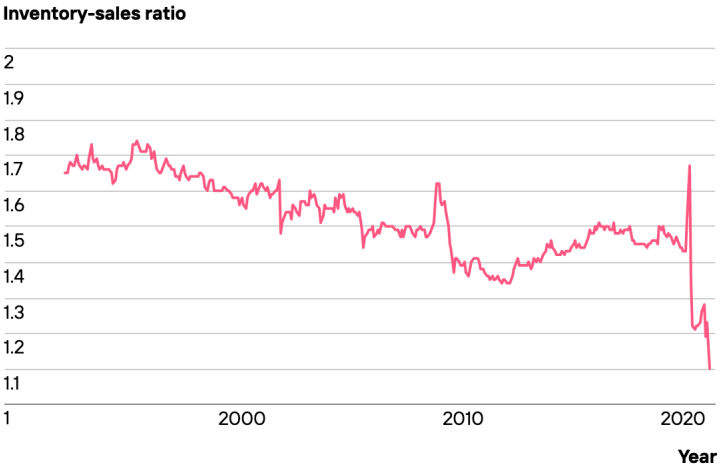
The economic rebound is causing price pressures in supply chains

Supply-chain disruption is resulting in spiking prices and delayed shipments. Producers are running down inventories and they struggle to restock.

Figure 182: PMI cost indices (>50 = expansion), various regions, 2009-2020

Source: Merrill, "Global economic viewpoint"

Figure 183: Inventory-to-sales ratio, US retailers, 1992-2021



Source: Federal Reserve Bank of St Louis, "Retailers: Inventories to Sales Ratio"

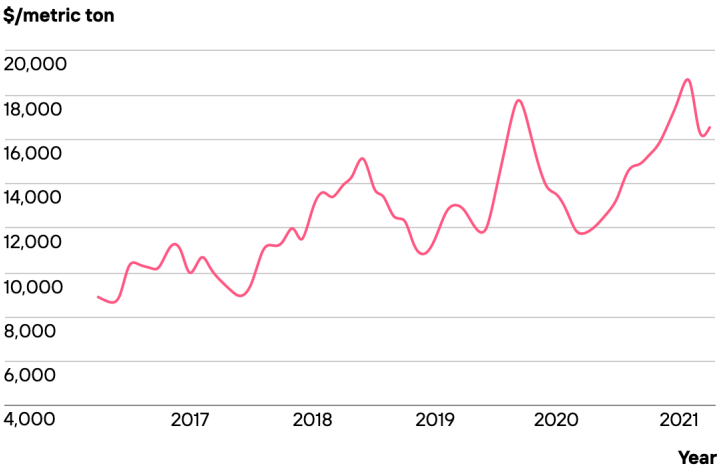
Commodities associated with green recovery are surging, with potential risks for net zero

Copper is a highly efficient conductor of electricity and heat. It is used in renewable energy systems to generate power from solar, hydro and others. High prices could dissuade investment.

Figure 184: Global price of copper, 1990-2021

Source: Federal Reserve Bank of St Louis, "Global price of copper"

Figure 185: Global price of nickel, 2016-2021

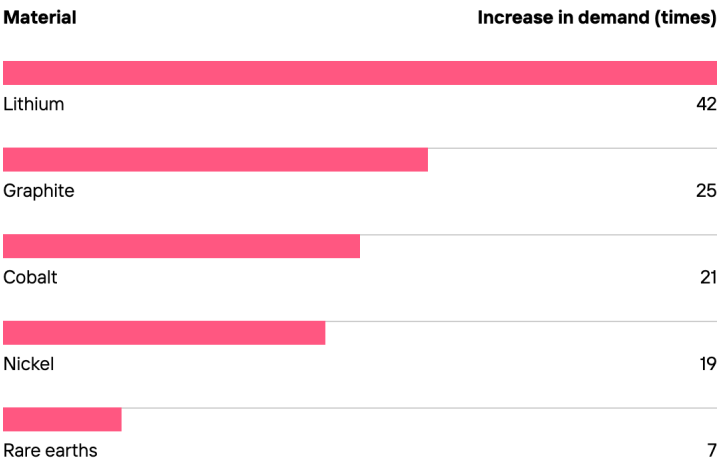


Source: Federal Reserve Bank of St Louis, "Global price of nickel"

Net zero will 'turbo-charge' demand for minerals, putting upward pressure on prices and reshaping commodity markets

Resource experts are also anticipating much finer differentiation between commodities according to their environmental and social performance, aided by smart technology.

Figure 186: Growth in demand for minerals under SDS, 2040 relative to 2020



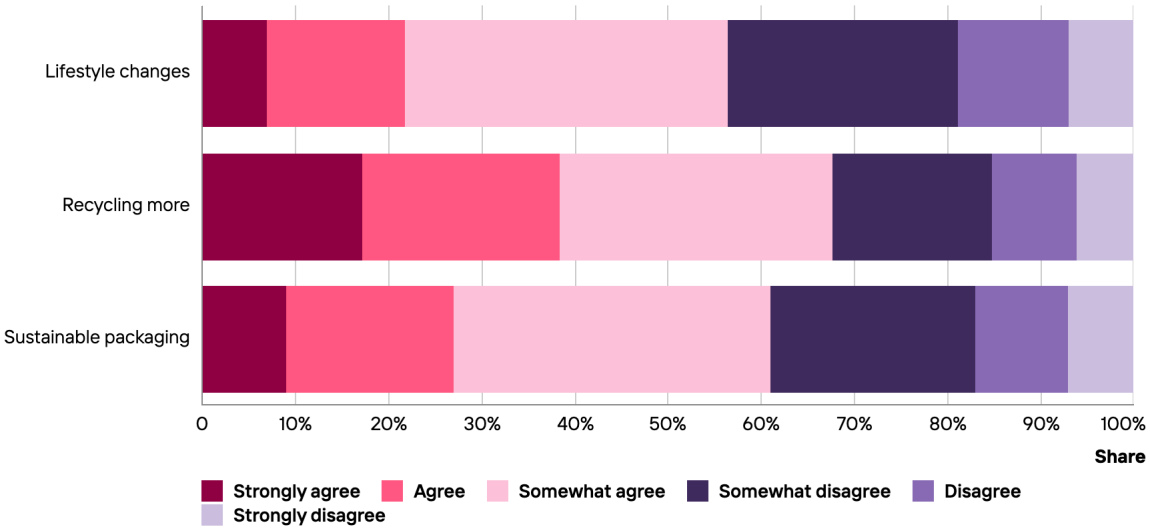
Source: IEA, "The role of critical minerals in clean energy transitions"

> "There will be no one price for copper. There will be no more one price for gold. Everything will be priced in relation... to how much global-warming gas is created in making that commodity"
>
> Robert Friedland

The pandemic has encouraged consumers to think about product value chains

Many people have made radical behavioural changes during the pandemic. More people have woken up to the environmental impact of consumer choices.

Figure 187: "Did you make the following behavioural changes during the pandemic?", %



Source: McKinsey, "Survey: Consumer sentiment on sustainability in fashion"

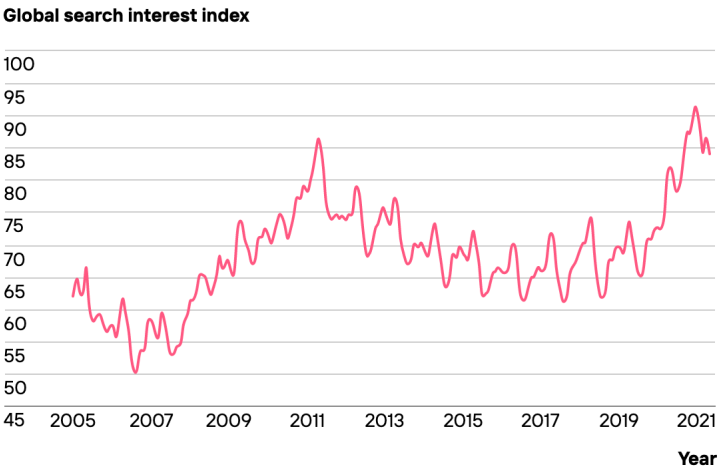
Figure 188: Survey respondents who consider environmental impact of products more because of COVID-19, by generation

Source: GlobalData, "Carbon-neutral snack foods will appeal to post-pandemic consumers, says GlobalData"

Consumer interest in sustainability is at an all-time high

Search interest in "sustainability" noticeably spiked in 2020.

Figure 189: Search interest for "sustainability", global, 2005-2021

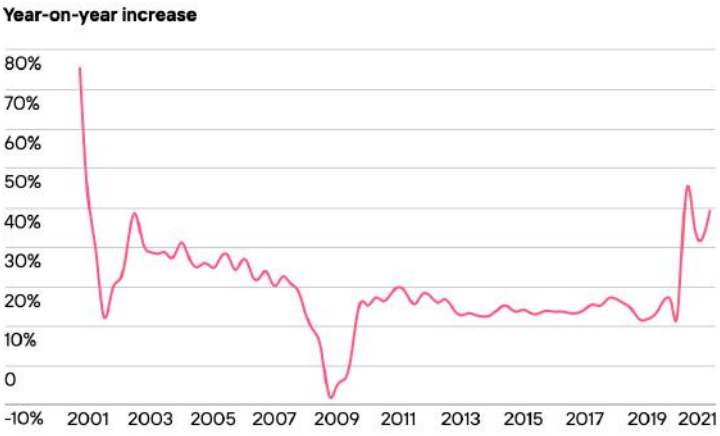


Source: Generation analysis of Google Trends data

There have been step changes in consumer behaviour

E-commerce has seen three years of growth in one. Generation's research has shown that online shopping at large retailers in the United States is 17% more carbon-efficient than visiting traditional stores.

Figure 190: Online retail sales, US, 2000-2020

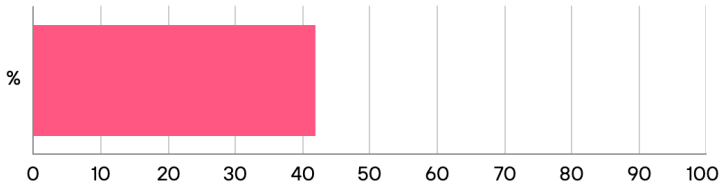


Source: Federal Reserve Bank of St Louis, "E-Commerce Retail Sales"

Though the risk of greenwashing is ever-present

Consumers face a barrage of misleading information on sustainability. In the European Union, a recent survey found that half of all claims made by traders on environmental issues came with insufficient information for consumers to judge the claim's accuracy. Just under half were false or deceptive and could therefore potentially amount to unfair commercial practice.

Figure 191: Websites with misleading claims on the environment, 2020



National consumer protection authorities had reason to believe that in 42% of cases the claims were exaggerated, false or deceptive and could potentially qualify as unfair commercial practices under EU rules.

Source: European Commission, "Screening of websites for 'greenwashing': half of green claims lack evidence"

Entrenched interests are a barrier to progress on the circular economy, but some are rethinking their business models

Figure 192: The Plastic Waste Makers index

Source: Minderoo Foundation

> "Miners are beginning to directly compete with each other in terms of their ESG credentials to win commercial advantage, reshaping their business models where needed to achieve this"

Daniel Litvin, Critical Resource

6.2 Rethinking value chains for sustainability and resilience

Investment activity in sustainable value chains has risen in recent years

This is likely to be the result of the disruption of the pandemic. However, the long-run trend is clearly towards more investment.

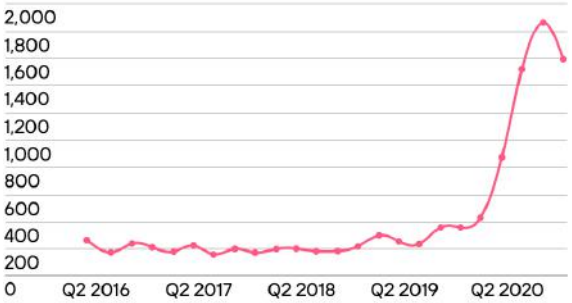
Figure 193: Private investment into sustainable value chains and circular economy, 2016-2020

Source: Generation analysis of CB Insights data

There is more emphasis on resilience in supply chains as a result of the pandemic

Mentions of "resilience" spiked last year, as more companies became concerned with ensuring that goods and services could continue to be delivered in the face of massive global disruption.

Figure 194: Mentions of "resilience" in earnings calls, 2016-2020



Source: CB Insights, "Chief Prepper Officer: Building Corporate Resilience In 2021"

Human rights violations in supply chains are high on the agenda

Concerns around human rights and cotton production go back many years, but they rose up the agenda this year with Xinjiang in western China. The response to allegations of forced labour of ethnic minorities in the region highlighted gaps between leaders and laggard companies.

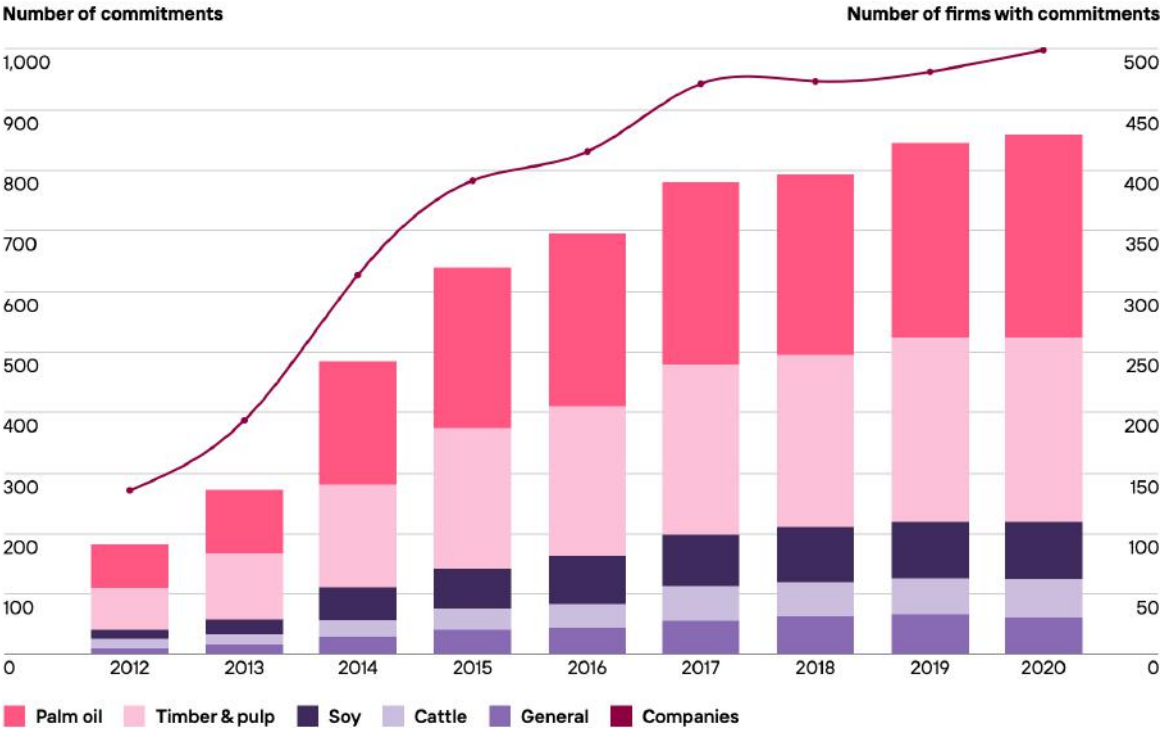
Worker in a cotton field. Xinjiang Uyghur Autonomous Region. China. Image: agefotostock/ Alamy Stock Photo

Commitments to end deforestation are common, but action lags far behind

Companies have increasingly been making commodity-level commitments to address deforestation. However, few companies are aligned with best practice when it comes to action.

In 2016, many companies agreed to end their contribution to deforestation by 2020, targets which in most cases have been missed.

Figure 195: Deforestation-related commitments in commodity supply chains, 2012-2020



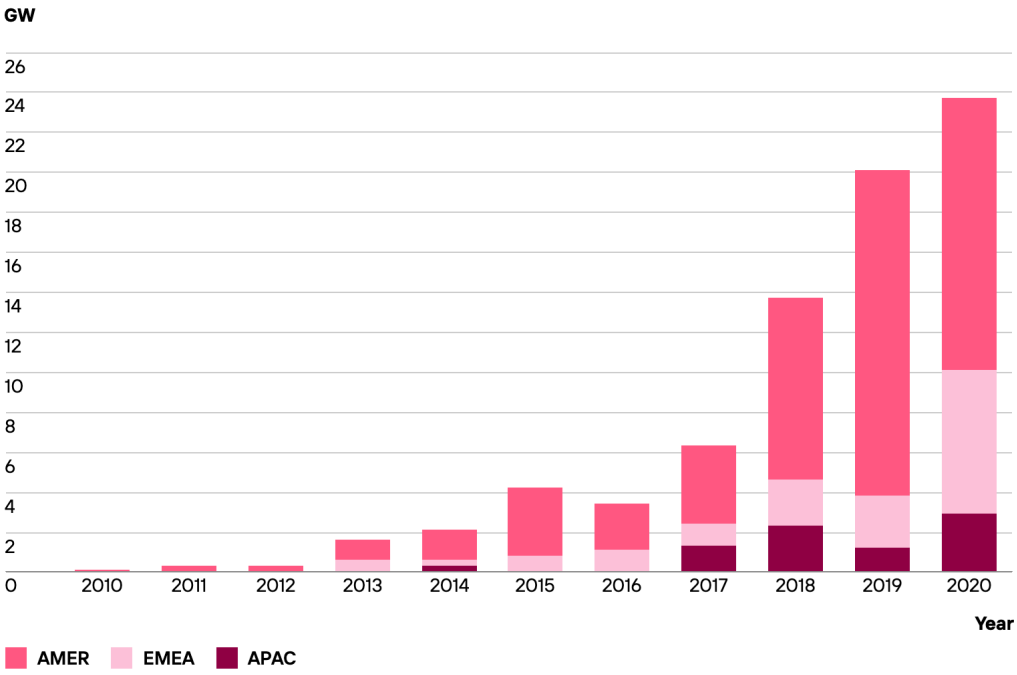
Source: New York Declaration on Forests (NYDF), "Eliminating deforestation from agricultural commodities"

> "$53 billion at risk from deforestation, yet only 1% of companies taking 'best practice' action"
>
> CDP

Companies are seeking to drive change down the value chain

A power-purchase agreement, or electricity power agreement, is a contract between two parties, one which generates electricity and one which is looking to purchase electricity. Global corporate PPA volumes are taking off.

Figure 196: Corporate purchase-power agreements, global, 2010-2020



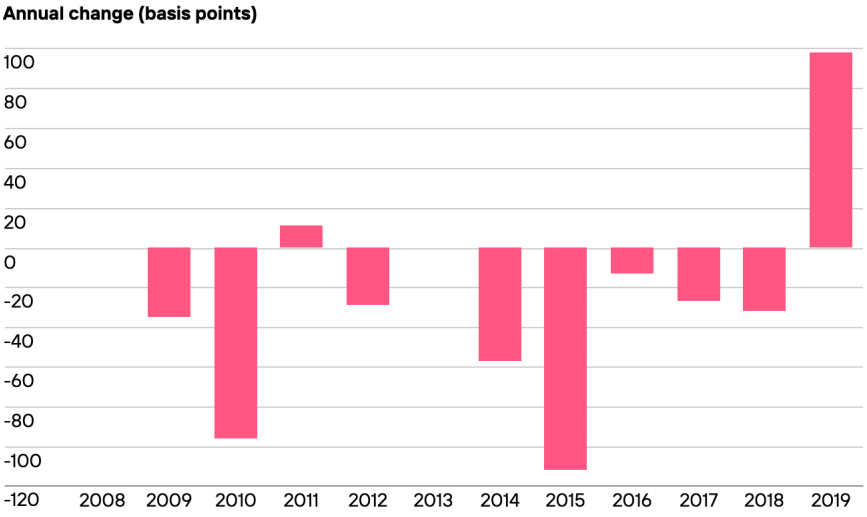
Corporations purchased a record of 23.7GW of clean energy in 2020, up from 20.1GW in 2019 and 13.6GW in 2018.

Source: BNEF, "Corporate Clean Energy Buying Grew 18% in 2020, Despite Mountain of Adversity"

And many companies are shortening supply chains in response to a variety of pressures

More economic activity is being brought back onshore, as a result of trade-war worries and a desire for resilience. A positive "import-output ratio" indicates net reshoring — the degree by which gross domestic output exceeded imports.

Figure 197: Import-to-output ratio, US, 2008-2019



Source: Colliers, "Back to the Shores | Reshoring and Onshoring"

There is increasing policy activity focused on cross-border supply chains

In the past, supply chain risks and sustainability challenges have often been governed by voluntary regimes or left to individual organisations to manage.

The EU is now expected to establish a mandatory due diligence regime for company supply chains in the coming months, aiming to raise the bar, tackle poor disclosure in key areas and avoid a fragmented approach. This builds on regulatory experience in the EU, US and other countries that has targeted specific commodities such as conflict minerals and illegal logging.

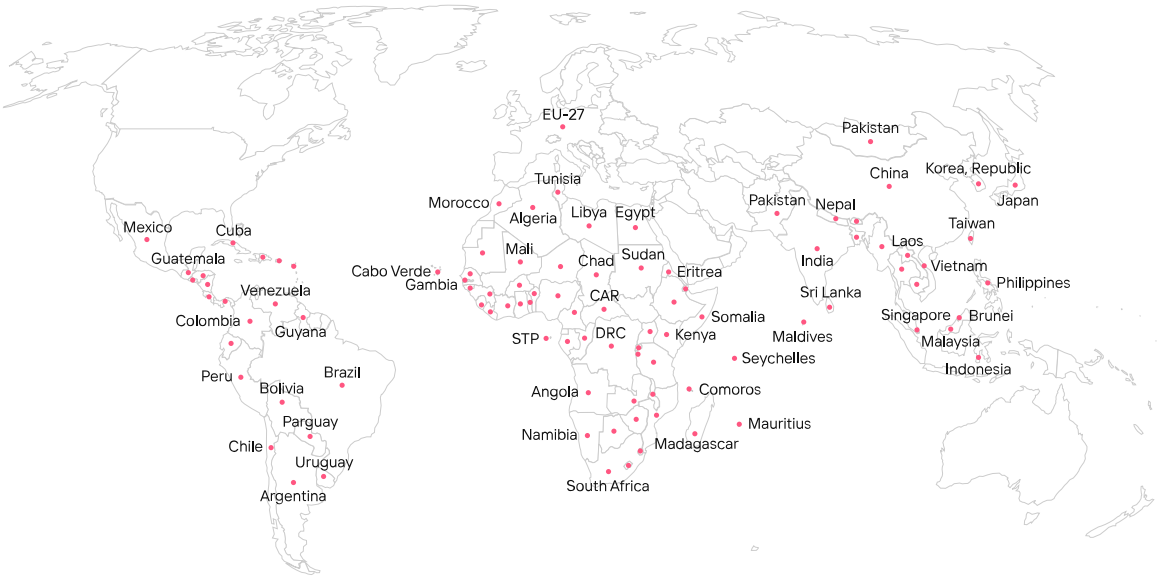
Separately, the EU is one of several jurisdictions looking to introduce a Carbon Border Adjustment Mechanism, which would apply a tariff for the embedded carbon in some goods entering the EU, where the exporting country is deemed not to be taking equivalent action on climate change. The aim is to ensure that domestic industries are not disadvantaged by tough climate policies.

6.3 Signs that the circular economy is finally taking shape

Circular-economy policies have expanded globally in the last few years

According to the Circularity Gap Report, circular-economy business models could cut global greenhouse gas emissions by 39% by 2032. Many new policy frameworks have been introduced in recent years to promote the circular economy. The aims include boosting employment and economic opportunity, reducing resource consumption and cutting emissions.

Figure 198: Circular economy policies



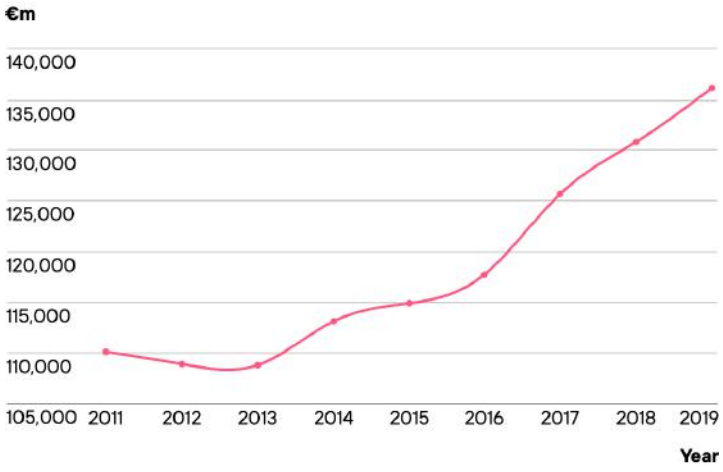
New or updated policy

Source: Chatham House, circulareconomy.earth

We have seen an upswell of public interest in plastics and other waste-related challenges

The economic value of circular-economy activity was clearly rising before the pandemic.

Figure 199: Gross value added of circular-economy sectors, Europe, 2011-2019

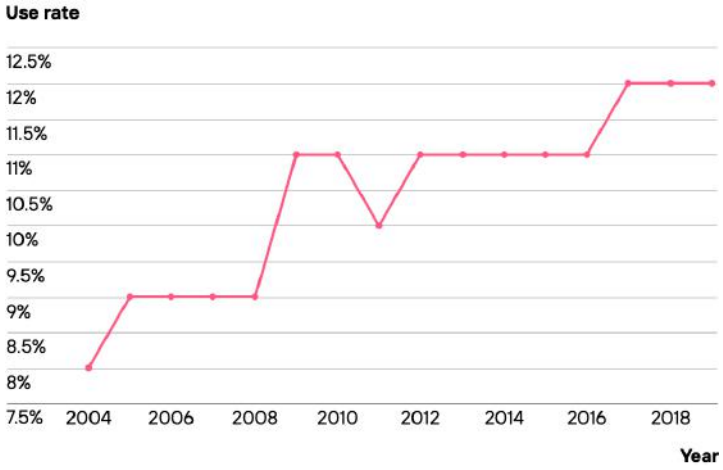


Source: Generation analysis of Eurostat data

Before the pandemic there was some limited progress towards a circular economy

The rate at which materials were reused was rising solidly in the EU before the pandemic. More waste was also being recycled.

Figure 200: Circular material use rate, EU, 2004-2019

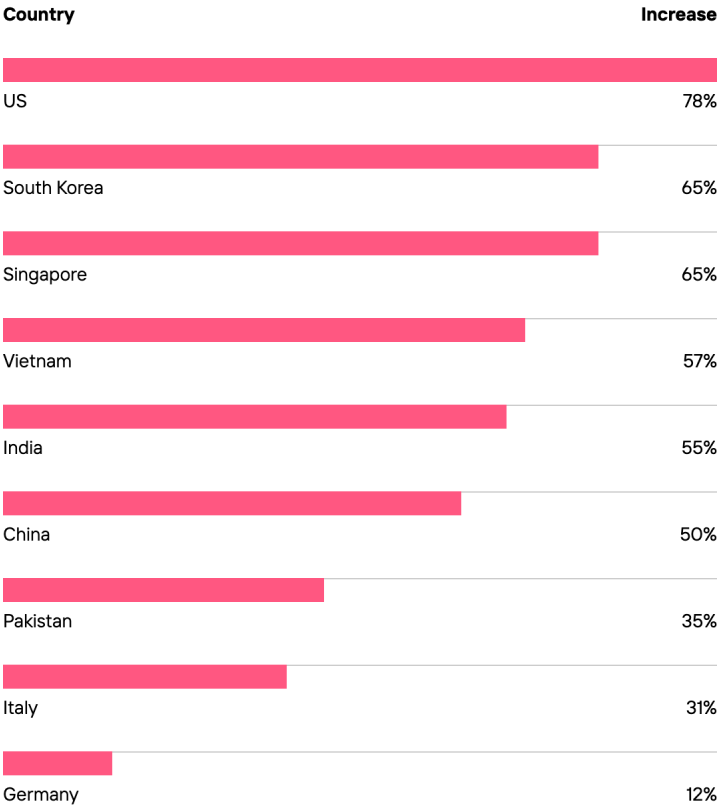


Source: Generation analysis of Eurostat data

The pandemic has been a setback for the circular economy in some respects

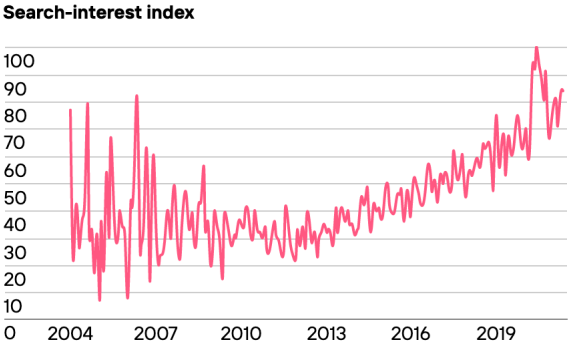
Takeout and an effort to reduce transmission have encouraged use of plastic. Interest in plastic containers has soared.

Figure 201: Increase in online shopping/takeout during pandemic



Source: World Economic Forum, "Plastics in a time of COVID-19 pandemic: protector or polluter?"

Figure 202: Search interest for "plastic container", global, 2004-2020

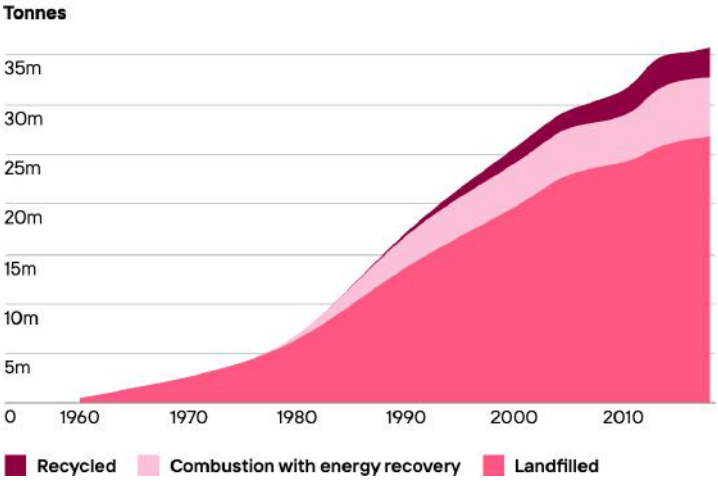


Source: Generation analysis of Google Trends

More plastic is being recycled, but overall rates are still very low

In the United States, the majority of plastic waste continues to end up in landfill. Globally, only 9% of the plastic ever produced has been recycled, according to a study by Geyer et al in 2017. Combustion/incineration is also highly emissions-intensive.

Figure 203: The fate of plastic waste, US, 1960-2018

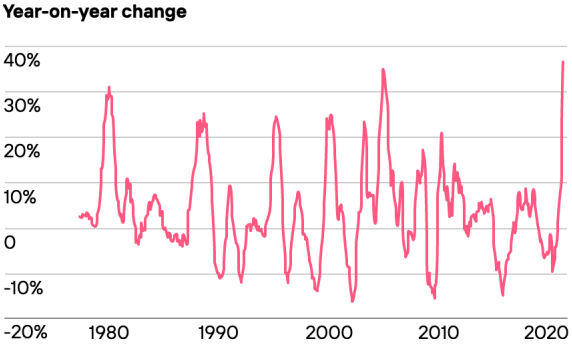


Source: ScienceNews, 27th January 2021, "Chemists are reimagining recycling to keep plastics out of landfills"

Prices for new plastic have soared in recent months, partly as a result of greater plastic consumption

Cheaper new-plastic prices have encouraged single uses.

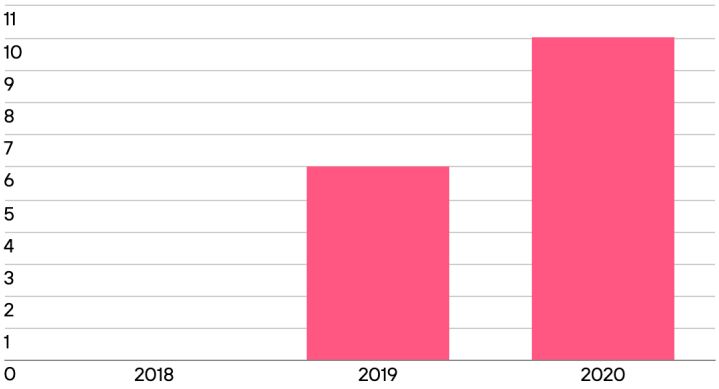
Figure 204: Plastic prices, US, 1977-2021



Source: Federal Reserve Bank of St Louis, "Producer Price Index by Industry: Plastics Material and Resins Manufacturing"

Investor interest in higher value-add circular economy businesses is rising

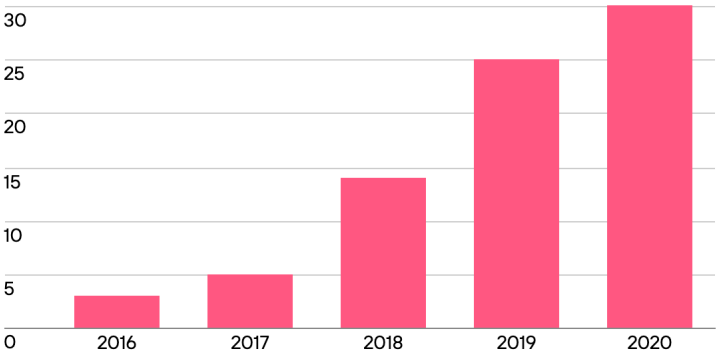
Figure 205: Number of outstanding bonds with a circular-economy focus, 2018-2020



2020 data for H1 only.

Source: Ellen Macarthur Foundation, "Financing the circular economy"

Figure 206: Number of private-market funds with a circular-economy focus, 2016-2020



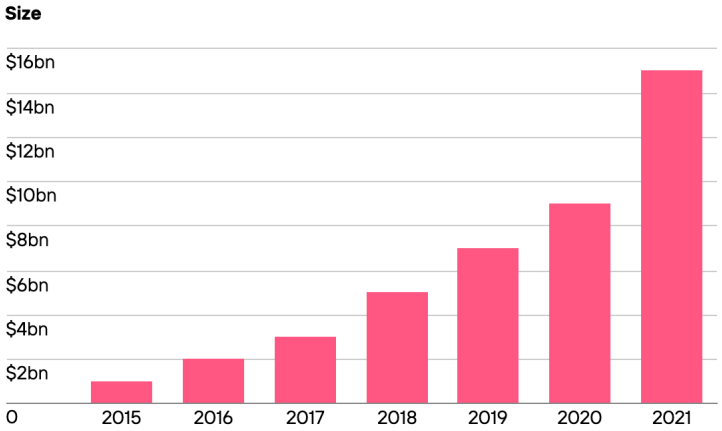
2020 data for H1 only.

Source: Ellen Macarthur Foundation, "Financing the circular economy"

Consumer attitudes to reused clothes and other goods are shifting

Fast fashion continues to grow, but resale growth is much more impressive. Online second-hand purchases are soaring.

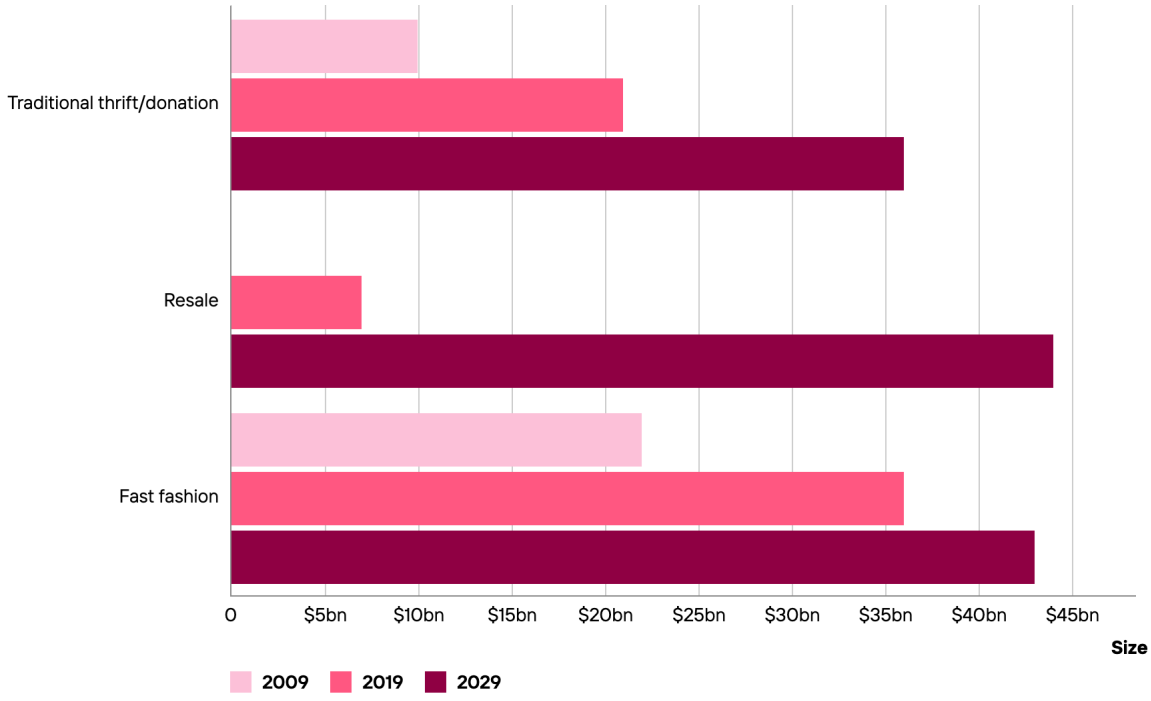
Figure 207: Market size estimates for resale sector



Resale is the sector of second-hand that includes more curated assortments, as opposed to traditional thrift and donation.

Source: thredUP, "2021 Resale Report"

Figure 208: Market value of fashion product types, US, 2009-2029



Source: thredUP, "2020 Resale Report"

Demand for used goods could be on the cusp of taking off

Global interest in used goods is rising fast, according to analysis of Google-search trends.

Image: Ikea

Figure 209: Global search interest in "used goods", 2005-2021

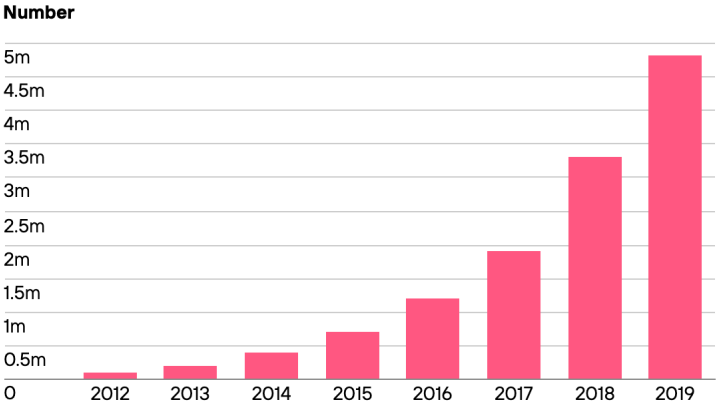
Source: Generation analysis of Google Trends

We need rapid progress on batteries, as demand continues to rise

The circular economy is much broader than the reuse of consumer goods.

For instance, as battery use continues to scale, they pose many supply chain challenges, from the minerals used in their production, through to end-of-life management. Work is underway across a number of fronts, from battery chemistries to reuse and recycling. In the EU, there are plans to implement a 'battery passport' to improve the traceability and encourage innovation.

Figure 210: Battery demand for electric vehicles, 2012-2019



Source: World Economic Forum

> "The sustainable expansion of the battery value chain offers many environmental, social and economic benefits. It will, however, not be achieved without an active shift from the current development trajectory"

World Economic Forum, Sustainable Battery Alliance

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Fig. 5  **Net-zero targets as a share of global GDP,** IMF World Economic Outlook, April 2021; ECIU Net Zero Tracker

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02 Natural Solutions

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Fig. 48 **Share of studies showing negative effects of pesticides, by taxa, 2021 estimate,** Gunstone, Tari, Tara Cornelisse, Kendra Klein, Aditi Dubey, and Nathan Donley. "Pesticides and Soil Invertebrates: A Hazard Assessment." Frontiers in Environmental Science 9 (2021): 122.

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05 Mobility & Buildings

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06 Value Chains & Circularity

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