TRANSFORMING FINANCE

A FAIR COP

50 SHADES OF GREEN

THE AGE OF EXTREMES

CARBON PRICING AND MEASUREMENT

AIQ

CLEANING UP CAPITALISM EDITION

TIME FOR A RETHINK

Aligning people, profit and the planet

AVIVA INVESTORS

Cleaning up: From the outside-in

When the global pandemic took hold in early 2020, economists were quick to label it as an exogenous shock. This thinking was (and still is) wrong.

A more rounded, systems-thinking view of the world would better capture the interconnections between human activity and zoonotic diseases. Larger lessons about internalising externalities (or 'outside' factors) and sustainability should be learned.

If we are to deal with some of the world's greatest challenges, capitalism needs a systems reboot. Many answers and solutions already exist, but with so much noise and complexity, the risk of confusion, greenwashing and unintended consequences looms large.

What we do know for certain is that piecemeal and uncoordinated efforts will not be enough to correct massive market failures like inequality, climate change and environmental degradation. Micro changes require macro changes layered on top.

As always, we do not pretend to have all the answers. Instead, we have tried to bring together some of the best ideas and opinions on how best to clean up capitalism. Fittingly, and to avoid the echo chamber issue, we blend both internal and external viewpoints to offer a more balanced view.

We look at how legal ('*Law and climate disorder*') and regulatory intervention ('*Pricing carbon*'), as well as more holistic accounting measures ('*Counting emissions and accounting omissions*') are necessary to ensure polluters pay for their contribution to the climate crisis. Beyond stick-based incentives, we explore how positive spill overs from key players can multiply through value chains ('*Supply chain ripples*') and the challenges of decarbonising heavy industry ('*The going gets tough*').

'*Cleaning up*' examines the way finance needs to transform itself for a net-zero world, while '*We need to talk about waste*' puts renewable energy under the spotlight. Rounding off our features is '*A fair COP*', which highlights the need to place people and justice at the heart of the climate transition.

These articles are complemented by wide-ranging columns and interviews from Rick Stathers, Steve Waygood, John Elkington and Alex Edmans.

As ever, we welcome your feedback, so please send any comments to me at the email address below.

Enjoy the issue.

Rob Davies,
Head of PR and Thought Leadership,
Aviva Investors

AIQ Editor

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THE AGE OF CLIMATE EXTREMES

CRISES, CASCADES AND COMFORT ZONES

The latest assessments from climate scientists suggest some geographical zones that have been lived in for thousands of years are becoming uncomfortably hot and fire-prone or wet and vulnerable to flooding. How will humanity adapt to new extremes? Rick Stathers assesses the evidence.

The human body has long proven its adaptability to changes in the environment. As air temperature and humidity changes, the systems that coordinate around 100 trillion cells work in unison to keep the body functioning. It makes adapting to temperatures between around four and 35 degrees Celsius (C)[1] relatively easy, as the diverse distribution of human settlements around the world reflects.

But what happens if global temperatures continue to rise?

This year, it has been hard to miss reports of areas where temperature records have been broken. A shattering heatwave in the Pacific Northwest, Arctic zones reaching over 30°C in summertime, and new highs in Africa are examples that continue a worrying trend. The latest climate summary from the Intergovernmental Panel on Climate Change (IPCC), published in August 2021, revealed how each of the last four decades has been successively warmer than the preceding ones, while the last seven years (2014-20) have been the hottest on record.[2]

> *There is still time to mitigate future climate impacts, but we need to think much more deeply about how to adapt*

Facing crisis cascades

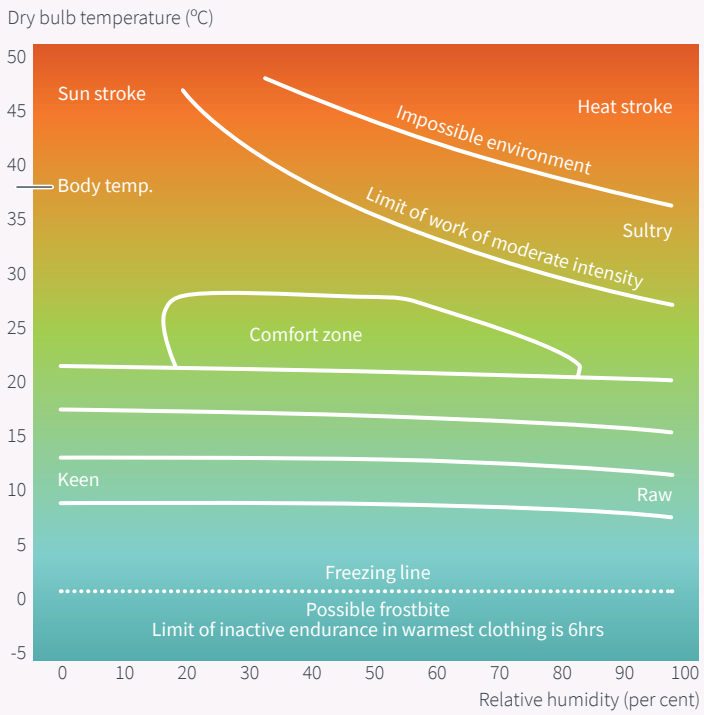
So, what does it mean on the ground? "We have a climate crisis fuelling cascading health, power, and transportation crises," noted Constantine Samaras, associate professor of civil and environmental engineering at Carnegie Mellon University in the US, as temperatures reached over 44°C in Oregon.[3] Thousands sweltered under stay-at-home orders and turned up the air conditioning. The solution backfired, though: surges in electricity demand caused cables to melt and triggered power outages.

It is a sobering reminder that much of today's infrastructure was not created for climate extremes. And there is a cruel irony in that switching on more cooling devices will worsen the problem, due to the warming impact of early generation refrigerants and the energy required to run them.

There are physical limits to contend with too in the form of an upper temperature bound above which human activity becomes difficult or even impossible (see Figure 1).

Nausea, cramp and an inability to focus have been reported in recent heatwaves, hitting lower-income groups, particularly those carrying out low-paid, physical work outdoors. At the extreme, there is a point when irreversible brain damage and, ultimately, death can occur. Issues with heat stress also exist for domesticated animals and in agricultural crops: above certain thresholds, productivity and fertility fall.

Figure 1: **Are you feeling comfortable? The human climate comfort zone**



Source: Aviva Investors, September 2021. Originally adapted by M.A. Maslin from T.R. Oke, 'Boundary layer climates', 1988.

These issues need urgent attention. "Without action to mitigate climate warming, the temperature experienced by an average person is expected to change more in the next few decades than it has over the past six millennia," wrote the authors of a recent paper published in *Proceedings of the National Academy of Sciences of the US*.[4] If warming persists, they conclude the world's hot zones might expand from one per cent to 19 per cent of the earth, with massive implications.

If fertile zones continue to become hotter and drier or atmospheric changes trigger super-charged downpours, existing food and water systems will be tested, and human productivity will fall. The hours of work lost to extreme heat will increase, which could trim GDP noticeably (in excess of seven per cent) in countries like India, Bangladesh and Pakistan, according to McKinsey.[5] Across the globe, the result might be more than a billion people on the move, seeking more temperate climes, with dramatic geopolitical consequences.

Adapting for climate extremes

This should be a wake-up call for societies everywhere because change on this scale needs to be anticipated and planned for. Data from the World Meteorological Association suggests climate and water-related disasters have already increased five-fold from 1970-2019, causing millions of deaths and costing an average $202 million each day.[7] There is still time to mitigate future climate impacts, (although the window to do that is small), but we also need to think much more deeply about how to adapt.

This is not a new question, of course, because the whole of human history has been about change. What is different is the speed at which the climate is altering (thought to be around ten times faster than in the past[8]) and the potential for cascading effects while humanity continues to live outside planetary boundaries.

For example, if a heatwave coincides with a long-running drought, as it has in the US, there is very little moisture in vegetation or soils to blunt temperatures through transpiration and evaporation. It inhibits the formation of clouds, which extends the cycle, in turn increasing fire risk. It means depleted waterways, hydro plants that cannot generate power, farmers that cannot irrigate and firefighters experiencing traumatic stress – all of which have occurred this year.

It is also worth noting the greatest climate warming is currently being reported in the poles. That has implications for the volume of snowmelt and sea level rise, and the amount of methane released as permafrost melts. It is near-impossible to anticipate how any natural feedbacks might amplify ecosystem responses. On the front line are 267 million people living less than two metres above sea level,[9] with homes vulnerable to chronic flooding in high tides and wild storms.

> *"Energy, transport and communications networks will need to be reshaped to be more resilient"*

Creating a more resilient world

In a hotter world, hundreds of millions will need support. While some assets will become wholly redundant, there will be opportunities for those creating and managing new physical infrastructure. Energy, transport and communications networks will need to be reshaped to be more resilient. The power grid will need to be hardened, potentially boosting the earnings of cable manufacturers and the producers of system controls.

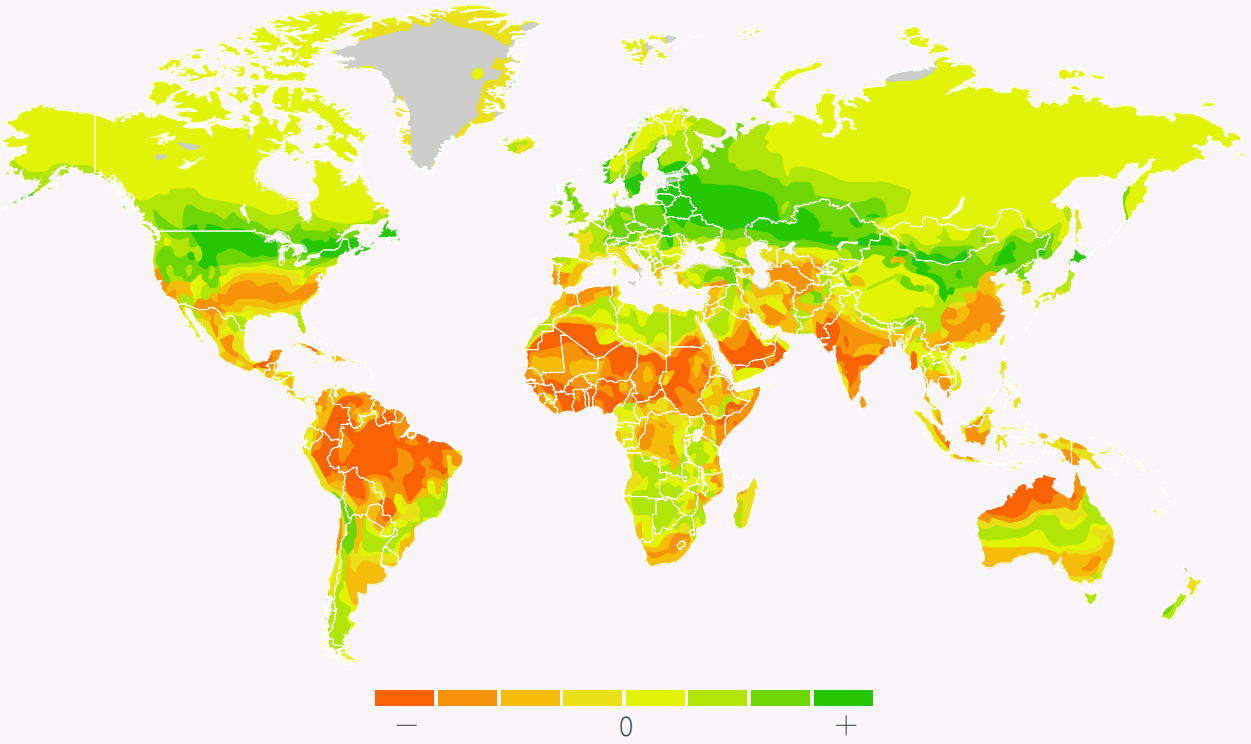
Ensuring food and water supplies are also urgent priorities. Precision irrigation could make a difference here; farmers' ability to draw on detailed data on terrain and hydrology at the field level could reduce water inputs and boost crop yields per drop. Overall, the availability of water is expected to become a much greater concern, either due to drought or on the back of extreme weather, as many different users compete for this essential resource. Companies providing technologies that can monitor leaks, enable water to be re-used or control flows of wastewater may have scope to grow.

But there are still big questions to be resolved. Who will fund the changes? Some of the most vulnerable are also among the world's poorest. Should the adaptations be hard (human-led, technological) or soft (nature-based)? These are conversations that need to be had, as climate impacts layer upon each other.

Species other than humans have already begun to change. Migratory patterns have shifted, and biologists are also investigating physical adaptations in birds and others to help them cool faster. Bacteria and fungi are shape shifting too, evolving for tomorrow's world. With all the political, social and environmental constraints, can human societies do the same?

There are no easy answers, but, with less than ten years remaining of the 1.5°C carbon budget at current emissions rates, the climate system will increasingly force us to confront these questions ●

Figure 2: **The changing human climate niche by 2070**



Note: Potential source (orange) and sink (green) areas if humans relocate to maintain existing temperature preferences.
Source: PNAS, May 26, 2020.

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WITHOUT A GLOBAL FINANCE PLAN, THE CLIMATE MOONSHOT WILL FAIL

If the world is to achieve the goals of the Paris Agreement, the international financial architecture needs far stronger coordination under a re-tooled OECD, writes Steve Waygood.

On a sunny afternoon in September 1962, President John F. Kennedy strode onto the football field at Rice Stadium in Houston, Texas. Addressing the crowd from a podium on the turf, he announced his government's ambition to put a man on the moon by the end of the decade. His speech is justly famous for its vivid rhetoric, which captured imaginations across the world.

"We set sail on this sea because there is new knowledge to be gained, and new rights to be won, and they must be won and used for the progress of all people," Kennedy said. "To do all this, and do it right, and do it first before the decade is out, then we must be bold."

What is less remembered is the note of pragmatism in the speech: Kennedy went on to explain precisely *how* the US would achieve this monumental feat. He outlined the role of NASA in leading the Apollo missions and specified the amount of additional funding the government would make available to turn America's spacefaring dream into reality – the "staggering sum" of $5.4 billion a year.[1]

> *Climate action is hampered by a lack of coordination – like a space programme without NASA*

The climate moonshot

The fight against climate change is often likened to Kennedy's "moonshot", and with good reason. Like the moon missions, it will require ambition, expertise, and an unprecedented marshalling of resources. But there are key differences.

For a start, climate change, with its globe-spanning effects and multidimensional feedback loops, is a much more complex technical problem than spaceflight – and far more expensive to solve. The International Energy Agency estimates it will cost at least $1 trillion a year to move the world economy onto a net-zero carbon basis.[2] That dwarfs the total outlay on the Apollo missions, which came to $25 billion (around $150 billion today, taking inflation into account).

Climate action is also hampered by a lack of coordination. Imagine if Kennedy had set his target without articulating a plan, and simply trusted public agencies and institutions – along with private companies with wildly divergent incentives and interests – to find a way to deliver it. That's a good analogy for the current state of the climate financing effort in the wake of the Paris Agreement – a space programme without NASA.

To mobilise the capital needed, we are relying on a patchwork of different organisations, most of which emerged in the service of a short-termist, shareholder-driven capitalist model that has proven wholly inadequate to the climate challenge. And although there are plenty of well-meaning climate initiatives, they are too often working at cross purposes.

A new role for the OECD

This is why Aviva Investors, as part of a coalition of 38 institutions from across the industry, is calling for reform of the global financial architecture ahead of the G20 meeting in Rome and the Conference of Parties (COP26) in Glasgow. By bringing together governments, multilateral organisations and financial institutions to implement an ambitious and coherent planning effort, we have an opportunity deliver a smooth and just transition for the global economy.

> *A retooled OECD could foster truly global collaboration on climate finance*

Our central recommendation is that the Organisation for Economic Cooperation and Development (OECD) assumes a new role as convenor and host of an International Platform for Climate Finance (IPCF).[3] This facility would provide technical support to countries to help them deliver on climate commitments, advise large private financial institutions on how to scale up their own climate contributions, and develop an overview of financing needs and opportunities at a global scale.

At first glance, the OECD might seem an odd candidate to lead reforms to the financial system. The organisation is often described, not without justification, as a "rich countries' club", and its role in the global economy is not always clear. But there are several reasons why the OECD fits the bill.

First, it is the pragmatic choice. The OECD is already well-funded, at around €380 million annually. It is also connected with the member states of the G20 and the UN Framework Convention on Climate Change, along with financial standards setters such as the Bank for International Settlements, the Financial Stability Board (FSB) and the International Organisation of Pension Supervisors. This means it will be ready to hit the ground running, sparing us the costly – and politically fraught – process of building a new intergovernmental organisation from scratch.

Second, it has the necessary expertise. With 2,500 specialists on its staff, many of whom are well-versed in the intricacies of climate finance, the OECD will be able to provide the requisite technical assistance to developed and developing countries, helping them to build financing strategies for their Nationally Determined Contributions (NDCs), while also facilitating access to the resources of other multilateral institutions. In providing this support while expanding its membership, the OECD could shed the "rich countries" tag and foster truly global collaboration on climate finance.

Third, the OECD already has a track record of delivering an ambitious international capital allocation project. It was established in 1948 to administer the Marshall Plan, managing the funds that went towards reconstruction in Europe after the devastation of World War II. By leading the climate finance effort, the OECD would productively reconnect with its roots.

> *America's moonshot succeeded because high-level ambition translated into a wider sense of mission*

Lessons from history

In short, a re-tooled OECD-IPCF is the best way to coordinate action to drive a more sustainable future for the global financial system – to act as a NASA for the climate moonshot.

The forthcoming G20 and COP26 meetings present an ideal opportunity to put this plan into action. As a starting point, we recommend the G20 invite the OECD to develop proposals for a standing facility to provide a secretariat for the IPCF. The OECD will also need to update its Principles of Corporate Governance to integrate climate disclosures and start to factor net-zero country commitments into its assessment procedures for new members.

Over the longer term, the OECD could also host a biennial dialogue on transition strategy, comprising its members as well as representatives from international financial institutions, the UN Development System, key civil society and philanthropic players, and the private sector.

Connecting all levels of the system will be crucial – because reform isn't just about directives from the top. For the financing effort to be successful, we must also galvanise the transition from the bottom up. One way to do this is to give individual investors everywhere more transparency on the climate implications of their pension holdings. Technological innovations, including digital tools with which individuals can make their voices heard at companies' shareholder meetings, are already helping make the system more inclusive and democratic.[4]

Think back to the NASA analogy: one reason for the success of America's moonshot was the way high-level ambition translated into a wider sense of mission: everyone involved knew what they had to do to make a difference.

Famously, Kennedy's visit to Houston in 1962 brought a chance encounter with a janitor who swept the corridors of the space centre. When the president asked what he was doing, the man replied: "I'm helping to put a man on the moon."[5]

This is the kind of clarity of purpose we need to address the climate crisis. With a robust and coordinated global climate finance plan, we can ensure governments, multilateral institutions, companies and individuals work in harmony towards our shared goals. To do all this properly, before the planet burns, we must be bold ●

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CLEANING UP

TRANSFORMING FINANCE FOR A NET ZERO WORLD

To align with net-zero emissions targets, the financial system needs a radical transformation. Can it get there and, if it does, what should it look like in 2050?

"If we don't harness markets to deliver the 2015 Paris Agreement and continue with business as usual, the long-term consequences will likely lead to economic collapse in some countries and migration to such a level we will see significant civil unrest and mounting geopolitical tensions," says Steve Waygood, chief responsible investment officer at Aviva Investors. "The likely erosion of value could be in the tens of trillions of dollars, but transforming finance now can help avoid those losses. In that sense, it's a colossal insurance plan."

As a stark example, a 2019 report by thinktank RethinkX on the future of food and agriculture forecasts exponential disruption to US beef and dairy markets. The kind of technology needed to meet the Paris goals, such as lab-grown alternatives to meat and dairy, could reduce revenues of the US beef and dairy industries and their suppliers, which together exceed $400 billion today, by at least 50 per cent by 2030 and by nearly 90 per cent by 2035. Livestock and commercial fisheries are predicted to follow a similar trajectory. This will ripple through the value chain, from farmland value to demand for animal products.

But there is a more positive flipside. RethinkX forecasts this shift will create new jobs, provide cheaper and superior food in a far more distributed, stable and resilient way, and lead to transformative improvements in the environmental impact of food production. New financial and economic value will also be created through food companies that adopt these innovations.[1] As noted in a recent white paper by the sustainability thinktank Volans, even if these forecasts are out by a decade or two, they are market-shaking prospects, creating risks and opportunities.[2]

Similar transformations are needed across all industries that require funding from the financial system, which must also manage the myriad risks that arise. A siloed climate risk management approach is no longer enough, and financial institutions must align their activities with the goals of the Paris Agreement and the Sustainable Development Goals (SDGs).

The 2021 *Finance climate action pathway* report, published by the Marrakech Partnership under the aegis of the United Nations, shares this vision, stating: "It is essential that finance and the power of markets are harnessed in the service of delivering a just and smooth transition to a resilient, net-zero-emission global economy that accounts for the climate impacts of its activities. If we transition finance in line with an under-1.5 °C, resilient future, then the result will be that the financial system enables the transition to that future."[3,4]

PART 1: FROM OUTSIDE IN TO INSIDE OUT

For the transition to be effective, finance must radically change its approach from outside in – measuring and mitigating the risks posed by climate change to finance – to inside out – measuring and mitigating the impacts finance has on the planet. This presents complex challenges, but with the key players increasingly committing to change, we can begin thinking about how the sector might evolve in the run up to 2050.

As shown by the current level of financed emissions found by Greenpeace and the WWF in a recent report, many financial institutions do not seem to grasp the urgency of the climate crisis, and the sector remains a high-carbon industry.[5] This is due to distortions in financial markets, misaligned business models, political headwinds and vested interests.

Business models and incentives

"Incentives and business models are structured around short termism," says Waygood. "This leads to a mentality that ignores the long-term problem of climate change."

While large asset owners like sovereign wealth funds should theoretically have the longest time horizons – potentially even investing on behalf of future generations – in practice they tend to invest no differently than smaller institutional investors or even hedge funds. This is in large part due to the ubiquity of modern portfolio theory and discounted cashflow (DCF) in portfolio design and management.

Waygood explains that fundamental research often tends to have a three-year view, then reverts to the mean growth rate, which fails to make any assumptions or adjustments for longer-term impacts. "DCF ignores future generations and the need to preserve natural capital by assuming all investments can grow indefinitely," he says. "We are left with millions of professional investors managing trillions of assets, all of which largely ignore the one planet boundary condition."[6]

According to a recent report by Volans, *Aligning finance for the net-zero economy*, this leads to a system in which "the vast majority of capital is deployed in secondary markets where many seemingly low-risk, high-return investments are available – not least because, since 2008, governments and central banks have effectively taken it upon themselves to underwrite financial asset prices.

"Why invest in the risky business of transforming a carbon-intensive company into a zero-carbon one, or in an unproven start-up that may develop a breakthrough climate solution, when you can put your money into an index fund, safe in the knowledge that the Federal Reserve and its counterparts around the world will prop up the market if needed?"[7]

Short termism adds to the disconnect between finance and the real economy, with profound implications for the industry's ability to help steer the global economy towards net zero. This is made worse by the absence of adequate carbon pricing as companies remain able to profit from activities that cause environmental harm (see 'Pricing carbon: Taxing polluters is the only way forward').[8]

Headwinds to political action

Unfortunately, there are several headwinds to efforts to change finance from a policy or regulatory standpoint.

CLEANING UP
continued

"I'm a baby boomer, so I begin to understand what happens to people as they age; one tendency is to become more conservative," says John Elkington, often referred to as the 'godfather of sustainability', and founder and chief pollinator at Volans. "As a result, the pensions industry is going to find itself under growing pressure to consider shorter time horizons, to build the financial returns people expect to receive on their investments. We risk seeing the necessary radical changes being slowed, stalled or disrupted by growing conservatism, with a small 'c'.

"High-frequency trading is a symptom of a much deeper malaise," he adds. "There is little or no time to consider wider consequences, intended or unintended. Some form of transaction taxation to slow the pace of speculative trading is now essential. People inside today's financial system may be nervous and argue against it, but we must do it, just as we have to tax carbon dioxide and other greenhouse gases in a robust way. But these changes are harder to achieve when you have a fragmenting political landscape."[9]

Waygood agrees, arguing the absence of a global finance or tax regulator means global carbon taxation cannot be a top-down endeavour, but instead will come through the aggregation of hundreds of different policies at national and regional levels.

Eric Usher, head of the UN Environment Programme Finance Initiative (UNEP FI),[10] believes the success of the 2015 Paris Agreement was due to its bottom-up structure, with each country deciding on its own commitments. While initially sceptical, he now thinks it can work due to growing pressure on companies and countries.

"The question is how to ensure they follow through," he says. "Companies and financial actors ratcheting up their ambitions have a very big impact through the signals this sends to governments to ratchet up their own ambitions. We need to figure out how to do it together because we are seeing progress, but we also know we are not on track to stay within 1.5 or even two degrees right now."

The entire financial system needs to be transformed, from its architecture to a new definition of fiduciary duty that encompasses climate risks, the alignment of business models, and the adequate pricing of harmful environmental practices.

PART 2: SYSTEMS CHANGE AND ADDRESSING MARKET FAILURES

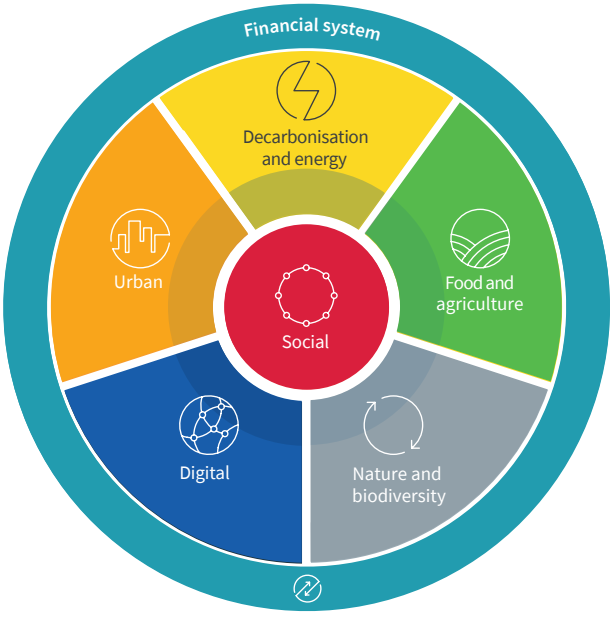
"Financial actors can no longer just focus on financial risks," says Usher. "They also need to understand the impact of their financing and, increasingly, we are going to see regulators mandating the disclosure of these impacts. The change has to be holistic and cover all systems within the organisation, including compensation.

"That means setting alignment targets, which requires an understanding of the science, and then to build risk models based on predictions for future losses, rather than just on historical losses," he adds. "That cuts across the entire financial system."

System transformation is also the approach taken by the World Benchmarking Alliance (WBA), co-founded by Aviva in 2018, which has developed several benchmarks to rank and measure 2,000 of the world's most influential companies on their contribution to the SDGs.

"We consulted at length on the areas where companies could have the greatest impact on the SDGs," says Pauliina Murphy,

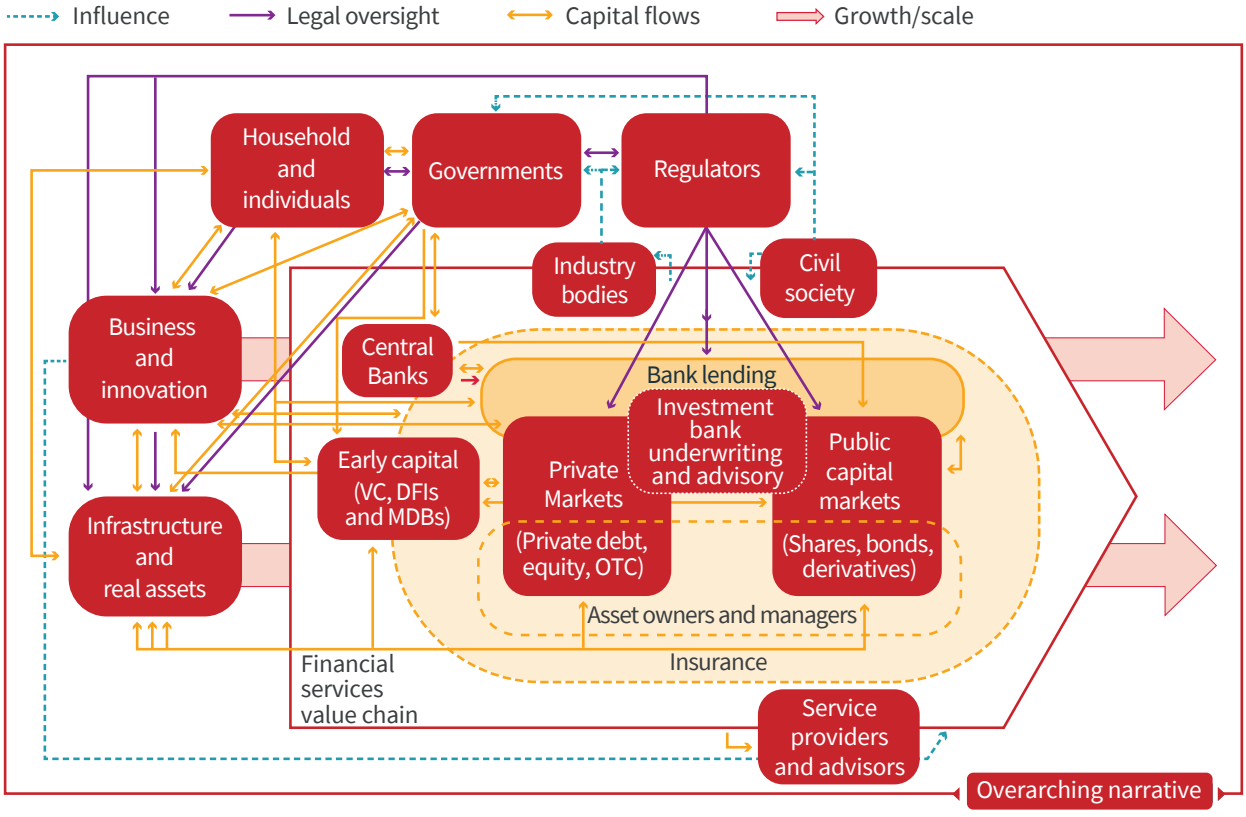
Figure 1: **The World Benchmarking Alliance's seven systems[11]**



Source: World Benchmarking Alliance, July 2019.

> *The entire financial system needs to be transformed*

Figure 2: **Finance system map[14]**



Source: United Nations Climate Change and Marrakech Partnership, 2021.

engagement director at the WBA. "Social transformation is in the middle, surrounded by five other transformations, with the financial system sitting outside. This recognises the role of finance as an enabler of the other six systems' transformations towards sustainable outcomes, but it can only play this role fully if it undergoes its transformation."[12]

Emilie Goodall, financial system lead at the WBA, believes that to truly transform a system, we must consider all its parts. This is particularly true of finance, where many of the largest institutions operate across several areas.

"We felt there was a gap in the disclosure and framework space to take that macro perspective and look at how are these things interconnected, because we are seeing great progress in certain areas but sometimes, even within the same company, the right hand is doing something quite different from the left," she says.[13]

Within the core of the international financial architecture are the three pillars of banking, insurance, and investing, which are closely interrelated.

"The institutions bank each other, insure each other, invest in each other and own each other," Waygood says. "The three pillars are regulated in discrete ways but often overlap at the board level as well as the operational level.

> *Even within the same company, the right hand is often doing something quite different from the left*

CLEANING UP
continued

> *Experts recommend mandatory disclosure of climate-related risks by companies and local authorities*

"At the heart of those pillars is the real economy, underwritten and capitalised by those three sectors, then come the national finance ministries, who oversee the central banks, who oversee the regulators, who oversee the pillars," he adds. "We need to look through that whole picture. We need to work inside out and change incentives in the real economy so that externalities are internalised. But we also need to work outside in and make sure the whole system aligns with the Paris goals. We effectively need a choreographer for climate finance globally in the international finance architecture."

To this end, in a white paper published in April 2021, Aviva Investors invited the OECD to bring forward proposals for convening an International Platform for Climate Finance (IPCF), an initiative it first called for in February 2020.[15,16]

The paper argues such a platform could enable the creation and implementation of a global investment plan to mobilise the public and private capital needed to deliver on the goals of the Paris Agreement.[17]

The IPCF would have the huge benefit of uncovering investment and commercial opportunities for financial institutions, but these also need to transform themselves by incorporating the impact of their strategies and operations in a systemic way. The idea is gaining traction and leaders in the field have begun to explore how this might play out. (See p10, *Without a global finance plan, the climate moonshot will fail*).

PART 3: DATA, DISCLOSURES AND MACRO STEWARDSHIP

The UN's *Finance climate action pathway* report states that to reach net zero by 2050, "every financial decision must take climate change into account and financial flows must be consistent with low greenhouse gas emissions and climate-resilient development".

Goodall believes this must start with financial institutions implementing an intentional strategy to lower their own carbon footprint, use their political influence, and change the way they lend, underwrite and invest.

UNEP FI's Usher agrees. "Investors, banks, insurers and others are getting better at managing the risks to their own operations, what I would call the 'outside-in' impact of environmental or social degradation on one's financial assets," he says. "However, if we manage all the risks but still only finance green activities at the margins, we are not going to be addressing climate or other sustainability risks. Focusing on the 'inside out', there is growing awareness that economic actors need to understand the impact they have on the environment and on social objectives.

"As a bank, it's no longer about managing your paper or energy consumption," he adds. "Those are relevant topics, but obviously the most important area for any financial actor is the impact its clients have. This all fits within the goal of moving from green transactions to green institutions."

It also follows that senior leadership must be on top of the issue, including by having sufficient expertise at the executive and board level.

"If you can track the science, it allows you to see through a confusing policy landscape," says Usher. "Carbon is not priced in everywhere, but if you follow the science, you realise climate change is getting worse. Assuming policy will follow science eventually, using science may well be the most responsible fiduciary approach to take."

As the UN's *Aligning finance for the net-zero economy* white paper explains, until emissions are adequately accounted for, the way public and private financial institutions approach de-risking net zero-aligned finance is vital to solve the mismatch between investors and financiers' risk appetite and the risk-return profiles of investments needed for the transition. While negative de-risking strategies such as exclusion policies have a role to play, not least in managing stranded assets, what is needed now is positive de-risking – collaborative models for risk and reward sharing such as public-private partnerships – applied at scale.[18]

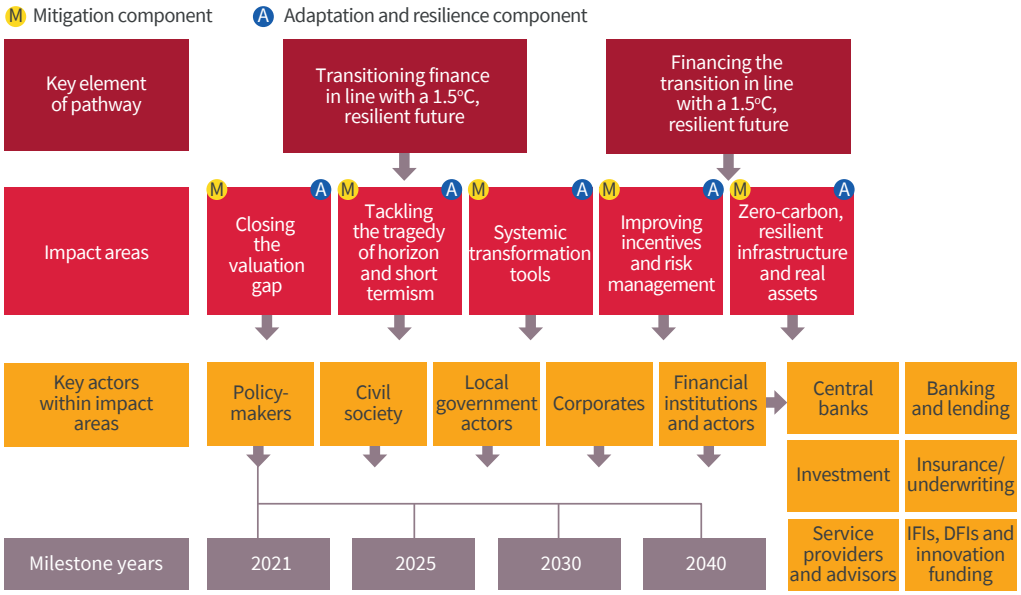
Data and disclosures

All the experts agree data will be key. The *Finance climate action pathway* report recommends mandatory disclosure of climate-related risks by companies, local authorities such as cities, and at the asset level, so financial institutions can better integrate those risks into their decisions. It also calls for regulatory oversight and macroprudential intervention over financial institutions' use of data to form transition plans and science-based short- and long-term targets for decarbonising financed emissions. As transition plans and targets are also required in the real economy, this could create positive feedback loops.

"In climate-risk disclosure, the challenge is to not predict the future based on what failed in the past," adds Usher. "This calls on institutions to build risk models based on scientific predictions for future losses. Increasingly, the requirement will be not to wait for the data to be perfect, but to start taking action based on the data available and adjusting the models as we go forward."

This should also be supported by updated accounting standards, auditing practices and listing rules on stock exchanges, so the true cost of climate risk is reflected on balance sheets – and in institutions' financing activities.[19] Encouragingly,

Figure 3: **Finance climate action pathway overview[21]**



Source: United Nations Climate Change and Marrakech Partnership, 2021.

some progress is happening in this area, with the IFRS Foundation establishing a Sustainability Standards Board in June 2021, which aims to encourage corporations to disclose their sustainability impacts[20]

Macro stewardship

Waygood believes regulators and financial institutions working in partnership – which he calls macro stewardship – is the best way to address market and regulatory failures.

"It's clearly in our clients' and our own interests to work in partnership towards a new vision," he says. "Financial institutions can tell regulators where the market failures lie, both together can explore how they might be corrected, and regulators can deploy the levers of change, such as fiscal measures or market mechanisms like trading schemes. The more investors join forces, the more change we can achieve."

Usher agrees the relationship between market actors and regulators will be key, even though historically the common view was that private institutions should not engage on topics like climate change until they were regulated to do so.

"That no longer holds true because, as these issues become increasingly complicated, it's very hard for regulators to mandate out of the blue," he says. "It's much more effective if market actors lean in voluntarily. For example, with climate-risk disclosures, when leaders started to issue voluntary disclosures based on the Task Force on Climate-Related Financial Disclosures (TCFD) recommendations, they showed how it could be done by developing scenario-based models, and regulators learned from that. In markets where regulators decide to mandate those disclosures, they can do so based on what has been done voluntarily."

However, he adds financial institutions can only do so much. "If some financial institutions stop financing coal but others don't, regulators or policymakers need to figure out how to ensure the coal stays in the ground," he says.

> *"Financial institutions can tell regulators where the market failures lie, both together can explore how they might be corrected, and regulators can deploy the levers of change"*

CLEANING UP
continued

PART 4: REGULATION, THE FINANCIAL TRANSITION AND SECTOR SPECIFICS

Financial regulators around the world are waking up to this and beginning to set out their expectations, helpfully recapped in a paper published in early 2021 by consultancy EY.[22] Though guidelines vary across jurisdictions, they cover aspects of governance and strategy, including reshaping business models and aligning remuneration policies, as well as risk management and disclosure rules. For instance, a growing number of jurisdictions are considering or implementing mandatory TCFD reporting, with New Zealand and the UK among those ahead of the pack.

"The UK government legislated in the Pension Schemes Bill in early 2021 for TCFD to become a mandatory requirement for pension schemes," notes Simon Oswald, senior public policy manager at Aviva. "That has since been extended, and the UK will be the first G20 country to mandate TCFD across its entire economy."

Climate-risk stress tests for banks are also becoming more widespread. Two first-movers, France and the UK, conducted such tests in 2021, closely watched by other regulatory authorities. The tests differed from traditional banking stress tests by including a longer time horizon (30 years), broader geographic exposures, and a sectoral/counterparty level modelling approach. According to the EY report, other authorities have similar tests planned in the coming months.

This was one of five key recommendations made by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) in a 2020 guide for integrating climate-related and environmental risks into prudential supervision, alongside determining how climate risks transmit to economies, clarifying their expectations towards financial institutions, and ensuring these manage and mitigate climate risk.[23]

In April 2021, the Basel Committee on Banking Supervision published a paper on climate-related risk drivers and their transmission channels, developing a framework for the modelling and management of climate risk for banks.[24]

In the same month, the European Insurance and Occupational Pensions Authority (EIOPA) published an opinion piece aiming "to foster a forward-looking management of [climate] risks to ensure the long-term solvency and viability of the industry". It called on national supervisory authorities to require insurers "to integrate climate change risks in their system of governance, risk-management system and own risk and solvency assessments (ORSA), on short- and long-term time horizons and through scenario analysis".[25]

Supervisors are also considering changes to capital requirements, and the integration of climate-related risks in business models, governance and risk management, and liquidity and funding. However, most consider they need more time to assess potential changes, as these present several challenges.

"Long-term vulnerabilities cannot be fully captured when capital adequacy is calibrated primarily within a one-year time horizon," the EY report states. "Lack of empirical evidence, granular data and modelling capabilities also hinder the quantitative assessment of the underlying risk, as financial authorities review the need and possibility of adjusting capital treatment of exposures associated with particularly high (or low) climate risk while ensuring that the prudential framework remains risk-based."

In terms of using capital requirements to incentivise investments into the net-zero transition, James Hughes, senior manager for EU and international public policy at Aviva, says there is intense regulatory debate about whether to give green investments more favourable capital treatment, even without evidence they are lower risk (green supporting factor), or whether to apply a brown penalising factor to emissions-intensive investments. Opponents of the green supporting factor worry it would sever capital requirements from the fundamentals of a risk-based prudential framework.

"An alternative approach for insurance that sidesteps some of these issues could be to look at capital requirements at a portfolio rather than individual asset level," adds Hughes. "The overall solvency capital requirement (SCR) is calculated as normal, but you then calculate the warming potential of your entire portfolio of assets to determine whether it is aligned with the Paris targets. A regulator could then apply a discount or charge to the entire SCR depending on your alignment to Paris."

This would offer a solution to the current framework, which rewards those assets that are well understood, whether issued by listed companies or able to demonstrate a long track record for a better credit rating. "The absence of a long track record can be used to justify unfavourable treatment of an investment in a new company or technology," explains Hughes. "There is quite a lot that makes it more difficult to invest in the transition."

It would also be a tangible step towards incorporating the concept of double materiality into insurance, one of seven initiatives recommended by responsible investment advocate ShareAction.

In fact, while regulators and supervisors are giving the issue serious consideration, the key challenge is, to date, they have been almost entirely focused on risk assessment and mitigation – the outside in – and do not

> *A growing number of jurisdictions are considering or implementing mandatory TCFD reporting*

yet make any proposals for inside-out impact assessment and management.

"Mandatory TCFD reporting is a big step forward, but it shouldn't be seen as an end in itself because it only focuses on the impacts of climate upon the company," says Oswald. "You need to look at double materiality – your impact on the climate and how you are going to transition towards net zero as a company, so the next piece of the jigsaw will be net-zero transition plans.

"Many companies are now making net-zero commitments," he adds. "We need to make sure those actually translate into real-world emission cuts, so we would like transition plans to become a mandatory requirement for financial institutions, also explaining how they are going to achieve net zero."[27]

Sector requirements

Given the complexity of the financial system, concerned parties have been convening to propose clear steps each sub-industry participant can take to achieve net zero and transform finance. Two papers go into detail on a sector-by-sector basis, namely the UN's *Financing our future* update report and the *Finance climate action pathway action table*, published alongside the eponymous report.

Both expert groups propose increased climate-risk disclosures, transition plans and targets, carbon pricing policies, the integration of climate risk in business-as-usual risk management and underwriting, and a scaling up of investments in net-zero and resilience solutions.[28,29]

Like the NGFS for central banks, many coalitions have formed to explore the best transition pathways and most impactful changes financial institutions can make. Several have been convened by the UN and were formed under the aegis of UNEP FI, such as the Net Zero Alliances, and the *Finance climate action pathway* recommends businesses join these groups to further their transition plans. Indeed, partnerships and alliances enable financial institutions not only to collaborate on developing solutions, but also to join forces to increase their influence.

Partnerships, coalitions and collaboration

Eric Usher says UN Secretary General António Guterres considers the Net Zero Asset Owner Alliance the gold standard initiative, because its members are issuing 2025 targets built on a science-based pathway to net zero.

"This group of investors [including Aviva] have been at the forefront, not only for setting targets, but also designing methodologies to assess how they have been implemented," he explains. "The investors have worked together to break it down across sectors like energy, transport, cement and steel, and agriculture and, for each of these sectors, to figure out a science-based pathway to net zero. This then allows investors to work with companies to help and nudge them to be on the right side of the transition.

"Insurers also play a critical role," adds Usher. "Some US coal companies could go bankrupt and no longer have much value from a capital markets perspective but will continue to operate even in bankruptcy. Insurers who insure such facilities will therefore have much more leverage over them than investors. Banks also have relationships with companies and can apply pressure."

The WBA's Goodall agrees. Beyond informing investors and consumers of the sustainability performance of companies, the benchmarks' other function is to allow investor coalitions to use the results in their engagement activities.

"A group of investors can take the findings and really engage either with laggards or on key issues that don't seem to be progressing, so the engagement can be very targeted," she says. "This is just a subset of the financial system, which is shareholders, but over time we would love to explore how we could use the benchmark results to engage bondholders or underwriters."

Other initiatives come from different sectors and call on financial institutions to help finance their transition. For instance, the Mission Possible Partnership, which aims to decarbonise heavy industry and transport, has detailed plans to bolster the business case for investment in the sector's transition, develop a granular investment roadmap and help financial institutions assess transition risks and opportunities on a sectoral basis, taking into account in-sector decarbonisation pathways and probable evolutions in demand.[30]

Goodall believes a system transformed in this way would see every financial institution making decisions in line with planetary boundaries and societal conventions. "If those considerations were systematically brought in at every level of decision-making, we would have a more sustainable financial system that would benefit people and the planet," she says.

> *Partnerships and alliances enable financial institutions to collaborate on developing solutions and increase their influence*

CLEANING UP
continued

> *Expectations about what future banking, insurance and investment might look like will be blown apart by innovators*

PART 5: THE FINANCE TRANSITION S-CURVE

The authors of the *Finance climate action pathway* report share Goodall's vision, hoping that by 2050, financial markets, institutions and systems will be in place to support and fund a resilient zero-carbon economy and society, ensuring temperature rise remains limited to 1.5 °C.

"Climate justice, equity and intergenerational fairness are now cornerstones of a financial system that is based on the embedded understanding of double materiality, so the impact of investments on sustainability is a consideration as much as the impact of sustainability factors on the value of those investments. The long-term investment horizons of the system now only reward those whose purpose has people and the planet at its heart."

The report's mission statement concludes: "Greater trust has been built in the financial system on a foundation of circular economies supporting a fair and just increase in living standards across the world's communities."[31]

Usher believes this transformation is beginning to happen. "Although scientists often see things changing in a linear fashion, capital markets are quirky and can quickly change. If a business is not managing and engaging on issues appropriately, its value can rapidly dissipate," he says.

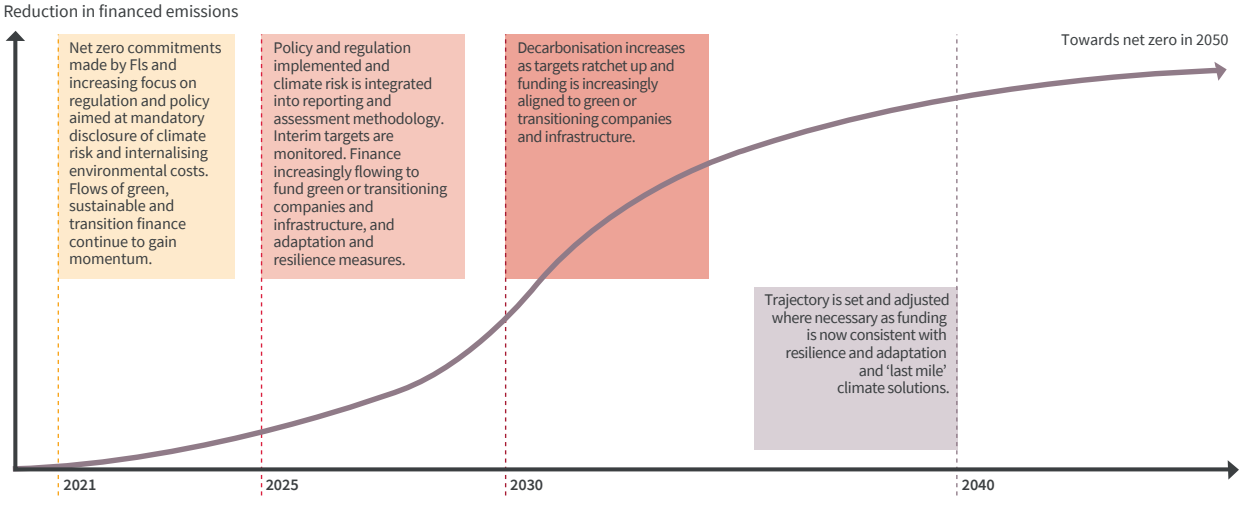
While policy reforms are not happening as fast as he would like, he points to the change in time horizon, which is now impacting financial markets.

"In 2015, everyone still thought of climate change as an end of century notion, but over the last six years we have shifted the focus to 2050, and now even 2030 or 2025," he notes. "Internal combustion vehicles are being phased out in many markets by the 2030s, so automakers that have not switched to electric vehicles are already suffering in terms of their valuations. The response has come into the business cycle: if we aren't acting today, we are exposing ourselves, our clients and our shareholders."

Elkington concurs. "In some ways, I am strangely optimistic," he says. "We have talked about needing system change for years, decades even. But when you try to change an existing system, there is often internal resistance. Vested interests, the incumbents, do not wish to see that change. But when the established system begins to disassemble, the opportunities to create something different are radically greater than in "normal" times.

"New actors are appearing and will continue to appear; the Elon Musks of the financial future, if you like. Some of the expectations we might have about what future banking, insurance and reinsurance and investment might look like will be blown apart by these innovators," he adds.

Figure 4: **The finance transition S-curve**[32]



Source: United Nations Climate Change and Marrakech Partnership, 2021.

THE ROLE OF CENTRAL BANKS AND SUPERVISORS

The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) is another example of how different bodies can and should influence each other. The NGFS was set up in 2017, when eight central banks and supervisors joined forces to gain a better understanding of how climate change could impact their mandates. The network has since grown to 95 members, highlighting that factoring in the impact of climate change has become a core part of central banks' and supervisors' role.

"We are responsible for price and financial stability and we have to care," says Dr Sabine Mauderer, executive board member at the Deutsche Bundesbank. "Climate change and other ecological threats are a significant source of financial risk, which raises the interest of central banks. From a financial stability standpoint, not only do we see the physical risk, but also transition risk; the latter describing the cost of the transition to a more environmentally-friendly economy.

"Because of those two major sources of financial risks, we also take care as banking supervisors because banks' balance sheets are exposed to climate risks as well," she adds.

Getting back to central banks' own operations, in March 2021 the network published a report setting out nine measures central banks can take to deal with climate change in their market operations (see Figure 5).[33]

"We did not make recommendations because we have a wide variety of mandates across our members, but all of them can implement the suggested measures," says Mauderer.

One set deals with managing climate risk in asset purchases. The second regards collateral required when central banks lend money to banks, and whether to accept only certain types of collateral and require additional disclosures. And the third covers credit operations.

Figure 5: **Nine options to adjust central banks' operational frameworks to climate risks**

Credit operations
1. Adjust pricing to reflect counterparties' climate-related lending
2. Adjust pricing to reflect the composition of pledged collateral
3. Adjust counterparties' eligibility
Collateral
4. Adjust haircuts
5. Negative screening
6. Positive screening
7. Align collateral pools with a climate-related objective
Asset purchases
8. Tilt purchases
9. Negative screening

Source: Network for Greening the Financial System, March 2021.

"Some central banks already practice targeted lending, either only lending to financial institutions that have a positive impact on the climate or offering them lower rates," says Mauderer. "Our report is aimed at central banks, but it can also be helpful for private investors and companies because it shows how we try to mitigate climate risk on our balance sheets, which is also an issue for private financial institutions. And secondly, our measures are linked to our requirements for private issuers. If we begin asking issuers to provide more information on their carbon footprint before we can accept their bonds for an asset purchase or as collateral, that is something they need to know in good time."

In addition, Mauderer explains that, while central banks do not have a mandate to determine climate policy, their analytical capabilities are widely recognised, and they could use them to raise governments' awareness of the urgency of the issue.

"If we conducted scenario analyses showing the economic outcome of climate change in certain jurisdictions, such as its effects on GDP, inflation, employment and so on, we could really raise awareness," she says.

> *"Central banks could use their analytical capabilities to raise governments' awareness of the urgency of the issue"*

CLEANING UP
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EXAMPLES OF KEY INITIATIVES

As set out in the *Finance climate action pathway – action table* for goals 1 and 2.

1. Goal: Closing the valuation gap

	Transitioning finance	Financing the transition
Central banks	• Require financial institutions to report in line with TFCD • Require annual climate-risk stress-tests • Exercise supervisory and prudential authority to ensure financial institutions are pursuing all necessary measures to align with net zero • Update monetary frameworks and models to account for climate impacts on macroeconomic outcomes	• Ensure all lending, refinancing and asset purchase activity is aligned with achieving net zero emissions by the 2040s and promoting adaptation/resilience to climate impacts
Banking and lending	• Commercial banks fully implement TCFD recommendations • Commercial banks align all commercial activities with net-zero emissions and fully embed costs from climate impacts by the 2040s, with executive compensation tied to interim targets • Commercial bank lending / investment / underwriting activity fully aligned with phase-out of coal in OECD by 2030 and worldwide by 2040 • Commercial banks publicly support updates to carbon pricing • Commercial banks engage with public finance institutions to ensure public finance is maximally deployed for investment in climate solutions in developing countries	• Commercial banks increase underwriting of corporate-issued certified "green" or "climate" bonds • Demonstrably advantageous terms available for lending and investments aligned with achieving net zero emissions by the 2040s and / or promoting climate resilience • Commercial banks to materially invest in climate solutions in emerging markets, including via blended finance • From 2040, all investment, lending and underwriting to be aligned with net zero and resilience, including in emerging markets
Asset owners	• Require investee companies to follow TCFD recommendations, apply an internal carbon price and follow IASB carbon accounting guidelines • Fully implement TCFD recommendations, including by assessing climate-related physical, transition and liability risks across their portfolios, implementing climate-competent governance, and undertaking scenario analysis • Publicly support ratchets to carbon prices • Align all portfolios with net zero and resilience by 2040	• Increase investments in green bonds and climate solutions, including in emerging markets • Call on asset managers to increase the range of investment vehicles aligned with net zero, until all investment vehicles are aligned
Asset managers	• Require investee companies to follow TCFD recommendations, apply an internal carbon price and follow IASB carbon accounting guidelines; engage with companies to encourage them to align with net zero and resilience pathways • Engage asset owners to commit to net-zero pathways • Challenge investment consultants to improve their advice on climate risks and opportunities • All portfolios and mandates net-zero aligned by the 2040s	• Increase investments in green bonds and climate solutions, including in emerging markets • Develop new investment vehicles until all are aligned to net-zero and resilience

	Transitioning finance	Financing the transition
Insurance	• Require insured and investee companies to adopt the TCFD recommendations and an internal carbon price • Adopt and ratchet exclusion policies to align underwriting with net zero, and publicly announce intentions and timelines for exiting high-carbon markets	• Increase investments in green bonds and climate solutions • Increase the range of underwriting products for mitigation and resilience • Curtail underwriting for companies and projects with outsized climate-risk exposure or those not net-zero aligned until all underwriting products are net-zero aligned • Increase investments in emerging markets
IFIs, DFIs and innovation funding	• Track and publish alignment of capital flows to net zero • Call for increased carbon prices • Align all funding programmes to net zero and resilience	• Maximise leverage of private capital for investments in climate solutions • Prioritise the development and commercialisation of solutions to address residual emissions and negative emission technologies
Service providers and advisors	• Investment consultants' products, strategies, business models and advice align with net-zero emissions by the 2040s • Credit ratings take into account the value of climate-related risks, resulting in improved ratings for governments and companies aligned with achieving net-zero emissions by the 2040s and taking material steps to increase climate resilience • All major stock exchanges require TCFD-aligned climate risk assessment and disclosure as a condition of listing • Index providers expand indices aligned with net-zero emissions by the 2040s and/or supporting climate resilience • Accountants are trained to assess climate-related risks consistent with IFRS Sustainability Standards • Data providers serving the financial sector have closed data gaps related to financed emissions, including Scope 3 emissions of investees • Auditing firms regularly assess accuracy and completeness of financial statements as to material climate-related financial risks	• Investment consultants' products and strategies are all in line with achieving net-zero emissions in this decade and supporting climate resilience • Cost of capital is lower for governments and companies on track to achieve net-zero emissions by the 2040s with improved climate resilience, and the cost of capital is prohibitively high for any new investment in carbon-intensive infrastructure

CLEANING UP
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2. Goal: Tackling the *Tragedy of the Horizon* and short-termism

All	Adopt TCFD recommendations, join net-zero alliances, engage with policymakers, align all business initiatives with net zero, request strategic transition plans from corporates including short- and long-term targets
Central banks	• Develop a net-zero roadmap including long-term expectations and near-term actions. Including the promotion of liaison and coordination between central banks, supervisors and policymakers • Make net-zero a core element of supervisory practice at micro and macro levels • Require all regulated financial institutions to submit net-zero transition plans, as well as addressing climate risks in regulatory ratios
Banking and lending	• Gradually restrict financing to transition infrastructure projects and companies that actively demonstrate just transition and regenerative outcomes such as circular material flows, community resilience building, ecosystem restoration
Asset owners	• Align asset manager mandates with net zero • Develop transition plans; Select benchmarks aligned to net zero; Set % targets for investments in climate solutions • Set KPIs or SLAs for service providers, consultants and advisors • Gradually move to a long-term horizon being business as usual
Asset managers	• Report on engagement, voting and policy outcomes • Align individual remuneration with net zero • Align mandates and products to net-zero commitments, with associated reporting and disclosures providing clients and end beneficiaries with informed choices, which results in increased flows to net-zero aligned products and climate solutions
Insurance	• Underwriting risk horizon increasing over time as more information about the transition and physical risks becomes understood • Require climate risk disclosures (TCFD and transition plans) as part of underwriting due diligence • Underwriting decisions aligned with net zero and non-aligned companies find underwriting costs increasingly prohibitive
IFIs, DFIs and innovation funding	• Develop and operate clear strategies for investing in transition sectors in ways that ensure resilient livelihoods and community/worker rights are designed in from the start • Ensure finance is only provided to transition infrastructure projects and companies that actively demonstrate integration of just transition and regenerative outcomes such as circular material flows, community resilience building, ecosystem restoration
Service providers and advisors	• Consultants able to provide advice on climate risks and the best methods to make a transition to net zero, as well as the most appropriate investment strategies to do so • Credit ratings now integrate climate and transition risks. Agencies deploy updated ratings so that they go beyond current ESG and impact issues to assess contributions of infrastructure to just transition and planetary health • Stock exchanges disclose trajectory and implied warming potential of exchange, and % of companies listed with net-zero targets • Sustainability financial accounting and reporting becomes business as usual

Note: See the *Finance climate action pathway – action table* for the full recommendations across the four goals.

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27 'Aviva joins forces with WWF: New partnership calls on government to commit for a greener financial system ahead of COP26', Aviva, June 18, 2021.
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29 'Finance climate action pathway - action table', United Nations Climate Change and Marrakech Partnership, 2021.
30 'Making Mission Possible: Delivering a net-zero economy', Energy Transitions Commission, September 2020.
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32 'Finance climate action pathway - action table', United Nations Climate Change and Marrakech Partnership, 2021.
33 'Adapting central bank operations to a hotter world: Reviewing some options', Network for Greening the Financial System, March 2021.
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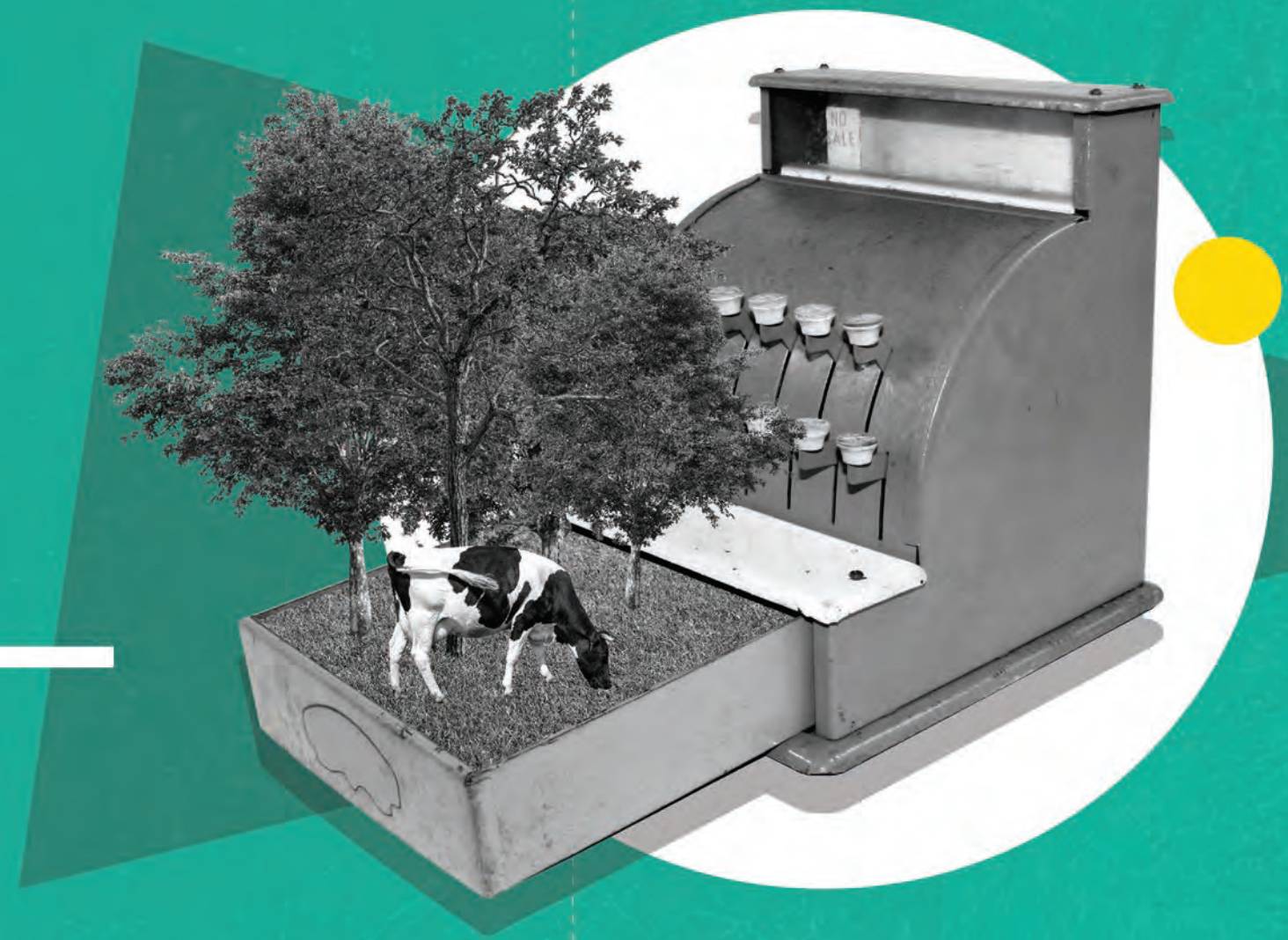
35 'Finance climate action pathway - action table', United Nations Climate Change and Marrakech Partnership, 2021.

COUNTING EMISSIONS AND ACCOUNTING OMISSIONS

THE STRUGGLE TO MEASURE, MONITOR AND MANAGE CORPORATE NET-ZERO EFFORTS

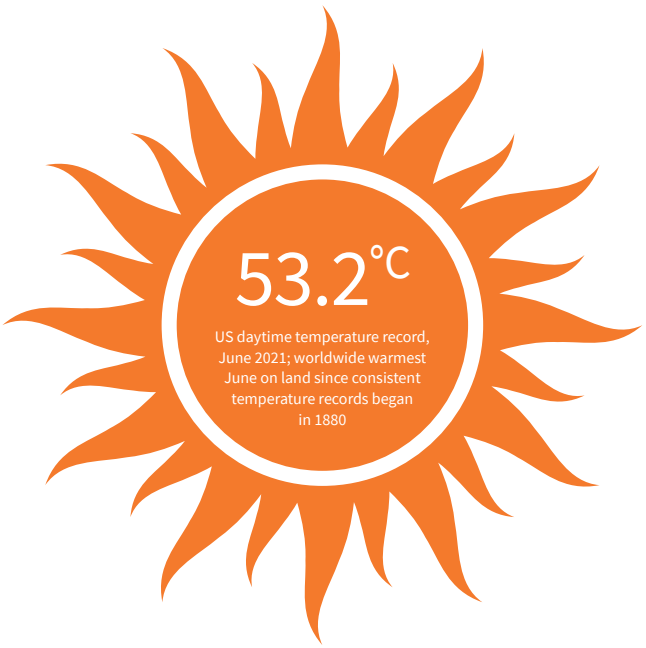


Internalise the climate externality. That is the major task facing policymakers and corporate executives. However, this requires accurate measurement and incorporation into financial accounts. Neither are straightforward.

Imagine daytime temperatures so hot that roads melt, pets taking a walk damage their paws and opening a car door could mean a severe burn. For residents of California, that moment has already arrived. The daytime temperature reached over 50 degrees Celsius in Palm Springs in June 2021,[1] enough to cook the white of an egg on a pavement. In this explosive heat, human health and ecosystems are at risk.

Meanwhile, efforts continue to capture information better, within the natural world and the financial one that underpins flows of capital. Can accountants really save the world, as Peter Bakker, CEO of the World Business Council for Sustainable Development, audaciously suggested?[2] Might new ideas like sustainable cost accounting force companies to address climate targets? Or will the failure to monitor, record and respond to the climate emergency ultimately prove disastrous for us all?

Figure 1: **Surviving the furnace[3]**



Source: Yale Climate Connections, July 13, 2021. Aviva Investors, October 2021.

PART 1: MEASURING EMISSIONS

A good place to start is to take a hard look at what we know. Take the carbon cycle, the backbone of life, which links an astonishing range of organisms and processes.

"It includes every plant, animal and microbe, every photosynthesising leaf and fallen tree, every ocean, lake, pond and puddle, every soil, sediment and carbonate rock, every breath of fresh air, volcanic eruption and bubble rising to the surface of a swamp, among much, much else," according to an introduction to carbon by the University of New Hampshire.[4] Within that complexity there are stores or sinks and fluxes that transfer carbon from one pool to another. The cycle encompasses "nearly everything".[5]

Frustratingly, our knowledge of "nearly everything" is detailed in parts, but thin in others. For example, just over a decade ago researchers were contemplating where

COUNTING EMISSIONS AND ACCOUNTING OMISSIONS

continued

around one billion tonnes of warming carbon dioxide (CO_2) might have gone. "They looked for it here and they looked for it there, but the carbon had vanished into thin air," wrote science writer Jane Burgermeister in 2007, keen not to miss a catchy line.[6]

Scientists assumed some of the carbon being produced by human activities – burning fossil fuels, removing virgin forest and introducing modern commercial agriculture – had been sequestered by trees in the vast boreal forests in northern latitudes. This was not the case; the 'lost' mass was later found in tropical zones.

Most tropical rainforests are not closely observed on the ground. Building an overview involves taking a small amount of experimental data and marrying it with information from ecosystem models and satellite imagery.[7] As a result, many of the estimates are inexact, as they are with many forms of natural capital, which has implications for how human actions and consequences are assessed.

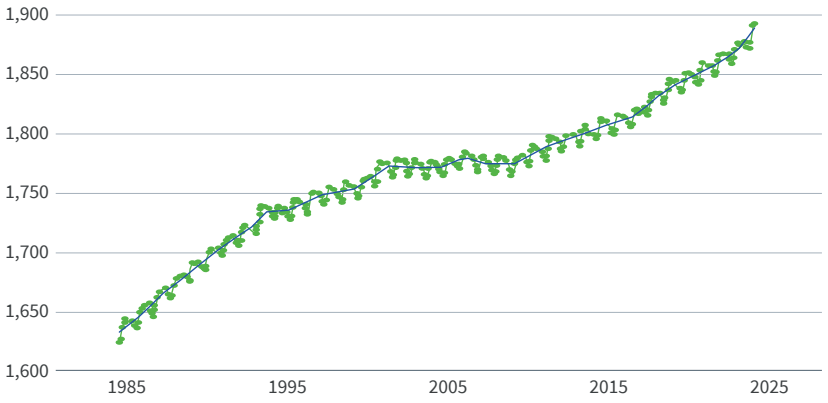
Forests are some of the more closely monitored ecosystems; other landscapes – like African agricultural systems – are "data deserts"[8] in comparison, according to Todd Rosenstock, an environmental scientist at World Agroforestry, responsible for investigating greenhouse gases (GHG) measurement protocols from Nairobi, Kenya.

"Measurements of nutrient stocks and GHG fluxes are typically collected at very local scales (less than one to 30 metres square) and then extrapolated to estimate impacts at larger spatial extents – farms, landscapes, or even countries," he explained in a book published in 2016.[9]

But that's not all. Knowledge of the extent of GHG-producing agricultural activities is patchy too. The data gaps are "staggering," he says, contributing to "an extraordinary blind spot" in GHG accounting.

> *Many natural capital estimates are inexact, which has implications for how human actions and consequences are assessed*

Figure 2: **Atmospheric methane reaches highest level since systematic records began (CH^4 mole fraction)[13]**



Source: NOAA Research News, April 7, 2021.

We need to talk about methane

If one billion tonnes of carbon can be 'lost' when stored in tangible form, how much greater is the challenge with invisible carbon compounds?

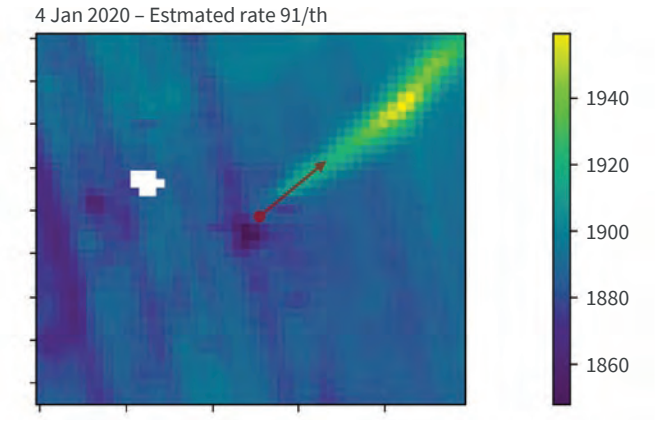
Take methane, for instance, the primary constituent of natural gas and a major contributor to human-induced climate warming. It is covered by the GHG protocol,[10] the global standard used by companies seeking to monitor and manage their environmental trajectories better. There are many natural sources of methane, including paddy fields that feed half the world's population, cattle and melting permafrost, but human-energy systems offer a route to address climate warming, fast.

"The most cost-effective thing we can do to bring down temperatures in the near term is focus on methane," notes Fred Krupp, president of the Environmental Defence Fund, the NGO seeking environmental solutions with the likes of oil majors Shell and BP.[11] "Methane is 34 times more potent than CO_2 over 100 years. It turns out methane doesn't last 100 years; it lasts less than 20 years. Over that period, it's over 80 times more powerful than CO_2. When you reduce methane emissions, you can have an outsized effect on reducing the temperatures we're going to see over the next 20 years."

Methane is difficult to detect. In the field, it needs specialist equipment, like quantum cascade lasers and spectrometers,[12] to assess its concentration in the air. It can be dispersed by wind and oxidise (from methane (CH_4) to CO_2 and water (H_2O)). It's invisible and odourless, so it can stay out of sight and out of mind. (See Figure 2 for atmospheric methane levels.)

Recent monitoring suggests a significant amount of methane is being emitted from energy networks. It includes gas released deliberately (vented, to reduce the dangerous build-up of pressure within infrastructure networks, or flared, burnt to convert emissions to CO_2) or inadvertently seeping out through leaks. A global trawl of satellite imagery in 2020 showed about 100 'super-emissions' events taking place at once, each generating as much CO_2 as a 750-MW coal power plant (see Figure 3.)

Figure 3: **Using satellite data to identify methane plumes (estimated rate 91/th)[14]**



Note: Plume of methane as seen on Sentinel 5P around Hassi Messaoud, Algeria, on January 4, 2020, matching Sonatrach's reported event. Methane concentrations are in parts per billion. Arrow indicates the wind direction.
Source: IEA, March 31, 2020.

> *Gas can leak from various points across energy and petrochemical infrastructure*

"When companies go out to drill a well, natural gas and methane will always be part of it. There aren't any wells drilled that don't have any gas or methane in them," explained Gretchen Watkins, US president of the Shell Oil Company in a recent industry discussion on fugitive methane emissions.[15] "If you drill a well in a place where there aren't existing pipelines or existing infrastructure, it's very difficult to capture the gas and do something with it."

Gas can also leak from various points across energy and petrochemical infrastructure, from the wells themselves to processing plants and surface storage stations. Figuring out where gas is escaping is a scientific and measurement challenge. But the International Energy Agency believes simply using industry best practice could trim total human emissions by 15 per cent, at comparatively low cost.[16]

Costing the Earth?

As is often the way, probing into where human-induced emissions are coming from has introduced new complexities.

"We know from US oil and gas field submissions that, on average, two per cent of what is coming out of the ground is going into the air," Krupp says. "In the Permian basin in the US, one of the biggest oil fields globally, we learnt very recently that (network) emissions are three to five times higher than what is being reported. The number is closer to 3.7 per cent."

Some historic studies put emissions higher still. While findings vary according to the nature and age of installations, the top end of the range reported by the National Oceanic and Atmospheric Administration, the US government agency, is more than twice the level mentioned by Krupp (illustrated in Figure 4).

"Just let me just take a second to explain the significance of that," Krupp adds. "When we have two per cent leakage, burning natural gas is only slightly better than coal. With 3.7 per cent leakage, burning natural gas is substantially worse...".[17]

This is not just a US problem; Europe has issues with fugitive emissions too. Surveys by the non-profit Clean Air Task Force (CATF) showed more than 90 per cent of the sites monitored in the Czech Republic, Hungary, Italy, Poland and Romania leak notable amounts of methane. In Germany and Austria, the record was better.[19]

Data discrepancies: Top-down versus bottom-up

These data points are alarming for those keen to present natural gas as a (comparatively) attractive transition fuel. No wonder energy majors are putting their weight behind methane monitoring initiatives with a view to protecting their social license to operate.

Meanwhile, as multiple stakeholders grapple with their measurement challenges, there are significant discrepancies between emissions profiles built in different ways. The view from the bottom-up, from individual samples at point sources, and aerial overviews, from aeroplanes and drones, may be quite different.[20]

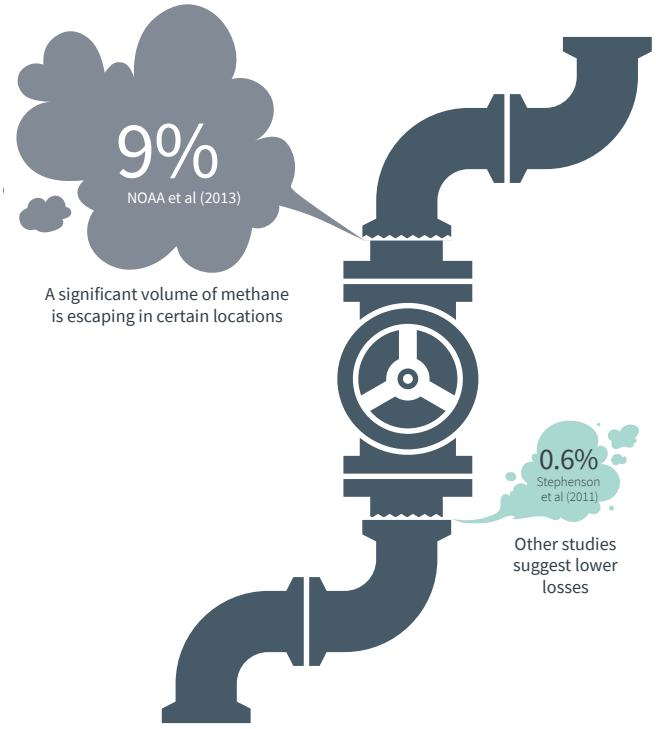
COUNTING EMISSIONS AND ACCOUNTING OMISSIONS
continued

"It is really challenging to measure the release of some GHG emissions," agrees Emily Kreps,* global director of capital markets at CDP, the non-profit body helping organisations measure and address their environmental impact. "China talked about it before the coronavirus triggered a global health crisis and mentioned using sensors comprehensively to quantify when gas is released. But global industry is far removed from that. Even when data is taken from satellite monitoring, it is not necessarily clear.

"What we are most likely to see is a logical build-up of data from the bottom-up, based on the operation of this plant or this business process," she adds. "We can anticipate what happens when we run a process for X number of minutes or hours or days. We are not working at the very granular level yet in terms of measurement, although it is hard for the financial sector to accept that."

So, unanswered questions abound. Although there is a formal GHG recording protocol in place and agreed units of measurement, we do not know precisely how much warming gas is being emitted from human energy systems, or from where. Equally, we don't know the quantity of warming gases natural systems are emitting or sequestering, or where.

Figure 4: **Fugitive methane emissions: Assessing scale (per cent)[18]**



Source: Carbon Brief, July 3, 2014. Aviva Investors, October 2021.

PART 2: ACCOUNTING OMISSIONS

Accountancy finds itself at the coalface of this confusion, charged with producing meaningful financial statements that increasingly bring once-considered non-financial disclosures onto the balance sheet. The challenge is doing it in a way that fairly represents what is going on. The rules that guide the industry are negotiated in a particular social environment; their purpose is to underpin the allocation of capital and reflect the views of the time.

Before environmental concerns loomed large in the societal register, those overseeing the industry were grappling with how to capture the change from industrial economies to an information age. The change has been messy, with more companies choosing to "go off the accounting piste" in certain jurisdictions, deviating from industry norms.[21] "Accounting has become the opposite of useful for users,"[22] noted an article in the *Financial Times* in 2019, pointing to the number of US companies using bespoke approaches in earnings releases.

Already facing the monumental task of incorporating intangible assets into financial accounts, which has led to a widening gap in industry norms and outputs, accountants now face an even bigger challenge: assessing the change implied by the Paris Climate Agreement. The accountancy profession is having to ask big questions of itself. Are established concepts – like materiality and prudence – leading to meaningful assessments of risk? Or could the patchwork of reporting requirements fail to communicate the risks implied by the climate transition?

These conflicts are already familiar to many users of financial reports and accounts, including professional investors. There are now some obvious gaps between the narratives in the front end of the reports, where climate risk is mentioned a lot, and the sparse data appearing at the back end in the audited accounts. This makes the work of the professional investment community much harder.

"I think of investment research as detective work," Nick Anderson, a former buy-side investor and current senior member of the International Accounting Standards Board (IASB), told a panel discussing

> *If a resource is not properly valued, it will tend to be overused; scarcity forces values higher*

Figure 5: **Capturing climate risk in IFRS standards**

Source: IASB, November 2020.

accounting for climate recently. "It's about gathering information from multiple sources, verifying, triangulating … It's about forming judgements based on that evidence, and then using your experience to reach a view."[23]

In that process, the information included in audited reports is pivotal. Investment analysts are always asking whether the messages they are receiving are coherent and consistent. Any dissonance or information gaps could be costly, hence the pressure from the investment community for more transparency. But these tensions are not yet being addressed. Nevertheless, various professional bodies (including the IASB and the International Auditing and Assurance Standards Board (IAASB)) suggest there is no need for radical re-thinking. They say established accounting principles already capture what is needed to get climate risk reflected on the balance sheet.

"IFRS standards do address climate-related risk," Anderson insists. "They do that through the requirements of specific standards, and the overriding requirements of International Accounting Standard (IAS) 1, relating to the disclosure of material information. Many of these requirements have been in place for years." He flags the standards in Figure 5 as particularly vital to consider through a climate lens, using assumptions compatible with achieving the Paris Agreement.

Focus in these areas is likely to generate lots of questions, according to David Pitt-Watson, executive fellow at Cambridge University's Judge Business School and former co-chair of the UNEP Finance Initiative.

"In the short term, there will have to be write offs if we have been valuing climate-exposed assets as though there is no climate issue," he says. "That's the right thing to do, just as it is the right thing to write off a bad loan rather than pretend an organisation is solvent."

Auditors need to be framing climate risk in a way aligned with achieving the Paris Agreement, and sensitive to recent industry guidance. "They [the accountancy bodies] want to see both the issuer and the auditor follow the letter and the spirit of the opinions of the IASB and the IAASB," adds Pitt-Watson.

Bringing carbon onto the balance sheet

Meanwhile, deeper questions are being asked about the philosophy driving the metrics themselves. Who are accounts for?

"The International Financial Reporting Standards Foundation (IFRS) suggests that accounts are primarily for the benefit of investors," says Richard Murphy, professor of accounting at Sheffield University Management School and founder of the Corporate Accountability Network, an NGO established in 2019 to target the "the weaknesses in the accounting disclosure of all companies" so they meet the needs of all stakeholders, not just those providing their capital.

"Implicit within that is a purely financial capital maintenance concept," adds Murphy. "That's what the IFRS metrics are all about. There is an amount on the balance sheet for this year which can be compared to last year, and so on. The making of profit, the creation of financial capital, is the priority."

Murphy believes the approach is fundamentally inconsistent with sustainability because the financial capital maintenance concept creates a perverse incentive to exploit natural capital. If a resource is not properly valued, it will tend to be overused, and then scarcity forces values higher in the interests of a powerful minority. But the climate emergency needs a universal

COUNTING EMISSIONS AND ACCOUNTING OMISSIONS

continued

approach since we only have one planet. Instead, Murphy suggests maintaining environmental capital should be the primary goal for the long-term benefit of society.

"While financial capital is important, it's secondary compared to the requirement for businesses to operate within the environmental constraints imposed upon them by the greater goal of achieving sustainability, aligned with the Paris Agreement," he says.

This is effectively the accountancy version of the conversation around the purpose of a corporation. Should companies be purely driven to create profit, or should greater attention be given to balancing that goal with wider environmental and social concerns?

Murphy suggests the IFRS Foundation is now contributing to an environment where one set of rules regulates financial accounting and another complex set of (mainly voluntary) guidelines shape sustainability reporting, broadly based around on the framework set out by the Task Force on Climate-related Financial Disclosures (TCFD). This view of the world, where sustainability reporting has only tenuous links into the accounting system, makes it possible for difficult climate-related decisions to be deferred.

For now, the climate externality is only partially addressed via carbon pricing and there is no explicit mechanism to hold corporate actors to account regarding their net-zero targets.

"There is a clear discontinuity, a large gap, between what companies say they will do and what they will actually be doing," is the frank view from Dr. Luca Taschini, associate professorial research fellow at the Grantham Research Institute on Climate Change and the Environment at the London School of Economics.

"There is an urgent need to verify corporate claims regarding the net-zero targets they are pursuing and assess the appropriateness and feasibility of these claims. This is the analysis we need; it reaches beyond conventional ESG analysis. It is not just about carbon pricing; it's about technology and practical solutions. Moving forward, the question is: How will you reduce emissions? What are you going to do to adapt your business to a low-carbon economy?"

One approach being discussed to help achieve that is sustainable cost accounting. Devised by Murphy as part of an academic challenge to bring climate directly into financial reporting, it suggests bringing decisions around carbon management onto the balance sheet of larger listed companies as part of TCFD guidelines.[25]

In countries like the UK, where achieving net zero is established in law, Murphy argues a crystalising event has taken place, which should force companies to set out exactly how they intend to achieve the goal using proven technologies and provision to cover the cost of achieving it.

"It would include the requirement to make a true and fair disclosure to say: 'This is the cost of the decision we have made to become sustainable,'" Murphy says. But achieving the target might mean changing the metric being monitored from carbon emissions (where the cost of carbon is outside the company's control) to the cost of carbon abatement within the company's own systems (where the company has greater influence).

Murphy suggests this is not radical in terms of accounting treatment – it uses well-established principles around provision-making – but could have radical implications for investors, savers and pension holders (see Figure 8). Firstly, corporate decision makers would be forced to cost the options to transition to a zero-carbon world; decisions could not be kicked down the road. Secondly, climate provisioning could constrain a company's ability to pay dividends, which

Figure 6: **Accounting systems as windows on the world[24]**

Source: Tax Research UK, December 8, 2020.

> *There's an enormous amount of data. But there is more data than there is understanding*

Figure 7: **The complex world of sustainability reporting**

The **Task Force on Climate-related Financial Disclosures** was set up by the G20's Financial Stability Board (FSB) to develop guidelines for companies, banks and investors to encourage disclosure of information on climate-related risks and opportunities for stakeholders.

The **Sustainability Accounting Standards Board** has published industry-oriented sustainability considerations and metrics, to identify issues likely to affect financial performance.

The **Global Reporting Initiative** is an international independent standard-setting organisation claiming to provide the most common framework for sustainability reporting.

EU Guidelines

EU Guidelines on reporting climate-related information for listed companies required to make disclosures under the Non-Financial Reporting Directive (NFRD). They incorporate TCFD recommendations and the EU taxonomy, a classification system designed to identify organisations having positive climate impacts.

CDP Is a non-profit organisation running a global disclosure system for investors, companies, cities, states and regions to manage environmental impacts.

The **Climate Disclosure Standards Board** has an established framework for companies to report environmental and climate change-related information in corporate financial reporting.

Source: Aviva Investors, September 2021

would also impact its attractiveness from a long-term investment perspective. And there could be implications for governments too if long-term savings expectations were to disappoint.

"Can companies afford to pay dividends unless they can demonstrate how they can also address climate change?" Murphy asks. "This is a going-concern issue. If they can put forward plausible plans to raise capital to fund the transition, then they can carry on paying dividends. If not, they will have to constrain distributions."

Out of this comes Murphy's idea of carbon insolvency. Exactly which businesses will fail to transition to a zero-carbon world is the question gripping investors everywhere; it features in regulatory risk conversations and discussions on how failing organisations might be handled via a climate 'bad bank'. But current financial disclosures do not allow stakeholders to assess the situation with any precision.

Assessing value chain emissions under current TCFD guidelines

Take the way in which companies are revealing Scope 3 emissions from across their value chains (as distinct from operational emissions). This is a "messy" area, according to Steve Waygood, chief responsible investment officer at Aviva Investors, one many organisations have not yet addressed, from the airport operators that enable planes to take off down runways to financial services companies funding carbon-heavy activities. The issues are increasingly apparent to organisations seeking to promote climate transparency, like CDP.

"We began asking financial institutions to look through their operational activities to their business activities in 2020," says Kreps. "We asked what types of companies and issuers are being financed, what the nature of lending is, what credit facilities are being put in place and so on. That's a level of analysis some institutions have not got to yet. We found the emissions from those business activities were 700 times greater than operational emissions from organisations making financial decisions.

"From that perspective, financial institutions are high emitters, because they are providing capital to the real economy and that will determine the transition or the lack of it. As players in the capital markets, they hold the purse strings and have the power. This is where I see a really significant opportunity for change."

Not all institutions allocating capital have a clear look-through to their investments, and the bodies in which they invest may also be grappling with their own operational minutiae. "There's an enormous amount of data," says Waygood. "But there is more data than there is understanding, and more initiatives than people really know what to

COUNTING EMISSIONS AND ACCOUNTING OMISSIONS

continued

do with. It's almost like the 'how do you measure alpha?' conversations that took place years ago, when people were talking about the efficient markets hypothesis and capital asset pricing model."

Sustainability professionals acknowledge the need to raise the bar. "We need to move from a discussion of ESG, that without anything further is just looking at all the relevant information, to putting the financial system onto a footing of sustainability. We need to reward those issuers with truly sustainable business models that do not result in the destruction of more natural or social capital than is generated or naturally replenished. Conversely, we must address the withdrawal of capital or underwriting from those who do not," says Tom Tayler, senior manager in Aviva Investors' Sustainable Finance Centre for Excellence.

In many cases, the information that could inform that action is incomplete, may involve large margins of error, and is not being translated into public accounts in an accessible way.

"Corporate GHG accounting practices as they now stand do not tell you that much about climate risk or the impact of investment decisions," warns Dr Matthew Brander, lecturer in carbon accounting at the University of Edinburgh. He suggests non-professionals are likely to be hard pushed to understand carbon management strategies from public information.[27]

In the quest for greater disclosure, it is possible that polluting or climate-sensitive activities are simply forced off balance sheet and into the hands of private actors, enabled by financiers contemplating high hurdle rates and rapid paybacks.

Surveying and course correcting simultaneously

These questions on the values reflected in data gathering, about how and what to measure and the value of metrics on the balance sheet are going to be critical in addressing the climate emergency. They will ultimately determine investment flows, who survives and who fails. But agreeing on what happens next is not straightforward.

Figure 8: **Impacts of sustainable cost accounting**

Source: Aviva Investors, September 2021.

"We are trying to course correct the global economy – by surveying the terrain, drawing the map and re-planning the route, all at the same time," says Waygood, who has been campaigning for greater transparency on climate exposures for years. He describes the changes being discussed as both too slow for what is needed, but also far too fast for many who find themselves without the expertise to navigate.

> *"These questions will ultimately determine investment flows, who survives and who fails"*

For Pitt-Watson, it is a question of survival. "No companies are going concerns if our planet is not a going concern, and it is crazy to be drawing up accounts as if there was no issue about whether our planet is a going concern," he says.

But carbon accounting is young and not all participants appreciate the urgency. "GHG accounting practice has a lot of maturing to do," as Brander points out. "We are still at a point where the users of GHG information do not see it as material. If they did, they would be shouting about misleading information. As climate change risk ramps up, certain practices that do not give meaningful representations of the carbon intensity of a company or its exposure to climate-related risk will be scrutinised much more carefully."

Let the scrutiny begin.

METHANE: SOCIAL AND ENVIRONMENTAL IMPACTS

"The air quality community has not talked about methane enough and the climate change community has not talked about the air quality issues of methane enough," says Nino Künzli, one of the Climate and Clean Air Coalition's Scientific Advisory Panel at the Swiss Tropical and Public Health Institute.[28]

The main public health concerns include the way in which methane contributes to the formation of ground-level ozone, visible as smog. Smog can trigger respiratory problems, increasing asthma-related hospital visits and even deaths in worst-case scenarios.[29]

Extreme heat, which methane contributes to, is also problematic. Hours of lost labour are one consideration, while heat-related deaths are also rising. A recent study using data from 43 countries showed heat-related mortality increasing on every continent between 1991 and 2018.

"Across all study countries, we find that 37 per cent (range 20.5–76.3 per cent) of warm-season heat-related deaths can be attributed to anthropogenic climate change," concluded Nature Climate Change.[30]

Ozone also affects plants, entering the stomata of leaves and damaging plant tissue during respiration. This has the effect of reducing yields; studies in various parts of the world flag negative impacts on the harvests of soybeans (-12 per cent), wheat (-15 per cent)[31] and grapes (-22 per cent)[32]

> *"Methane contributes to the formation of ground-level ozone, visible as smog, which can trigger respiratory problems"*

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*Emily Kreps now works for Deutsche Bank.

PRICING CARBON

TAXING POLLUTERS IS THE ONLY WAY FORWARD

> *Nearly three decades and countless international conferences on, efforts to curb climate emissions have failed miserably*

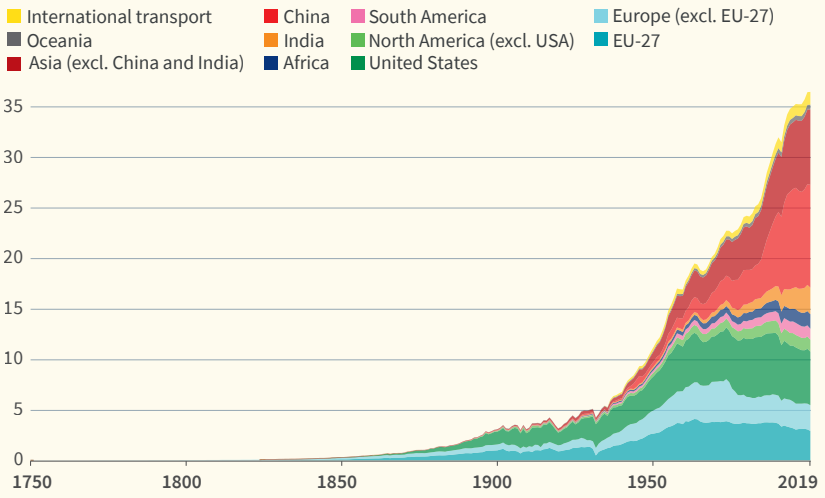
Nearly three decades after it first agreed to tackle climate change, the world has failed miserably to curb the growth in CO_2 emissions. To succeed, it urgently needs to establish an effective price for carbon.

In the 1820s, French mathematician Joseph Fourier calculated an object the size of Earth, at its distance from the Sun, should be considerably colder than the planet is if warmed only by the effects of incoming solar radiation. His consideration of the possibility the Earth's atmosphere might act as an insulator is widely recognised as the first proposal of what came to be known as the greenhouse effect.

It took over a century, however, for the dangers of burning fossil fuels to be better understood. Edward Teller, a Hungarian-American theoretical physicist, sometimes referred to as 'the father of the hydrogen bomb', was among the first to sound the warning. At an address to the membership of the American Chemical Society in December 1957, Teller warned the large amount of fuel that had been burnt since the mid-19th century was increasing the concentration of carbon dioxide (CO_2) in the atmosphere and would "act in the same way as a greenhouse by raising the temperature at the surface".

By 1992, with evidence of the perils of man-made climate change mounting, 154 countries agreed to begin to address the problem. Signatories to the United Nations Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro committed to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with Earth's climate system". Nearly three decades and countless international conferences on, efforts to curb climate emissions have failed miserably.

Figure 1: **Annual total CO_2 emissions, by region (billion tonnes)[1]**



Note: This measures CO_2 emissions from fossil fuels and cement production only – land use change is not included.
Source: Our World in Data based on the Global Carbon Project, data as of August 2020.

PRICING CARBON
continued

> *The Kyoto Protocol never looked likely to succeed*

Commons problem

Five years after Rio, the first international treaty to cut emissions was signed amid scenes of jubilation. The Kyoto Protocol, in which several developed countries agreed concrete steps to limit emissions, was hailed as a breakthrough to set the world on a new low-carbon path.

However, although the protocol entered into force in February 2005, it never really got off the ground. Four years earlier, the US had effectively withdrawn, having never even got as far as formally ratifying the treaty – the Byrd–Hagel Resolution, effectively rejecting it, was passed 95-0 in the Senate in 1997. Kyoto died a death on 31 December 2012, when Canada, Japan, New Zealand, and Russia withdrew.

Despite the acclaim that greeted Kyoto, the agreement never looked likely to succeed. To see why, one needs to understand the nature of the problem policymakers are trying to confront.

Climate change is a problem of the 'commons'. The atmosphere is shared between countries and while a CO_2-abating country incurs the full cost of its abatement, it receives only a small fraction of the benefits. Moreover, most of those accrue to future generations, some in the distant future. As with any such public good, the self-interested response is to 'free ride' in the hope others will foot the bill. That is especially true in a globalised economy where energy costs affect competitiveness and there is an ever-present danger of 'carbon leakage'.

Even within nations, resolving public goods problems such as road congestion or the provision of railway tracks can be problematic, especially for federated systems of government. But the global nature of the problem makes it that much more intractable since there is no government to prevent free riding. Instead, ways of addressing the problem by either taxing or imposing limits on emissions must be negotiated among sovereign nations.

Global cap and trade

The Kyoto negotiations tried to create a global cap-and-trade system, whereby a limit on emissions was set at a global level, following which individual countries would commit to cutting emissions beneath 1990 levels to varying degrees to meet that cap. The protocol assigned international emissions permits – 'assigned amount units' (AAUs) – and set up a system for trading them. The result was a patchwork of weak and unenforceable commitments that failed to address the free-rider problem.

The AAU market proved so illiquid and secretive there was no effective market price and the price of few transactions was known; meanwhile, no carbon pricing policies resulted. To the extent Kyoto made any difference, it was via command-and-control policies such as subsidies and requirements for clean energy like wind and solar, as well as energy-efficiency improvements.

Nations have since stumbled through a series of summits and conferences to find a replacement without success. Although the UN Conference of the Parties (COP21) meeting in Paris received the usual victory statements – UN Secretary General Ban Ki-moon hailed it as "a monumental triumph for people and our planet"[2] – the agreement was seen by some as a step back from Kyoto.

There was no longer any serious discussion of a common commitment to reduce the quantity of carbon emissions by negotiating a global cap. Countries merely agreed to non-binding, non-enforceable, incomparable 'intended nationally determined contributions' (INDCs).

Under a so-called pledge-and-review approach adopted at Paris, INDCs will be registered without any coordination of the method or the metric of measurement of the ambition of these actions. Reporting on, and verification of, the pledges was not decided, despite being crucial to the credibility of the system. In effect, there was no serious effort to confront the free-rider issue. Although the hope is for an upward spiral of ambition over time, history suggests this could be wishful thinking.

> *As with any public good, the self-interested response is to 'free ride' in the hope others will foot the bill*

> *To promote cooperation, a collective goal must be translated into a reciprocal accord*

How not to negotiate

According to Dr Stephen Stoft, co-editor of the 2017 book *Global Carbon Pricing*, the failure of successive negotiations is telling. To see where things have gone wrong, he says game theory, particularly the work of political scientist Elinor Ostrom, is instructive. She was awarded the Nobel Prize in economics for her innovative work which, against the grain, argued that common-pool resource over usage was not inevitable, or subject to a 'Tragedy of the Commons' as the ecologist Garrett Hardin suggested in 1968. Drawing on both the science of game theory and real-world examples, Ostrom showed cooperation could be maintained by the interaction of reciprocity, reputation, and trust.

Stoft, who has consulted for the World Bank, the US Department of Energy, and the UK's Department of Energy & Climate Change, says Ostrom's work suggests the way negotiators went about trying to solve the problem at Kyoto and Paris meant the talks were doomed from the start.

Kyoto's failure to deliver an agreement on curbing emissions is partly explained by the complexities involved in reaching a cap-and-trade deal at a global level with multiple countries involved, each with an incentive to negotiate a high cap for itself and free ride off others. At Kyoto, for example, negotiators unsuccessfully proposed at least ten formulae for establishing individual commitments. In the end, however, countries were merely asked to provide their final numbers for insertion into the draft.

As for the 'pledge and review' approach, not only was there nothing to prevent countries setting themselves unambitious targets, there was no agreed penalty for not meeting them.

Time for a change

Stoft says what Ostrom and others show is that to promote cooperation, a collective goal must be translated into a reciprocal accord: an agreement to abide by rules that specify ambitious behaviour, provided others abide by the same rules. Moreover, penalties for breaking the rules are needed to discipline free riders.

"Success requires a common commitment, not a patchwork of individual actions. After 20 years of pretending to do what is right for the climate and doing almost nothing, it is time for a change of direction," he says.

Yale professor William Nordhaus says if there is a single lesson to be learnt from economics, it is that "economic participants – thousands of governments, millions of firms, billions of people, all taking trillions of decisions each year – face a market price of carbon that reflects the social costs of their consumption, investment, and innovation".

While Stoft agrees a uniform price would be economically efficient, he argues establishing a global minimum carbon price as a starting point would give the negotiations a much better chance of success. By providing a salient focal point for discussions, talks would likely be much more straightforward than those over a global cap-and-trade deal proved to be. It was Thomas Schelling, another American economist awarded the Nobel Prize for his work on game theory, who argued cooperation can be enhanced when participants' actions converge on a focal point.

The idea of trying to establish a global carbon price appears to be gaining currency beyond academia. The Intergovernmental Panel on Climate Change, the UN's own body for assessing the science related to climate change, recommends a "single global carbon price" high enough to create the necessary incentives to limit global warming to about 2°C above pre-industrial levels.

In May 2019, over 75 businesses, including eBay, Nike, Mars, Microsoft and PepsiCo, called on Congress to pass meaningful climate legislation. Placing a price on carbon was high up their agenda.[3] In November 2020, a number of UK businesses called on their government to do likewise.[4] The corporate world's call for action has been echoed by various international bodies such as the World Bank, International Monetary Fund (IMF) and Organisation for Economic Cooperation and Development. UN Secretary-General António Guterres has called for "much more progress on carbon pricing".[5]

Leading policymakers are beginning to chime in too. In January 2021, US Treasury Secretary Janet Yellen said the climate crisis cannot be solved "without effective carbon pricing". Yellen, who Stoft describes as the "best person to move the issue forward", said US President Joe Biden supported an "enforcement mechanism that requires polluters to bear the full cost of the carbon pollution they are emitting".[6] Just days later, European Central Bank chief Christine Lagarde talked of the need for an effective carbon price if "the EU's targets for reducing emissions are to be reached".[7]

75+

businesses called on Congress to pass meaningful climate legislation in May 2019

PRICING CARBON
continued

> *We're running out of time and urgently need a concrete plan of action*
>
> **Tom Tayler**
> Senior Manager, Aviva Investors Sustainable Finance Centre for Excellence

Skirting Around the issue

The increasing calls for action make it hard to understand why successive UN climate change conferences have tended to skirt around the issue.

"Go all the way back to Rio, they talked about internalising the externality. It just hasn't happened. We're running out of time and urgently need a concrete plan of action," says Tom Tayler, senior manager in Aviva Investors' Sustainable Finance Centre for Excellence.

Although the Paris Agreement talked about the need for a global carbon market, negotiators essentially kicked the can down the road. Article 6 is central to the integrity of the accord and negotiators have warned weak rules could undermine the entire agreement. Yet few appear to have much idea how the rules governing this mechanism could be made to work. Many doubt they ever can.

Article 6 is just two pages long. Perhaps in a deliberate effort to obfuscate, the wording is complex; tellingly, it fails to describe how the system will work, and what rules will ensure it leads to real emissions cuts, in anything other than the vaguest terms.

While some say resolving the article could make or break COP26, both Tayler and Aviva Investors' chief responsible investment officer Steve Waygood believe such expectations are unrealistic.

Intensive lobbying by the fossil fuel industry has in the past been an obstacle to reaching agreement on carbon pricing at UN summits – for example, COP25 in Madrid was criticised because it was sponsored by some of Spain's biggest polluters. However, the main impediment is that unanimity, or near unanimity, is required for agreement to be reached.

"Blaming the UNFCCC for not coming up with a global carbon price is unfair. It's an inappropriate forum," says Waygood.

Nordhaus, who has been dubbed the father of climate change economics and in 2018 received the Nobel Prize for his ground-breaking work modelling the interplay between climate change and the economy, says the requirement for unanimity is in reality "a recipe for inaction", particularly where there are strong asymmetries in the costs and benefits.

"In light of the failure of the Kyoto Protocol, it is easy to conclude that international cooperation is doomed to failure. This is the wrong conclusion," he argues.

> *It is easy to conclude that international cooperation is doomed to failure. This is the wrong conclusion*
>
> **William Nordhaus**
> Sterling Professor of Economics and Professor in the School of the Environment at Yale University

Join the club

In April 2021, IMF chief Kristalina Georgieva said a "focus on a minimum carbon price floor among large emitters, such as the G20, could facilitate an agreement covering up to 80 per cent of global emissions".[8]

She appears to have taken her cue from Nordhaus, who in 2015 advanced the idea of establishing a 'climate club' as a means of breaking the deadlock.

Luca Taschini, associate professorial research fellow at the London School of Economics' Grantham Research Institute, agrees this may offer the best prospect of meaningful progress. While establishing such a club would not be simple, even if just the EU and China could agree to impose a uniform price on all their carbon emissions, "that would be a major step forward; you could then envisage the US wanting to join".

Waygood says it is encouraging that the US and China were able to put ongoing difficulties in their bilateral relations to one side in April and commit to cooperating with each other and other countries to tackle the climate crisis with urgency.[9]

By pricing carbon, governments capture the costs that the public pays for in other ways, such as healthcare costs from pollution, heatwaves and droughts, and damage to property from fires, flooding, and sea level rise. A carbon price would give polluters – businesses and consumers – a choice: to discontinue their activity, gravitate towards greener technologies, or continue polluting and pay for it. It would also allow capital markets to more accurately compare companies' true cost of capital.

Establishing what that carbon price should be is not straightforward. From an economic efficiency perspective, the price ought to match the social cost of carbon (SCC), the

> *If the EU and China agree to impose a uniform price on all their carbon emissions, you could then envisage the US wanting to join*
>
> **Luca Taschini**
> Associate professorial research fellow, the London School of Economics' Grantham Research Institute

marginal damage caused by one extra tonne of emissions. Unfortunately, estimates of the SCC – strictly speaking the social cost of CO_2, not simply carbon – are highly uncertain. They depend on a multitude of assumptions about future emissions, how the climate will respond, the impacts this will cause and crucially the discount rate applied to damages, some of which will be felt far into the future.

Moreover, estimates of the SCC vary across countries since they are partially dependent on national considerations. For example, it is generally estimated to be quite high in China, where there are domestic benefits from reducing air pollution in a relatively densely populated country. By contrast, in Australia, where there is a low population density and power plants are located near the coast so emissions disperse 'harmlessly' over the oceans, it is lower. In February, the US government estimated it at about $51 per tonne for the US.[10]

The IMF says a global carbon price of $75 or more per tonne is needed by 2030 to restrict global warming to below 2°C;[11] the Bank of England reckons a price of £150 might be needed;[12] while the International Energy Agency said in May the price in advanced economies needed to rise to $130 by 2030 and to $250 by 2050.[13]

> *Estimates of the social cost of carbon vary across countries since they are partially dependent on national considerations*

The price is right?

According to Waygood, even if there is great uncertainty as to the optimal carbon price, that is no excuse for prevarication.

"One way forward could be for countries to agree to price carbon emissions at least as high as a global floor. Others would be free to set a higher price," he says.

He was encouraged when G20 finance ministers in July 2021 collectively endorsed carbon pricing for the first time, describing the once contentious idea as one of "a wide set of tools" to tackle climate change.[14]

Nordhaus says even pricing carbon at $35-40 per tonne would be "a reasonable start", although thereafter the price would need to rise "three to four per cent a year in real terms".

Theoretically, countries or trading blocs could be given leeway to determine how to price emissions, whether via taxation, a cap-and-trade system or a combination of the two, even if most economists tend to believe taxation would be the cleanest, most readily comparable, and therefore optimal method.

"The most efficient strategy for slowing or preventing climate change is to impose a universal and internationally harmonised carbon tax levied on the carbon content of fossil fuels," Nordhaus says.

Forming a club would not be without its difficulties. But although it would need to be determined at what point in the production process a carbon price was to be collected, and countries would need to be monitored to ensure they were not cooking the books, few hurdles are insurmountable.

For the system to work, the thorniest issue would be the need for richer nations to transfer money to poorer ones. Otherwise, the likelihood is many would be unwilling to impose a price on carbon, fearful it would unfairly curb economic growth. Not only do they see themselves as not having caused the problem, economic development is viewed as comparatively more important than the need to mitigate climate change.

> *Countries or trading blocs could be given leeway to determine how to price emissions*

However, although discussions over the size of transfer payments undermined the Kyoto discussions, this does not mean renewed attempts are doomed to failure as well. Rather, it is an argument for setting a realistic initial carbon price, especially since there would be nothing to prevent richer nations from being more ambitious.

> *The thorniest issue would be the need for richer nations to transfer money to poorer ones*

PRICING CARBON
continued

≤25%
of countries' total emissions reductions are at risk due to carbon leakage

Carrot and stick

Taschini says that as well as the carrot of transfer payments to induce developing countries to set a minimum carbon price and join the club, a stick would be needed to discipline free riders and prevent carbon leakage.

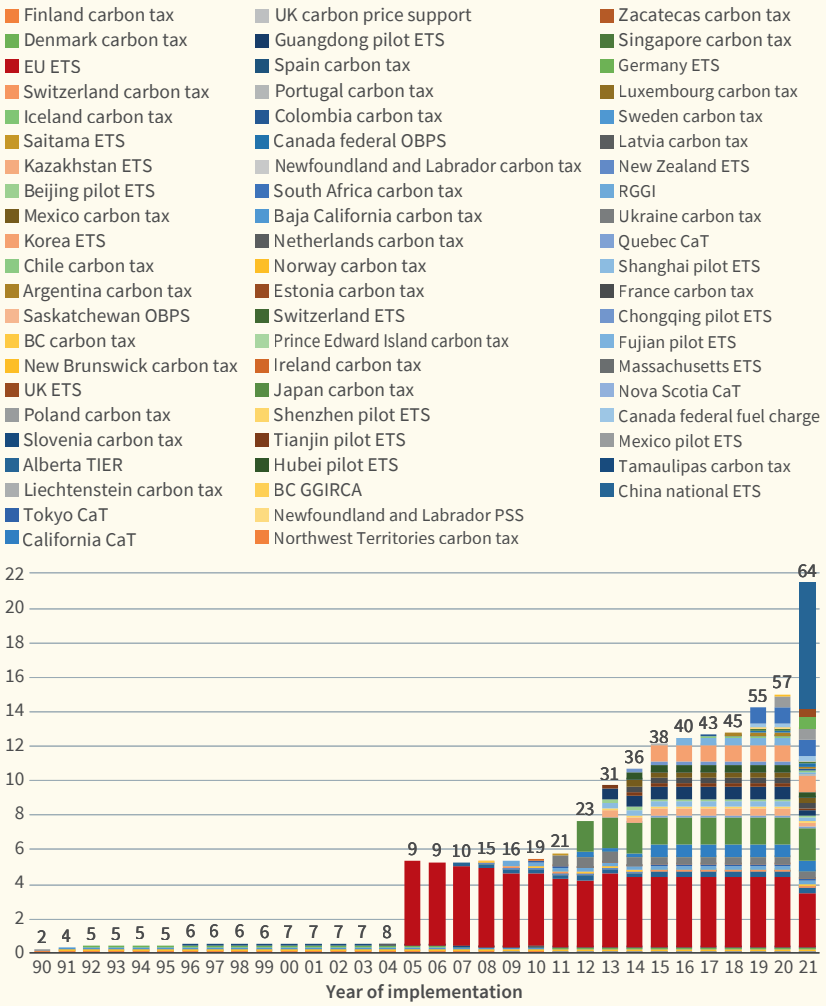
Estimates of the potential for carbon leakage vary wildly. An analysis of 25 studies suggested countries risked giving up between five and 25 per cent of their total emissions reductions due to companies moving high-carbon production elsewhere.[15] To avoid this, Taschini says the obvious stick to use would be tariffs on imports from countries that refused to join the club.

This explains why the EU in July said it planned to introduce a carbon border levy by 2026. By holding products such as imported steel, aluminium, fertiliser and cement responsible for their emissions the same way domestically produced products are, the aim is to maintain the bloc's competitiveness, prevent carbon leakage, and ultimately encourage other countries to match the EU's ambition.

Some sceptics see the EU's plans as little more than a form of green protectionism, while members of the World Trade Organisation have questioned whether they would be compliant with existing WTO rules. However, Taschini believes integrating environmental concerns in a way that doesn't infringe the WTO's rulebook is "absolutely possible".

Biden's climate envoy John Kerry, having in March warned the EU that a carbon border tax adjustment should be a "last resort",[16] within two months said the US was considering copying it.[17]

Figure 2: **Share of global emissions covered by global pricing initiatives (ETS and carbon tax) (per cent)[20]**



Note: The GHG emissions coverage for each jurisdiction is based on official government sources and/or estimates. The information on the China national ETS represents early unofficial estimates based on the announcement of China's National Development and Reform Commission on the launch of the national ETS of December 2017.

Source: The World Bank, April 1, 2021.

> *Companies will be compelled to manage their carbon footprints with greater urgency*
>
> **Boston Consulting Group**

According to Boston Consulting Group, the size and strategic importance of the EU market means a border tax "could transform the fundamentals of global advantage". In a report published in June 2020, it said companies around the world will be "compelled to manage their carbon footprints with greater urgency". The degree of impact on industrial sectors would be largely influenced by two factors: carbon intensity and trade intensity.[18]

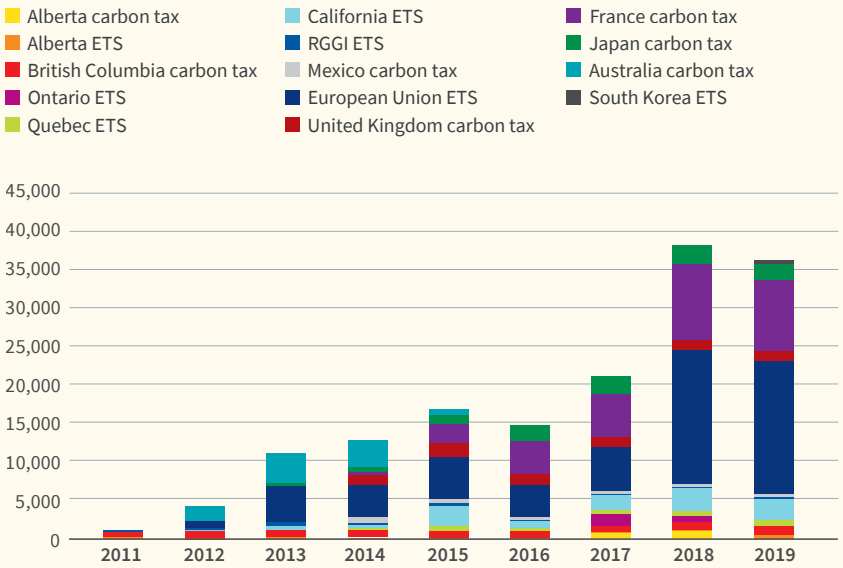
One of the most frequent arguments against carbon taxation is that it is regressive with poorer members of society hit hardest. However, since taxes would be levied and retained at the national level, there is nothing to prevent countries redistributing those tax receipts progressively.

Carbon pricing schemes have been growing both in number and ambition. According to the World Bank, as of April 2021 there were 64 initiatives – 29 emissions trading schemes and 35 carbon taxes.[19] However, those covered just 22 percent of global emissions.

Worse still, the size of levy on the emissions being taxed is woefully inadequate. According to Germany's statistics office, global CO_2 emissions reached a record 38 billion tonnes in 2019, with G20 states responsible for around 80 per cent, or 30.4 billion tonnes.[21]

Although the Institute for Climate Economics estimates carbon revenues collected by the G20 almost tripled from $16.9 billion to $47.8 billion between 2016 and 2019,[22] this implies an average CO_2 emissions taxation rate of just over $1.5 per tonne in 2019. While the IMF puts the figure for the world as a whole at closer to $3 per tonne,[23] even that is just a tiny fraction of what most believe is needed and little more than six per cent of what the US government estimates the SCC to be.

Figure 3: **Carbon pricing revenues in G20 countries (US$m)**



Note: RGGI = Regional Greenhouse Gas Initiative (Connecticut, Delaware, Maine, Maryland, Massachuetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont).

Source: Institute for Climate Economics.

$47.8bn

in carbon revenues collected by the G20 between 2016 and 2019

PRICING CARBON
continued

Not that taxing

One reason the world struggles to kick its addiction to fossil fuels is the perceived cost of doing so. Although many activists and politicians promote climate mitigation policies as an opportunity to create jobs and boost growth, the argument looks specious. The fact so few countries come even close to doing their fair share speaks volumes. After all, burning carbon enables valuable activities to happen, such as driving cars, heating houses and manufacturing steel. Taxing carbon, until greener replacements become more available, inevitably leads to a reduction in consumer welfare as those activities are reduced.

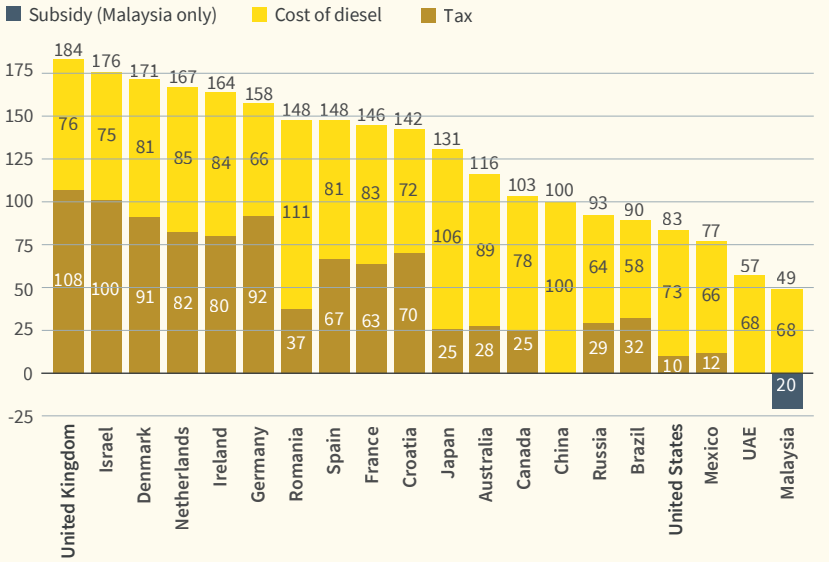
Having said that, establishing an effective carbon price seems unlikely to be as ruinous as some fear. Take a carbon price of $40. That would add around $74, around 12 per cent, to the price of a tonne of steel, $72 to the cost of a return flight between London and New York and would be equivalent to just 9.2 US cents (6.6 British pence) on a litre of petrol.

Imposed around the world, a carbon price of $40 would raise tax revenues of around $1.5 trillion, or roughly 1.7 per cent of global GDP. But while it might seem that would lead to a corresponding drop in consumption and investment, that ignores the fact the same tax revenues would be recycled.

The dead-weight loss likely to result from taxing carbon would be a small fraction of that. Moreover, it would most likely quickly diminish as new technologies are developed to facilitate the shift away from burning carbon. Indeed, Bank of America suggests tackling climate change offers a massive opportunity to get ahead of rivals in developing the clean technologies of the future.[24] Besides, the costs need to be judged against the long-term consequences of inaction.

For the time being, we appear to have got the worst of both worlds. Not only are the measures being taken well short of what is needed to meaningfully tackle global warming, governments are creating massive economic inefficiencies by failing to co-ordinate action. Take the huge disparity in fuel taxes. Whereas diesel levies in the UK, Germany and France are 59, 58 and 43 per cent respectively, the US levies just 12 per cent and China does not tax it at all.[25]

Figure 4: **Filling the (80-litre) tank of a Ford Transit with diesel – proportion of cost made up of fuel cost and tax[26]**



Source: UHY, 2014.

The world's ongoing failure to price carbon has led to a mishmash of command-and-control policies. They range from the imposition of auto emissions standards or the complete phasing out of internal combustion engine car sales, to the subsidisation of various green technologies. In many cases these come at a high cost and are of questionable benefit.

One of the clearest examples is Germany's Energiewende legislation. In 2010, the country set itself an ambitious renewable energy target of 60 per cent by 2050. However, the programme is widely seen as an unmitigated disaster.

Following the Fukushima nuclear accident of 2011, Germany decided to close its nuclear plants. Unable to build renewables fast enough, it turned to lignite, a particularly dirty form of coal. As a result, CO_2 emissions have hardly dropped at all. In 2000, the country derived nearly 84 percent of its total primary energy from fossil fuels; this share fell to about 78 percent in 2019. At this rate, fossil fuels will still be providing nearly 70 per cent of the country's primary energy supply in 2050. Meanwhile, the average cost of electricity for German households has doubled since 2000. By 2019, they had to pay 34 US cents per kilowatt-hour, compared to 22 cents in France and 13 cents in the US.[27]

> *"Establishing an effective carbon price seems unlikely to be as ruinous as some fear"*

Pricing power

In many instances, with politicians unwilling to grasp the nettle, the problem is being outsourced to the private sector. While not denying the private sector has a vital role to play, for example by refusing to finance a coal-related project or demanding higher returns from investments in oil exploration companies, Waygood says it needs a carbon price to perform this function efficiently.

In 1920, British economist Arthur Pigou outlined the merits of using "bounties and taxes" to tackle the problem of externalities – an issue first identified by his tutor Alfred Marshall. By using prices to correct market failures, such a solution would be preferable to regulation that risked strangling people with red tape.

As Waygood says: "We have the world's biggest market failure in climate change, and this will go on until we start to price at least a significant chunk of worldwide carbon emissions more appropriately. While no one would suggest we immediately stop driving, flying, or using steel, the sooner we admit these activities come with a cost, the better."

While Stoft is pessimistic on the prospects for change in the immediate future, he retains hope that increased interest in, and acceptance of, national carbon pricing "might naturally lead to global carbon pricing in another five years, when people get more desperate".

Edward Teller came to be seen by some in the scientific community as something of a villain, partly because of his outspoken support for the development of a hydrogen bomb by the US. But by pointing out the dangers of burning carbon, he alerted the world to an even bigger threat. In doing so, he arguably deserves to be cast in a more favourable light. As for Pigou, while his work is not without critics, it would appear to offer the world an obvious way of dealing with the problem Teller helped identify.

> *While no one would suggest we immediately stop driving, flying, or using steel, the sooner we admit these activities come with a cost, the better*
>
> **Steve Waygood**
> Chief Responsible Investment Officer

INVESTING IN ANTICIPATION OF HIGHER CARBON PRICES

While the world may have so far failed to impose a sufficiently high price on carbon to limit the consumption of fossil fuels, investors would be wise not to bet on this persisting indefinitely.

In May 2019, over 75 businesses, including BP, eBay, Nike, Mars, Microsoft, Nestlé, PepsiCo, Shell, Tesla and Unilever, met with US lawmakers to call on Congress to pass meaningful climate legislation. Placing a price on carbon was high up their agenda.[28] Influential policymakers including Janet Yellen, Christine Lagarde and Ursula von der Leyen have also joined the call for action.

The growing clamour for the world to start pricing carbon closer to its true societal cost means investors should be trying to incorporate higher carbon prices into their valuations of securities issued by a wide range of companies, not just fossil fuel producers and energy suppliers.

"While an effective carbon price may be some way off, the direction of travel is clear. Companies that better manage climate transition risks – for example by minimising potential externalities such as the impact of a carbon price on their operations and hence earnings – should outperform in the long run," says Julie Zhuang, global equities portfolio manager at Aviva Investors.

This helps explain her "fairly negative views" on steel and fertiliser production companies. Zhuang believes many firms in high-emitting sectors such as these face years of materially increased capital expenditure in lower-emitting technologies, and potentially diminishing returns if their businesses are to avoid being rendered uncompetitive by tougher regulations and/or higher carbon prices.

Similarly, Justine Vroman, investment grade credit portfolio manager at Aviva Investors, says while the introduction of an explicit and meaningful carbon price may be some way off, credit investors need to recognise the issue threatens to radically alter the investment landscape.

"With the introduction of the EU Emissions Trading System, many European utilities have become pioneers in terms of investing in renewables and smart grids and decommissioning thermal-coal facilities. Meanwhile, their US counterparts still have a long road ahead to decarbonise. As a result, the cost of debt of some US utilities may not fully reflect the amount of capital expenditure needed," she says.

In the absence of more effective action from governments, it is often left to companies to introduce some form of internal carbon pricing mechanism. They are doing this to help determine projects in which to invest and to reduce carbon emissions within their supply chains.

PRICING CARBON
continued

According to a May 2020 report from CDP – a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions – of more than 5,900 companies worldwide that disclosed information, 853 said they already use an internal carbon price, representing a 43 per cent increase in two years. A further 1,159 said they planned to do so within two years.[29]

Vroman says the climate transition credit strategy she co-manages uses this information to help identify leaders and laggards in the transition to a low-carbon economy.

"Companies that use an internal carbon price are more likely to be taking steps to incorporate climate risk into their business strategy and committing to set science-based targets," she says, adding the adoption of these targets is an effective way of driving change as it puts pressure on emissions reduction throughout the value chain.

However, both she and Zhuang concede that while the growing prevalence of internal carbon pricing is welcome, it is a far-from-optimal solution.

As Zhuang points out, several oil majors have in recent years begun adopting internal carbon pricing to evaluate new projects, under pressure from investors. In many instances that has led the likes of Shell, Total and others to divest assets.

Unfortunately, all too often this has merely shifted assets from a publicly listed owner to private companies or foreign state-run operators, who are often under little or no scrutiny from investors and other stakeholders.

"If all we're doing is shifting assets from one type of company to another, that's not going to tackle climate change. It's another argument for a carbon tax mechanism that would apply to companies, regardless of who the ultimate owner is," says Zhuang.

As for Vroman, she says while the accuracy of carbon accounting remains an issue, especially for Scope 3 emissions that factor in supply chains and product use, regional carbon pricing initiatives have had an impact by forcing companies in various sectors to adapt faster. She concludes a more coordinated approach applied by governments across the board with regards to carbon pricing would be "a powerful catalyst for global decarbonisation".

Unfortunately, that still appears some way off. In the absence of governments imposing an explicit price on all activities that emit carbon, markets will struggle to accurately gauge the climate transition costs facing individual companies.

Nonetheless, Vroman says investors can seek to identify the long-term winners and losers of a transition toward a low-carbon world. She and her team are investing in both solution providers to climate change, enabling the transition towards net-zero, and transition-ready companies that are making their value chains resilient to climate change.

"The push for further climate regulation globally is inevitably going to accelerate the gap between leaders and laggards. Companies that are pivoting ahead will outperform over the long term," she says ●

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LAW AND CLIMATE

USING THE LEGAL STICK TO ACCELERATE CHANGE

LAW AND CLIMATE
continued

Energy majors, cement producers, utilities and financial services providers are among the latest targets of legal action designed to make them move faster towards a lower-carbon world. Could this be an inflection point, as the conversation turns to specific responsibilities rather than vague commitments to change?

Achieving net zero stands prominently in Royal Dutch Shell's corporate strategy, just behind its commitment to shareholders. The oil major has already agreed to reduce the carbon intensity of the energy it sells and aims to become a net-zero emissions business by 2050. Shell says its ambitions are "in step with society's progress"[1] towards a lower carbon world. But is this enough?

In a game-changing development, the company was on May 26, 2021 ordered by a judge in a district court in the Hague to cut Scope 1, 2 and 3 emissions by 45 per cent from 2019 levels by the end of the decade. This captures operational emissions as well as emissions generated from the fuel sold by Shell on the forecourt.

"This is very significant," explains Tom Tayler, senior manager at Aviva Investors' Sustainable Finance Centre for Excellence. "Previously, climate litigation led to countries having emissions targets imposed by the courts, most notably in the Netherlands, but it is the first time a company has been ordered to cut emissions by the courts."

The judgement[2] was based around the concept of civil wrongs established in the Dutch Civil Code. It makes it unlawful for an entity to act in conflict with a generally accepted standard of care. Shell, and others, must act to prevent harm and in a way consistent with what society expects.

"The judge combined bold assumptions about what society believes about climate change, what society believes about human rights and what society expects of businesses; in doing so, she really moved the debate forward," Tayler says.

"One of the most staggering things she said related to how much the emissions reductions might curb Shell's growth. She accepted the 45 per cent reduction might be costly from a commercial perspective, but the need to reduce emissions trumped that. This is an incredibly important conclusion and one others will be sure to want to use as a precedent in future actions."

While Shell will appeal, comments from its CEO Ben van Beurden suggest the climate message has landed. "We will seek ways to reduce emissions even further in a way that remains purposeful and profitable," he said in an interview in June. "That is likely to mean taking some bold but measured steps over the coming years."[3]

While legal manoeuvres may continue for months, the judgement is seen as a major step forward by environmental campaigners. The man behind the case was high-profile environmental lawyer Roger Cox, author of *Revolution justified: Why only the law can save us now*.[4]

In representing Milieudefensie (the Dutch arm of Friends of the Earth) against Shell, Cox argued Shell was "on a collision course" with the climate target set out by the international scientific community and numerous governments. To meet the Paris Agreement, where the goal is to limit global temperature increases to below two degrees Celsius above the pre-industrial average, and ideally to 1.5 degrees, Shell has been told to do more.

Testing the law as a governance tool

Meanwhile, the volume of climate-related litigation around the world is stepping up. Since the Rio Earth Summit in 1992, a large body of climate legislation has been developed (see maps in Figures 6 and 7), with assorted stakeholders and pressure groups prepared to test it.

Cases have almost doubled from 884 to 1550 since 2017.[5] Most litigation (79 per cent) has been in the US; just 10 per cent has been directed at corporates. The majority of the 135 businesses facing challenges are energy and natural resources companies, with litigation concentrated in six areas: the rights to life and a clean environment, the need to keep carbon in the ground, areas of corporate responsibility, enforcement of climate targets, adaptation impacts and climate disclosures. The last category includes a growing number of financial markets cases, focusing on financial risks, fiduciary duty and corporate due diligence, affecting banks, pension funds and asset managers.[6]

At this stage, the financial consequences are unclear. "Our understanding of the potential costs arising from climate change litigation is very poor," wrote Javier Solana, a lecturer at University of Glasgow's School of Law, in an academic paper last year.[8] "Contrary to popular understanding, not all direct costs will arise at the end of legal proceedings." Ultimately, total costs may be much higher than headline fines or court orders, particularly if litigation results in negative publicity and long-lasting reputational damage.

The action is testing the role of the judiciary and reflects important social questions around values and expectations. "There is a definite generational shift underway," says Paul Pritchard from sustainability consultant Iken Associates. "People have been talking about climate for 25 years, but it is only recently that views have started to crystalise. The younger generation wants to see more action; they are taking this much more seriously," Pritchard says.

For Tayler, the nature of the language being used by the courts to support calls for fairer treatment and intergenerational fairness is worth noting. In Australia, for example, a recent judgement suggested failure by the environment minister to take climate action

> *Climate attribution allows human impacts on climate change to be assessed, down to the individual company level*

on coal could wreak "devastation" on children, forming part of part of "the greatest intergenerational injustice ever inflicted by one generation of human upon the next".[9] Germany's Constitutional Court has also deemed the 2019 Climate Change Act unconstitutional for placing too much of the decarbonisation burden after 2030. It declared that one generation could not be given the right to consume a large share of the carbon dioxide (CO_2) budget if it left radical reductions to others and exposed them to "comprehensive losses of freedom".[10]

Pritchard believes the underlying value shift will become increasingly apparent in consumer action: "They will reflect their values and choices in their behaviour, where they work, where they invest their money and so on."

So, how do experts view Cox's latest crowdfunded challenge? "The Shell case in the Netherlands is important, because it addresses whether Shell is going to deliver on its targets. Those that brought the case said: 'It does not look as if you are going to do that' and are really calling on Shell to change its core business model," says Joana Setzer, assistant professorial research fellow at the Grantham Research Institute on Climate Change and the Environment at the London School of Economics.

The key analytical tool that might prove pertinent is climate attribution. This rapidly evolving science allows human impacts on climate change to be assessed (within certain data constraints), right down to the individual company level. By taking a pre-industrial climate scenario, then comparing it with one that takes man-made emissions into account, it may be possible to define the human contribution in a particular scenario.

These developments are significant because until recently it was not possible to be definitive about causative relationships, to establish that a single company's actions might have contributed to a particular weather event.

"Because of the causation issues, quantifying damages for acceleration of climate change may be difficult," noted law firm Norton Rose Fulbright.[13] The evolution of climate attribution has gripped the legal profession; a judge hearing a case in the US is reported to have asked for a relevant 'teach-in', to help him prepare.[14]

"This is where the work of Dr. Friederike Otto, Richard Heede and others has made a real difference," Setzer says. "They have developed attribution science, but they are also producing science that is useful for courts. We had science produced prior to that, but lawyers couldn't readily use it. Now the lawyers and scientists are talking, the scientists are producing information that is purposeful and this is already making a difference."

One important consideration in legal action is whether greenhouse gas emitters can be shown to have known about environmental risks but pressed ahead with harmful activities regardless. If evidence like this coexists with information from an internationally recognised body like the Intergovernmental Panel on Climate Change, companies may find it harder to have the cases against them dismissed.

"The ruling against Shell is game changing," says Sora Utzinger, senior environmental, social and governance (ESG) analyst at Aviva Investors. "Prior to now, most of the behaviour change related to climate has come about from top-down regulation. More governments have announced plans to reach net zero, and companies have changed their behaviour accordingly, to reflect what society wants to achieve. This is different; it makes company commitments binding."

Meanwhile, environmental consultants warn of oversimplifying the analysis, making it all about the few. "One concern I have is about the need for quite a simple narrative, about good guys and bad guys," says Pritchard. "It is not particularly helpful to demonise a small group of companies. The oil majors are not the only ones involved here.

"They might be supplying a product, but lots of others are using it, and perhaps those individuals could be doing more to look for alternatives themselves," he adds. "I hope the discussion becomes broader. There are companies that need to be held to account, but hopefully that does not lead to the conclusion that only a handful are the problem. It is much bigger and more complex than that. We need to be asking more questions, like who burns the gas and puts the aviation fuel in the planes?"

Figure 1: **Direct and indirect cases involving the private sector[7]**

Source: Grantham Research Institute on Climate Change and the Environment, July 2021.

LAW AND CLIMATE
continued

> *These cases could set wide-ranging precedents in terms of establishing a company's liability*

Facing up to responsibility for the global commons

Meanwhile, in Germany, another climate case is being played out. A small-scale Peruvian farmer, Saul Luciano Lliuya, is taking on the German utility RWE, backed by the sustainable development organisation Germanwatch.[15]

RWE is one of Europe's largest emitters, giving out around 100 million tonnes of CO_2 annually from fossil-fuel fired power stations and other assets. It has plans to phase out coal and be carbon neutral by 2040.

"German regulations require an end to coal-fired energy generation by 2038," says Utzinger. "RWE plans to use one of the dirtier fuels right up to that regulatory deadline. Other European peers seem to be moving faster in the energy transition, although generally they are all ahead of their equivalents in the US."

Lliuya lives in the Andes, about 280 miles north of Lima, where rising temperatures have led a glacier to retreat. The melting ice is feeding a glacial lake, which threatens to burst. If it does, it will affect Lliuya and the lives of thousands of other local residents.

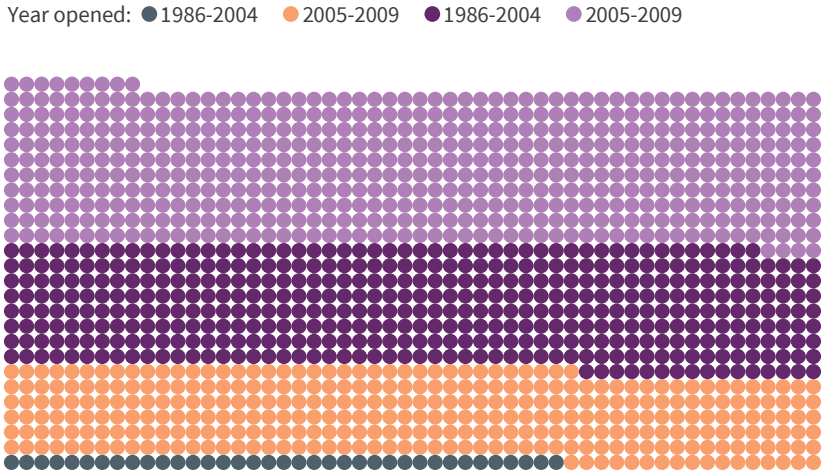
"This is the first lawsuit in Europe where a person affected by the hazards of climate change has sued a private company," Germanwatch says.[16] Lliuya is seeking damages from RWE to compensate for the investment he has made to protect his home. The amount itself is not vast – less than half of one per cent of the total cost incurred by himself and the local authorities. That's the same percentage as RWE's estimated contribution to global greenhouse gas emissions since industrialisation began.[17] If Lliuya's legal team is ultimately successful using a 'general nuisance' clause in the German Civil Code, it potentially opens the floodgates to countless other claims.

"Litigation like this presents both a risk and an opportunity from an ESG perspective," says Utzinger. "Companies can differentiate themselves through the progress they make as they move towards an effective low-carbon transition. But we should not underestimate the risks. These cases could set quite wide-ranging precedents in terms of establishing a company's liability towards society, not based on a specific locale."

To clarify, RWE is in the dock for impacts in Peru, although it has no operations there at all.

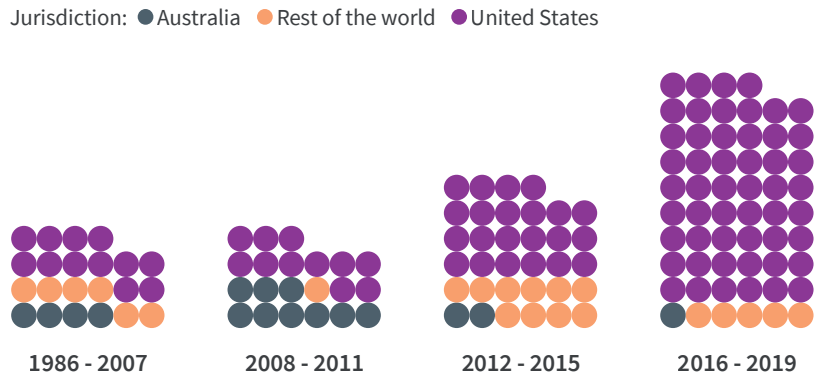
In a story of many twists, RWE has now taken legal action against the Netherlands in a €1.4 billion corporate/state dispute. It is looking to offset the cost of retiring a coal-fired power station early;[18] that decision came about after Cox's successful case against the Dutch government. RWE is the subject of climate litigation and also using it.

Figure 2: **Climate-related litigation: Total cases 1986-2019**[11]



Note: Each dot represents one case.
Source: Freshfields Bruckhaus Deringer, December 2019.

Figure 3: **Climate-related litigation: Cases against companies 1986-2019**[12]



Source: Freshfields Bruckhaus Deringer, December 2019.

The complex web linking social values and risk

So, what does this imply? "We see the right to environment emerging globally," says Laura Burgers from the Amsterdam Centre for Transformative Private Law at the University of Amsterdam.[19] "We see the environment as a foundation of society, as a part, a necessary condition, of constitutional democracy, as a condition to be able to exercise the other rights you have."

Because environmental issues transcend national boundaries, there is an obvious governance challenge. "It is interesting that many defendants in climate cases point out they are not responsible, but it is rather a global responsibility," she says. "And they are right – climate change is a global issue that can only be addressed effectively if everyone is on board. At the same time, it means we all should actually be on board!"

The analytical framework that has developed to encapsulate the changing environment involves an intricate web of physical, transition and litigation risk. "As physical risks become larger, so does the litigation risk," Setzer says. "But transition risks also increase litigation risk. This is why it is important for private actors to track cases against states, not just cases against companies they invest in or insure."

Important implications flow from this. Recent analysis by the UN Environment Programme points to six key areas where litigation may step up, shown in Figure 4.

Where might these various risks present? What mechanisms might be lightning rods for risk transmission?

No clear answers emerge. A high-profile case could prove a tipping point, but Pritchard believes a more likely outcome is that litigation will "pick up laggards, rather than drive change fundamentally". Perhaps controversially, he suggests attention is being directed at climate risk "because it has universal metrics; it can be measured in terms of greenhouse gases".

Figure 4: **Future trends in climate litigation**

Migration triggers litigation in the global south

Mass displacement from extreme climate impacts is likely to disproportionately affect countries in the global south. Anticipate growing number of cases seeking to address status of displaced people.

Consumer and investor fraud claims increase

Claims against companies for failure to disclose or inadequate disclosure are expected to increase. Greater regulatory requirements and scientific advances mean climate events are more likely to be foreseeable, leaving companies at higher risk of litigation for failure to disclose.

Pre- and post-disaster cases rise

Anticipate more cases based on alleged failure to plan or manage the consequences of extreme climate events, for example related to fires or advancing sea level.

More disputes around the implementation of adaptation measures

Ways in which changes are implemented (or not) are likely to be the source of future litigation.

Greater attention on climate attribution

Few climate-litigation cases have reached evidentiary stage, where courts have scrutinised whether alleged loss or injury is directly caused by climate change and the defendants' contribution to it. The science of climate change is becoming more robust. Attribution of responsibility is central to climate litigation; expect climate attribution to receive more attention.

Increased use of international adjudicatory bodies

Judgements may be sought from international adjudicatory bodies rather than domestic regimes which may not be effective at holding governments to account. Opinions from international bodies may not be enforceable, but they can influence how judges and other stakeholders view the law.

Source: UNEP Global Climate Litigation Report: 2020 Status Review, January 2021.

> *"As physical risks become larger, so does the litigation risk"*

LAW AND CLIMATE
continued

> *Litigation is being used in every direction, and we are going to see more of it*

Figure 5: **Assessing litigation risk**[21]

TCFD recommendation:	Governance	Strategy	Risk management	Metrics and targets
Litigation risk role:	Incorporation of climate-related litigation risk into the governance of an organisation, including in relation to the senior management and directors' responsibilities.	Consideration of climate-related litigation risk when defining the sustainability and overall business strategy for ensuring a robust and forward-looking business model.	Incorporation of climate-related litigation risk into the risk management function, including identification, assessment, mitigation, monitoring and reporting.	Definition of metrics and targets for climate-related litigation risk management.

Source: UNEP, January 2021.

In his view, other nature impacts connected with climate change, such as biodiversity loss, need attention too. "In some ways, a focus on nature-related impacts rather than greenhouse gases might afford an easier route to litigation, not least through geographic dependencies that allow cause-effect pathways to be constructed," he says.

There is plenty of stakeholder tension to contemplate as well. If carbon-heavy businesses accelerate towards transition, will their return on capital fall? Could that leave emitters open to criticism from climate change activists as well as disgruntled shareholders, with risk on both counts?

"They are, in a sense, damned if they do and damned if they don't,"[20] as law firm Freshfields Bruckhaus Derringer puts it.

"Climate transition risks are being taken much more seriously by the oil majors," Utzinger says. "They are factoring them into the capital budgeting process, resulting in a higher cost of capital. Those on the path to net zero know they have to de-risk their traditional upstream business; that's why they talk about 'advantaged resources', where there is a sweet spot between low breakeven prices and lower emissions intensity.

"Of course, returns on invested capital (ROIC) vary across hydrocarbon and low-carbon energy sources," she adds. "We think companies should not just focus on ROIC but on the underlying risk profile – ultimately knowing where to play and understanding where established capabilities can create value in the low-carbon space is going to be a critical component of strategy."

All this suggests an environment that requires thoughtful handling, particularly as there is little consistency with carbon disclosures yet. Ultimately, best practice means companies that could be targets of climate action need to inform their shareholders, build provisions, and ensure material risks are reported. In the background, they need to recognise the potential to be challenged in jurisdictions in which they do not operate.

Institutional investors also need to think carefully about their duties to clients, how their risk exposures are being presented and their ability to verify any claims being made about environmental credentials. Cases to bear in mind include McVeigh vs. REST, where a 25-year-old member of an Australian pension scheme won a case after suggesting the scheme was not doing enough to protect his savings.[22] Ultimately, the scheme agreed climate change implied a "material, direct and current financial risk", to align its portfolio to net zero by 2050, and report using the guidelines agreed by the Task Force on Climate-related Financial Disclosures.

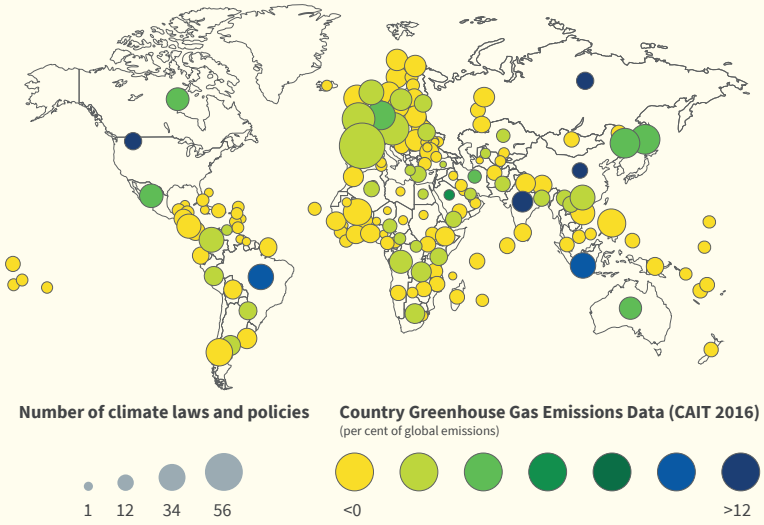
Insurers also need to prepare for detailed scenario analyses with forensic scrutiny of underwriting decisions and the assets they hold, to help mitigate the uncertainty.

These changes reflect the complex way the environment is changing, how environmental protest has become global and how climate action is part of an evolving social debate.

"Litigation is being used in every direction, and we are going to see more of it," Setzer warns. "The terrain becomes complex, risks and uncertainty are high, and the players involved are powerful. It will be a hard fight" ●

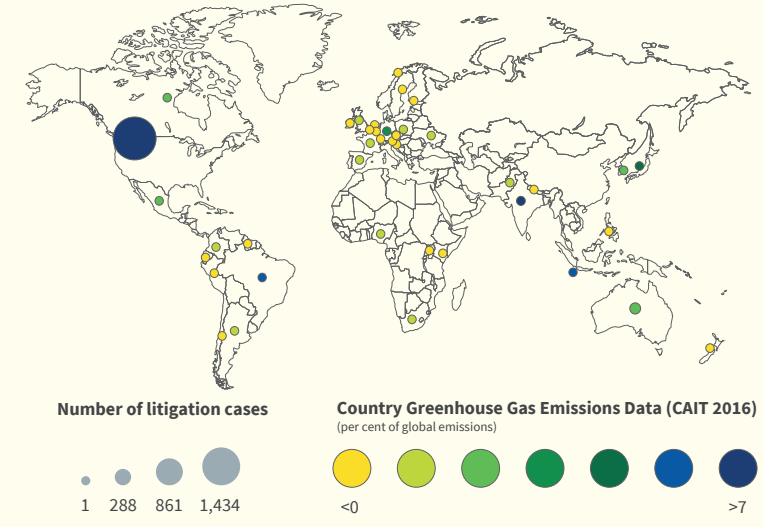
THE LAW AS A GOVERNANCE TOOL

Figure 6: **Climate laws and policies and greenhouse gas emissions[23]**



Note: The size of the circle represents the number of climate laws and policies. The larger the circle, the higher the number of climate laws and policies. The colour of the circle represents the percentage of carbon dioxide emissions from the use of fossil fuel and the manufacture of cement, land-use change, and forestry. The darker the circle, the higher the emissions.
Source: Grantham Research Institute on Climate Change and the Environment, March 2021.

Figure 7: **Climate litigation and greenhouse gas emissions[24]**



Note: The size of the circle represents the number of climate lawsuits. The larger the circle, the higher the number of climate lawsuits. The colour of the circle represents the percentage of carbon dioxide emissions from the use of fossil fuel and the manufacture of cement, land-use change, and forestry. The darker the circle, the higher the emissions.
Source: Grantham Research Institute on Climate Change and the Environment March 2021.

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CRISIS OR OPPORTUNITY OF A LIFETIME?

RETHINKING THE FUTURE OF THE PLANET

Will a world beset with challenges spin into catastrophic breakdown or spur humanity to change and reach new heights? John Elkington widely regarded as the 'godfather of sustainability', contemplates the future with *AIQ*.

> *When backed into a corner, Homo sapiens sometimes does its best work and moves to a different level of innovative thinking and creativity*

Elkington, an authoritative voice on corporate responsibility, warns that key elements of the climate, biosphere and established economic order are under threat, which raises the question: is it too late to change? "We are headed into a hellish world of systemic breakdowns," he declared in the opening pages of his latest book,[1] *Green Swans*.

As an advisor to leading companies for over four decades, including through his latest venture Volans, a London-based sustainability and innovation thinktank, Elkington's views carry weight. Yet far from feeling negative, he sees the breakdown of the established order as an opportunity to create a better, more sustainable world. It could be the start of an adventure, Elkington says, as we rethink the future of the planet, societies, and capitalism itself.

Last November, you said: "We are moving through a point in our history where the reality we all grew up with is starting to unravel. This is an extraordinarily challenging time in our history, but also one of the biggest opportunities we have ever had." Can you elaborate?

Economists like Nikolai Kondratiev and Joseph Schumpeter flagged long-wave cycles, with periods of investment and periods of disinvestment, periods of order and periods of chaos. The point I made is about the spirit of long-wave cycles of change.

I think we are entering one of the chaotic periods of disinvestment. This is not simply financial and economic; it is social, psychological and emotional as well. So, for example, after the Second World War, the Bretton Woods Agreement established an unparalleled global political and economic order. It is something we have all benefited from to some considerable degree. We have grown up with it and taken it for granted, but now it is unravelling.

Several years ago, we started to witness that process with populism emerging as one symptom. Ordinary people began to feel something needed to change. I don't think the change is going to be over by next Tuesday or next year; historically it tends to take at least 12 to 15 years to work through, and the result is that the political and economic landscape is transformed. At that point, many of the big brands and companies you have grown up with, worked for, bought from and – to some degree – relied on and even loved will not be there any longer.

What factors will determine the outcome?

The critical dimension is the political realm. In the worlds of politics and governance, there is no guarantee we will emerge in good time and in good order, because our species tends to deny responsibilities as long as it can. But when backed into a corner, *Homo sapiens* sometimes does its best work and moves to a different level of innovative thinking and creativity. It is no accident the order created by Bretton Woods flowed from the crucible of the Second World War. It changed expectations entirely, because people were so horrified by what they had seen, they were prepared to do the previously unthinkable, sharing sovereignty and so on.

> *When the established system begins to disassemble, the opportunities to create something different are radically greater than in 'normal' times*

I believe we are in one of those times again, this time with the focus on our natural environment given the terrible fires, floods, storms, droughts and so on. The evidence of climate change is pressing in hard. Increasingly, people are primed to understand something dramatic is needed.

The other thing is that the inadequacies of political leadership are being exposed. The current generation of leaders does not understand what it is being called upon to do. Greta Thunberg is 18-years old, speaking for emerging generations and giving the UN General Assembly and the World Economic Forum some sense of urgency and direction. The 1960s was the last time we saw a fracturing of the relationships between younger people and older people of this kind. I believe it is starting again, and that can be profoundly dangerous if mishandled.

But in some ways, counterintuitively, I am strangely optimistic. We have talked about needing system change for years, decades even. But when you try to change an existing system, there is often internal resistance. Vested interests, the incumbents, do not wish to see that change. But when the established system begins to disassemble, the opportunities to create something different are radically greater than in "normal" times.

In your latest book, you introduce the idea of 'green swans' as symbols of better times to come. Can you tell us more about the genesis of this? Have you discussed your thoughts with Nassim Nicholas Taleb, whose ideas on black swans you build from?

Green swans were introduced in my 20th book to capture positive solutions with the potential to take us exponentially towards breakthroughs that could deliver a sustainable future for everyone. Many years ago, I introduced the concept of the triple bottom line (a framework integrating social, environmental and financial considerations), in effect going head-to-head with Milton Friedman's ideas on profit maximising. Of course, I never had the chance to speak to the late Friedman myself.

Similarly, I have not met Taleb. He might suggest I have misinterpreted his conception of a black swan, because that captures both problems and solutions with exponential characteristics. But rather than concentrating on the 'problem' side, I prefer to focus on areas of positive, deliberate action.

Like Taleb, I also believe many of the issues we face have exponential characteristics, which subvert our ability to understand what is going on. They take us beyond the competence of most governance mechanisms we have in place. Climate change, biodiversity loss and antibiotic resistance are all issues with these characteristics that we must now address.

Your new Green Swans Observatory is actively seeking scaleable solutions to challenges. Do you have any examples of solutions that might look 'weird' or surprising at the outset, but could have remarkable upsides?

The Observatory was almost forced upon us, because I have engaged with audiences in over 35 countries since my book came out. People expressed great interest in the ideas, but tended to say: "I'm operating in this sector, in this geography, these are my risks, these are my opportunities…what can you tell us about relevant solutions?" The Observatory was set up in response to this. It takes different pieces of a puzzle and examines them in more detail. We look at soils, water, farming, food, nutrition, health, finance and so on, and try to assess what's going on.

I'm always impressed by business schools doing case studies of successful businesses, but very often they appear at the pinnacle of the relevant organisation's success. These studies explore what led to the current success, but surprisingly often things fall apart shortly afterwards. What we are doing is creating living case studies, where we take organisations in the process of transformation and investigate what happens over time.

One example is the Scottish Environmental Protection Agency. We are looking at the way in which it is trying to bring regenerative solutions into an area around the River Leven in the Scottish Highlands with its chief executive Terry A'Hearn. We talked last year about what an environmental protection agency fit for the 21st century might look like; then the organisation was subject to a huge cyber-attack. It had to decide whether to pay a ransom demand to recover 50 years of environmental data. It decided it would not. A'Hearn is now saying: "This is a blank sheet. This is an opportunity to rethink what an environmental protection agency does and how it does it, and how that might play into a positive, green swan narrative".

These living case studies are important, and we have been invited to profile our work in universities and business schools around the world, including in Japan, Egypt, Portugal, America, UK and so on.

If I had to pick case studies now, I would include Tesla. When I first came across its founder Elon Musk 15 years ago, I was advising the Ford Motor Company in Detroit. It seemed electric mobility was likely to be a powerful trend, but people would say: "We tried that 100 years ago and it did not work. It's not going to work this time." What you see now is how comprehensively expectations have been disrupted. By 2023, there will be about 500 electric vehicle models on the market and intense competition will drive down the cost of batteries and charging infrastructure.

The work of the thinktank RethinkX is another example. It looks at the speed and scale of technological disruption, underscoring how sectors as diverse as transport, energy and cattle ranching face exponential disruption. The result will be to turn current expectations on their head.

These examples underpin my optimism. Things that look impossible now are going to become possible in short order, and then society's views will flip. We will come to see the relevant changes as inevitable. We often do this as a species. We might say with Tesla: "Of course, it was inevitable. Tesla was guaranteed to be a success, wasn't it?" The answer is 'absolutely not'. The company skirted disaster at a number of points in its evolution.

I have read enough about these exponential trajectories to know that in the early stages of a paradigm shift, people don't see the change. In fact, more often than not they fight against what's coming in their direction, even if there were great benefits for the wider world.

> *"Things that look impossible now are going to become possible in short order, and then society's views will flip"*

Does the financial services sector appreciate the scale of change ahead? Could you set out how different the sector might need to be to align finance to a net-zero economy?

I think it will be very different. New actors are appearing and will continue to appear. The Elon Musks of the financial future, if you like. Some of the expectations we might have about what future banking, insurance and reinsurance and investment might look like will be blown apart by these innovators.

Let me give an example. For 30 years I have sat on the advisory boards of socially responsible investment funds and similar boards with venture capitalists and so on. Our own family pension is something I have largely managed myself, drawing on different advice along the way, and I thought it would hold up to scrutiny quite well. But a former colleague recently reviewed all our holdings and identified a number of key issues. What shocked me, once we began to shift gears, was just how long it took us to exit some legacy holdings.

My view is that the financial sector seems to be configured to stop rather than enable people to do the right thing. I look at the environmental, social and governance (ESG) trend now and see a stampede, a feeding frenzy. It worries me, partly because we are herd animals who tend to do things on reflex. If everyone is moving in one direction, we tend to do the same thing. I have always seen ESG as necessary, but only as a stepping stone. This is a sector that will be rocked by tomorrow's mis-selling scandals.

In finance, does big mean bad?

Not necessarily. Scale is needed in any market, including finance. There are certain benefits that come from scale and stability, including the opening up of access to products and services to wider populations.

The issue is that scale often goes with monopolistic or oligopolistic tendencies, as we see with the largest US technology companies, the FAANGS (Facebook, Amazon, Apple, Netflix and Alphabet (Google)). I think they need to be broken up. If not, we will certainly regret it.

So, the next question is: will we have to break up the banks and insurers as well? I'm not convinced of that, although much will depend on how the big financial institutions behave. It is more important, I think, that we change the rules of the game.

In a recent paper, you suggested speculative, short-term trading activity needs to be curtailed. What other changes do you see on the horizon?

High-frequency trading is a symptom of a much deeper malaise, where we expect financial returns over shorter and shorter timescales. Trading is so fast that there is little or no time to consider wider consequences, intended or unintended. Some form of transaction taxation to slow the pace of speculative trading is now essential. People inside today's financial system may be nervous and argue against it, but we must do it, just as we have to tax carbon dioxide and other greenhouse gases in a robust way. But these changes are harder to achieve when you have a fragmenting political landscape.

> *"Some form of transaction taxation to slow the pace of speculative trading is now essential"*

> *We need serious efforts to change the system, particularly the rules of the economic game*

In my view, most people in the financial sector do not yet think in the way that they – or the survivors – will be thinking in the 2030s. Many of the people who occupy senior positions in finance today will no longer be there for various reasons. Considerable numbers may need to be forcibly retired in a period of convulsive change.

I'm a baby boomer. I'm 72, so I begin to understand what happens to people as they age; one tendency is to become more conservative. As a result, the pensions industry is going to find itself under growing pressure to consider shorter time horizons, to build the financial returns people expect to receive on their investments. I am worried about the impact this greying of populations will have, both in pensions and in political voting. We risk seeing the necessary radical changes being slowed, stalled or disrupted by growing conservatism, with a small 'c'.

We cannot simply stand back and say: "This is a younger person's problem." This is an intergenerational challenge with massive consequences for us all as part of the wider – and clearly dysfunctional – financial system.

What is most striking about the operating environment today?

In the past, companies often claimed investors would not support certain actions. Now, company after company is telling us they are being asked penetrating questions on ESG issues by investors and financial analysts. Initially that may have been about analysts trying to move up their own learning curves, but it seems they are starting to think more rigorously and systematically about the related market dynamics. There are also many different groups coming together ahead of COP26, including bankers and central bankers; in the past, some of these parties tended to lag the curve.

I believe we are moving into a period of significant deglobalisation, where current expectations about where we are heading will be challenged profoundly. What is going on in Afghanistan again signals the end of an era. The old order – the Pax Americana – can no longer be relied on. It does not necessarily mean it disappears entirely, but geopolitics are also going through convulsive change. These are sink or swim times.

As a result, in business the spotlight is increasingly on CEOs and boards. Business leaders are coming together with new initiatives for shaping markets and taking part in the transition toward a more sustainable world. We see more businesses aligning differently, ahead of regulatory pressure to do it.

The fact Walmart's CEO Doug McMillon has committed to make it a 'regenerative' company is a sign of the times. We are yet to see it happen in full, as with so many companies' net-zero carbon commitments, but large companies in Walmart's supply chain like PepsiCo and Unilever are scurrying about and asking: "What does this mean for us?"

These are axial, pivotal times. Young people are starting to articulate a very different future from their parents, let alone grandparents, and the financial sector is – and going to be – in the eye of the storm. We need serious efforts to change the system, particularly the rules of the economic game. Those who get this right will sometimes enjoy quite disproportionate benefits, as those long-wave economists concluded long ago ●

1 John Elkington, 'Green swans: The coming boom in regenerative capitalism', Fast Company Press, 2021

A FAIR COP

WHY SOCIAL JUSTICE IS VITAL TO CLIMATE ACTION

For too long, issues of justice and equality have been left out of the climate conversation. But policymakers, companies and investors are slowly beginning to acknowledge the social dimensions of climate action.

In January 2020, a group of young climate activists held a press conference at the World Economic Forum in Davos. The Associated Press published a photograph of the event online: the image showed Swedish teenager Greta Thunberg and three other white women against a backdrop of snowy mountains.

But someone was missing. The only black member of the group, 23-year-old Ugandan campaigner Vanessa Nakate, was cropped from the image. When she politely tweeted AP to ask why, she found herself at the centre of a debate about racism in journalism – and the climate movement itself.

"We don't deserve this. Africa is the least emitter of carbons, but we are the most affected by the climate crisis," Nakate said later, in a video statement posted on social media. "You erasing our voices won't change anything. You erasing our stories won't change anything."[1]

Although the AP apologised, claiming the image was cropped "purely on compositional grounds", the incident was a reminder of how people in the global south are routinely ignored in the fight against climate change. But thanks to the work of Nakate and others, the concept of a just transition – a more equitable, inclusive route to a net-zero future – is gaining ground among policymakers, workers and businesses across the world.

PART 1: A JUST TRANSITION

Start with the question of fairness. Low-income economies in Africa, Asia, Latin America and Oceania have historically contributed little carbon to the atmosphere (see Figure 1). In many cases, they are also still suffering the legacy of the colonial period, when Western powers brutally plundered poorer countries' resources to further their own, carbon-intensive development.

"Rich countries that exploited the world have a moral obligation to help solve this crisis in an equitable way," says Steve Waygood, chief responsible investment officer at Aviva Investors. "Even after colonialism ended, Western companies extracted property rights and licences using unfair profit-sharing agreements, meaning the world's poor lost out."

In a cruel irony, developing economies are unlikely to be able to make full use of their remaining hydrocarbon wealth, due to the imperative to rapidly decarbonise the global economy. Their governments face the tricky task of diversifying away from oil and gas, while simultaneously lifting citizens out of poverty and channelling capital towards costly climate resilience and adaptation projects.

"A just transition in Africa centres on one word – socio-economics," says Richard Munang, Africa Regional Climate Change Coordinator at the United Nations Environment Programme (UNEP). "While Africa has contributed least to the current emissions causing climate change effects, at two to three per cent, it suffers disproportionately because of a very low socio-economic base.

"While climate change effects are global, the poor are disproportionately vulnerable because they lack the resources to afford goods and services to buffer against the worst effects," Munang adds.

Within richer nations, too, the physical and economic impacts of climate change tend to fall on those without the means to protect themselves. In the US and Europe, poorly managed deindustrialisation has created impoverished rustbelts and extreme weather is already hurting working class and minority communities, worsening existing inequalities. Research from *The New York Times* finds white people are less likely than people of colour to be affected by natural disasters in the US – and more likely to benefit from government aid when they are.[2]

Rights and capabilities

It doesn't have to be this way. A growing body of evidence indicates a well-designed energy transition can bring a range of benefits in both rich and poor countries, mitigating social problems and creating new employment opportunities. A study from the International Labour Organisation, a UN agency, finds the energy transition is likely to create 24 million jobs in clean industries worldwide, with six million lost – a net gain of 18 million.[4]

The challenge is to ensure those benefits are evenly spread. One way to do this is to focus on human *capabilities*. Derived from the ideas of the philosophers Martha Nussbaum and Amartya Sen, the capabilities approach to welfare centres on people's ability to access the resources they need to achieve their full potential and defend their human rights.

"The capabilities framework makes demands for climate action stronger because it recognises the need to connect climate action with human wellbeing. You cannot possibly meet your capabilities if you are experiencing a multi-year drought, or if you live in a rustbelt town where coal mining is your only choice of work," says Sonja Klinksy, associate professor at the School of Sustainability at Arizona State University and co-author of *The Global Climate Regime and Transitional Justice*.

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continued

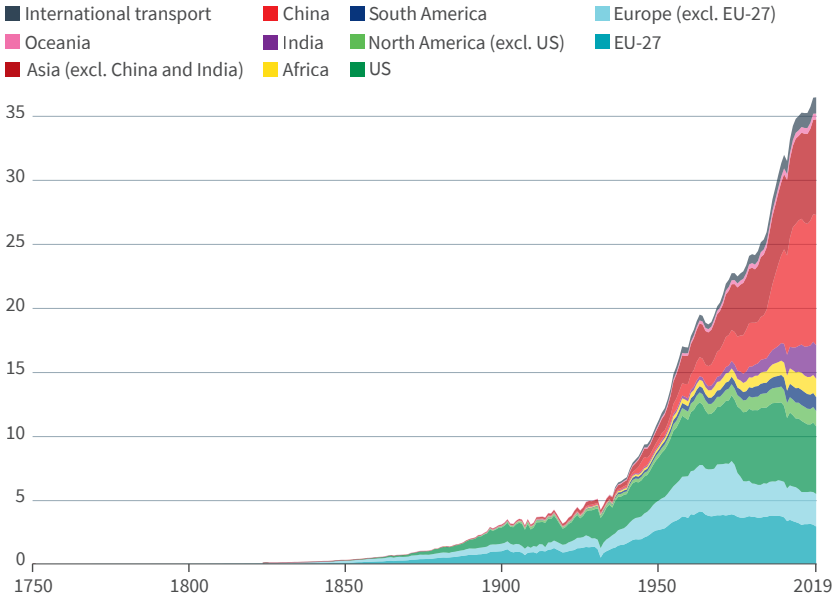
> *The just transition applies at all levels, from global to national down to the specific locality*

The capabilities framework also helps to codify the legal basis of the just transition. The principle of Common but Differentiated Responsibilities and Respective Capabilities, recognising the need for climate action to take into account disparities between developed and developing economies, was enshrined in the United Nations Framework Convention on Climate Change as early as 1992.

While progress has been slow since then, Klinsky says awareness of the need to deliver a just transition is growing, for pragmatic as well as ethical reasons.

"When I started working in this area, in 2005, there was a lot of scepticism. But in the last few years, it's become very apparent that if you don't integrate the needs and lived experiences of those who are facing the greatest change, you simply cannot get where you want to go. That said, it's one thing to recognise the issue, quite another to put in place the kinds of policies and actions that get us there," Klinsky adds.

Figure 1: **Historic carbon emissions by region (billion tonnes)[3]**



Note: This measures CO_2 emissions from fossil fuels and cement production only – land use change is not included.
Source: Carbon Project.

PART 2: FROM GLOBAL TO LOCAL: CLIMATE ACTION AND THE JUST TRANSITION

Action on the just transition needs to happen at several different levels: from multilateral agreements to establish countries' relative responsibilities and mobilise private investment; to national policies such as carbon taxes; to regional and place-based initiatives promoting communities' capabilities through the transition.

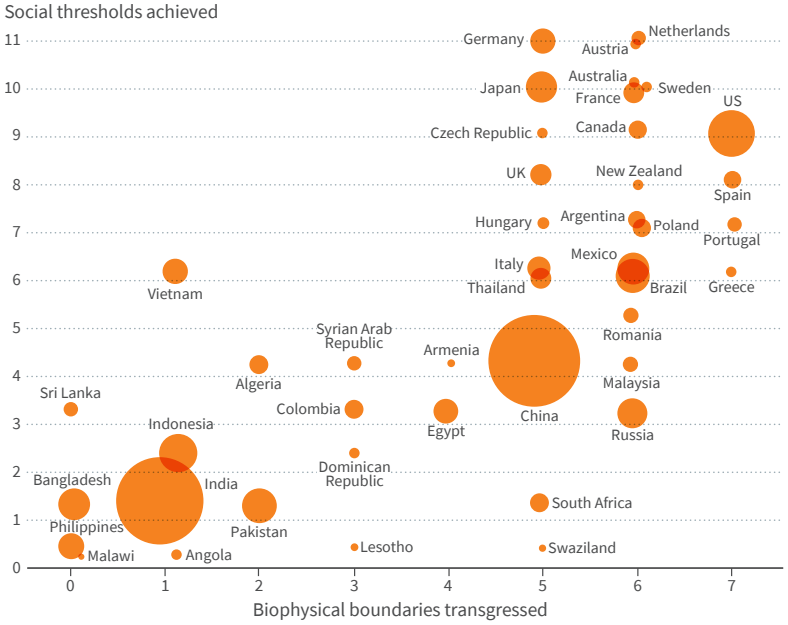
"The just transition applies at all levels, from global to national down to the specific locality," says Nick Robins, professor in practice for sustainable finance at the London School of Economics (LSE) Grantham Research Institute. "People talk about a 'whole of society', 'whole of government', 'whole of business' approach to the climate crisis, and this is exactly what's needed for a just transition."

At the global level, the importance of a just transition was nominally recognised in the 2015 Paris Agreement, which outlined the need to "[take] into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities". However, this text appeared only in the preamble of the document, rather than the agreement proper.

"We are paying lip service to the just transition, but we are still far from actualising it in our transition plans," says Fatima Denton, director of the United Nations University Institute for Natural Resources in Africa (UNU-INRA) and a lead author of the Intergovernmental Panel on Climate Change's sixth assessment report. "Our approaches are often macro, discounting the need for social justice to serve a group of people that will be disproportionately impacted in a low-carbon development transition. Even the terminology 'net zero' has justice implications. Whose net zero are we talking about?"

COP26 in Glasgow represents an opportunity to put concrete plans for a just transition in place. But even before the conference begins, climate activists from the global south are warning the meeting could be a "rich nations stitch-up" – especially if COVID-19 protocols prevent their delegates from travelling to Scotland.[5]

Figure 2: **Social development tends to come at an environmental cost[17]**



Note: The Y axis tracks companies' progress on social metrics such as education and electricity access; the X axis shows the extent to which they are exploiting natural resources to do so.

Source: Nature Sustainability, 2018

> *If gender equity is intersected with adaptation projects, it will unleash more societal and economic benefits*

Organisers say they are loosening COVID rules to allow people who have been unable to access vaccines in their home countries to attend – but the unvaccinated will still have to quarantine at their own expense. According to Maria Reyes, a climate campaigner from Mexico, this points to an exclusive, neo-colonial approach: "You're preventing the attendance of the people affected by the climate crisis. That really has let us see how this is going to be the most imperialistic COP ever."[6]

Adaptation and resilience

Nonetheless, delegates from developing economies are determined to make their voices heard. The African Group of Negotiators on Climate Change (AGN) has outlined a series of priorities for COP26, including a new climate finance framework that would enable African economies to raise investment and meet ambitious nationally determined contributions (NDCs).[7]

The AGN, along with the Climate Vulnerable Forum, which represents billions of people across Africa, Asia, the Caribbean, Latin America and the Pacific, is also calling on rich countries to follow through on pledges of support for climate resilience and adaptation projects. At COP16 in Mexico in 2010, developed economies agreed to raise $100 billion per year by 2020 for this purpose – but the target has still not been met, and the original amount may no longer be sufficient in any case given the impact of COVID-19 on poorer countries' finances. The UN estimates annual adaptation costs could hit $300 billion by 2030 and $500 billion by 2050.[8]

Belated progress was made at the UN General Assembly in September 2021, when US President Joe Biden promised to double aid to countries on the frontlines of the climate crisis to $11 billion, sparking optimism other nations will make similar pledges at the COP meeting.[9]

The AGN wants to direct some of the promised capital to the African Adaptation Initiative, a collaborative effort among several African states. One of its flagship schemes seeks to ensure the 80 million people living in the Lake Chad River Basin, an area that spans five countries, receive advance warning of droughts and floods, along with protective infrastructure and technology.[10] The AGN stresses support for such initiatives should come in the form of grants, rather than loans that would only add to the target countries' swingeing debt burdens.

Properly designed, adaptation schemes can bring other advantages. "If gender equity is intersected with adaptation projects, it will unleash more societal and economic benefits," says Denton. "For instance, governments should intentionally make an effort to provide climate-relevant data to women farmers. Access to critical information will improve their forecasting skills, enable them to make strategic farming decisions,

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> *Carbon markets could equip countries with tools they to decouple development from environmental degradation*

and address agricultural risks related to uncertainty that may result in poor harvests."

Experts stress that resilience is both a physical and economic concept. Munang cites efforts to promote ecosystem-based adaptation (EBA) in the agricultural sector in Africa, an approach that limits damage to the environment through farming and taps into growing international demand for organic, sustainably sourced food, thereby bolstering resilience in both senses of the word.

"EBA is looked at not just from its biophysical ability to minimise the physical damage of climate change, but its socio-economic value, to create income opportunities for communities to buffer themselves," he says.

Stranded assets

Over the longer term, developing economies will need to fully diversify away from fossil fuels, to meet their own NDCs and avoid the risk their natural resources become uneconomic – so-called 'stranded assets'.

A recent report from the UNU-INRA points out African economies face a threefold risk: that they are "locked in" to fossil-fuel-based infrastructure; "locked out" of a clean-energy transition, through lack of access to technologies related to low-carbon development; and "pushed out", as carbon-intensive assets are relocated to the global south.[11]

"This is already happening, and it is the equivalent of 'dumping' dirty technologies in countries where legislation is weak or low-carbon technologies are still at experimental stages," says Denton.

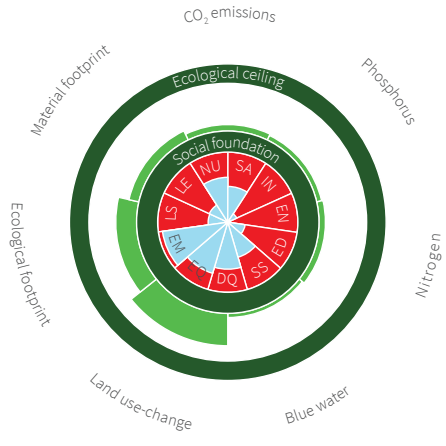
Given these challenges, nations currently reliant on fossil-fuel exports are likely to have to delay their transitions relative to developed economies, giving them time to implement sustainable economic plans. It may make sense for them to maximise revenues from fossil fuels while such a strategy remains economically viable, by investing in value-add facilities such as oil refineries and putting in place follow-up low-carbon energy infrastructure. Natural gas, a less carbon-intensive alternative to oil and coal, could serve as a transition fuel.[12]

The establishment of international carbon markets, meanwhile, could equip countries with the financial tools they need to decouple development from environmental degradation over the longer term, rewarding conservation.

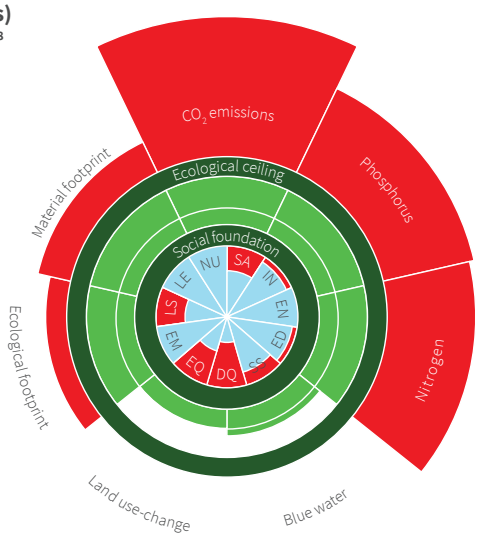
Take the example of Gabon, a country that has sought to protect vast swathes of equatorial forest, an important carbon sink – as a result, it is a net-carbon sequester (Gabon's trees absorb around one third of the carbon emitted by France, its former colonial occupier).[13] Under a scheme called the Central African Forest Initiative, Gabon already receives money for offsetting emissions from European countries; in 2021, it received a $17 million payment from oil-rich Norway. A more established carbon market would allow it to formally sell its emissions reductions as credits.[14]

Figure 3: **Developed economies (and some fast-growing emerging economies) have achieved social goals by transgressing ecological boundaries[18]**

LS – Life satisfaction
LE – Healthy life expectancy
NU – Nutrition
SA – Sanitation
IN – Income
EN – Access to energy
ED – Education
SS – Social support
DQ – Democratic quality
EQ – Equality
EM – Employment



Malawi



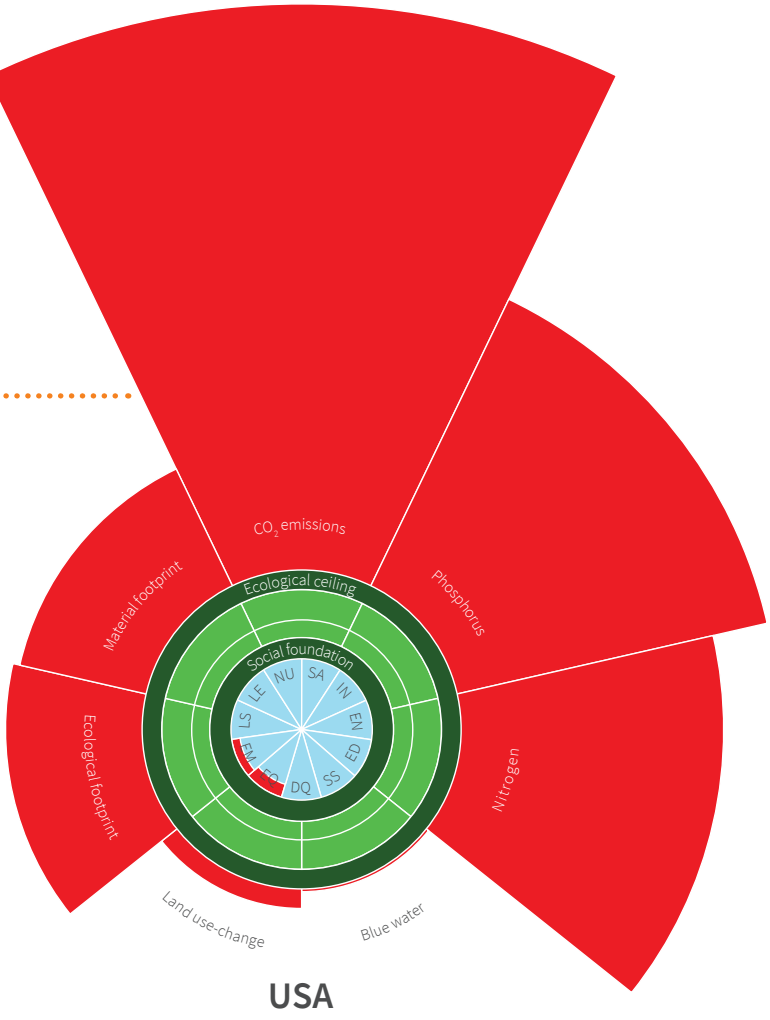
China

Note: Green wedges show resource use relative to a biophysical boundary associated with sustainability.Red wedges show shortfalls below the social threshold (in the middle of each circle) or overshoots beyond the biophysical boundary (on the outer edge).
Source: Nature Sustainability, 2018.

Combining climate action and development

In the meantime, poorer countries are looking to make use of sustainable energy sources to both decarbonise and boost living standards. Niger, located in the arid Sahel region, recently announced the construction of a photovoltaic power plant that will improve energy access among isolated populations.[15]

As Munang points out, energy access is a widespread concern in sub-Saharan Africa. People without direct grid access to electricity often use fossil-fuel-guzzling generators that cost between three- and six-times more than the rates consumers pay elsewhere. Using renewable power to improve access neatly links climate action with development and can bring wider social benefits.[16]



USA

In Bangladesh, for instance, a public-private entity was established to provide low-interest loans to rural families for the purpose of installing solar systems at home; a study of the scheme found that using solar electricity eased the burden of household work on women and freed them to engage in income-generating activities.

Rolled out at scale, these kinds of inclusive and sustainable initiatives could allow low-income economies to achieve their social priorities without following the path of carbon-intensive development trodden elsewhere. Figures 2 and 3, based on research by the University of Leeds, show how countries have historically tended to raise living standards by exploiting natural resources and transgressing environmental boundaries; the key to a just and effective transition is to break this link.

The left behind

In middle- and high-income economies that have already overstepped their environmental boundaries, the onus is on governments to cut emissions more quickly and steeply. Here, just transition efforts centre on ensuring the most vulnerable communities receive adequate support, especially in regions that have traditionally been dominated by carbon-intensive industries.

The European Union has established a Just Transition Mechanism that aims to mobilise €65-75 billion between 2021 and 2027 to alleviate the social and economic impact of the transition on affected areas; it has already provided support to coal-producing regions in Slovakia, Romania and Greece. Funds are earmarked for subsidies, retraining and education initiatives.[19]

In the US, the Biden administration has pledged to incorporate the just transition into a massive infrastructure development package; 40 per cent of its clean energy investments will go to disadvantaged communities.[20] The plan

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continued

contains specific measures to protect the retirement benefits of workers hardest hit by the transition, such as coal miners and their dependants.

"The just transition is now a priority in Europe and the US. [European Commission President] Von der Leyen has made clear that a just transition is absolutely key to climate action," says the LSE's Robins. "And look at President Biden's climate strategy: his number one theme is jobs, and environmental justice across communities is also a major consideration. These two massive economies now recognise the just transition as being a critical enabling factor in tackling climate change."

Governments appear to be learning the lessons of the past, when transition policies that ignored social impact were greeted with a fierce backlash ('Vive le carbon tax!', p.71.). And clear, well-designed transition plans could also bring further benefits, in the form of much-needed investment.

PART 3: THE ROLE OF FINANCE

Until now, finance has been slow to recognise the importance of social issues and reluctant to connect the 'E' and the 'S' in ESG. But this is changing as the just transition provides a strategic lens through which to assess and manage risk. A disorderly transition will increase the vulnerability of certain economies, bringing hazards for those seeking to allocate capital.

"The fiscal impact of funding the climate transition on developing economies, given already high debt levels, is a key risk – particularly if the bulk of the costs are borne by the state," says Carmen Altenkirch, emerging market sovereign analyst at Aviva Investors.

"For sub-Saharan Africa, a rough estimate suggests meeting climate targets under the International Energy Agency's Sustainable Development Scenarios would cost around five per cent of GDP on an annual basis. Average debt across the region is already sitting at 56 per cent, so these added costs risk making debt unsustainable very quickly. To make the climate transition affordable for poor nations, it needs to be funded by both the private and public sector – and ultimately it needs to be growth-enhancing," she adds.

One way to attract private financing is through new instruments. In June 2021, Benin raised €500 million through the issuance of bonds directly linked to the UN's Sustainable Development Goals, pledging to devote the proceeds to relevant environmental and social objectives, including access to water and clean energy, education, health, decent housing, connectivity, and biodiversity conservation.[21]

Such deals remain rare. Public-private partnerships or guarantees from governments and multilateral organisations, such as the World Bank, could help though, by unlocking more capital for socially valuable projects in developing economies that have modest credit ratings, and making the costs more affordable.

"To be sustainable, the cost of green or social bonds needs to be materially lower than conventional Eurobonds, but recent deals suggest that this is not the case so far," says Altenkirch. "Multilateral guarantees to raise the issuer rating and reduce the cost of issuance would be supportive. Ultimately, the pool of capital to support these projects needs to be expanded, as well as the capacity of countries to implement projects. More local currency issuance to fund green projects, equity investments in companies supporting the green transition, grants and foreign direct investment will all be part of the solution."

Policy and shareholder engagement

Investors can also play a role in engaging with policymakers and multilateral institutions to ensure capital is directed to where it is needed most. As Robins argues: "Investors have a very influential voice with governments. They need governments to have investment-grade climate policies because there are certain things investors can't do – they cannot deliver training policy, or regional policy. The right policies can unlock capital for the just transition."

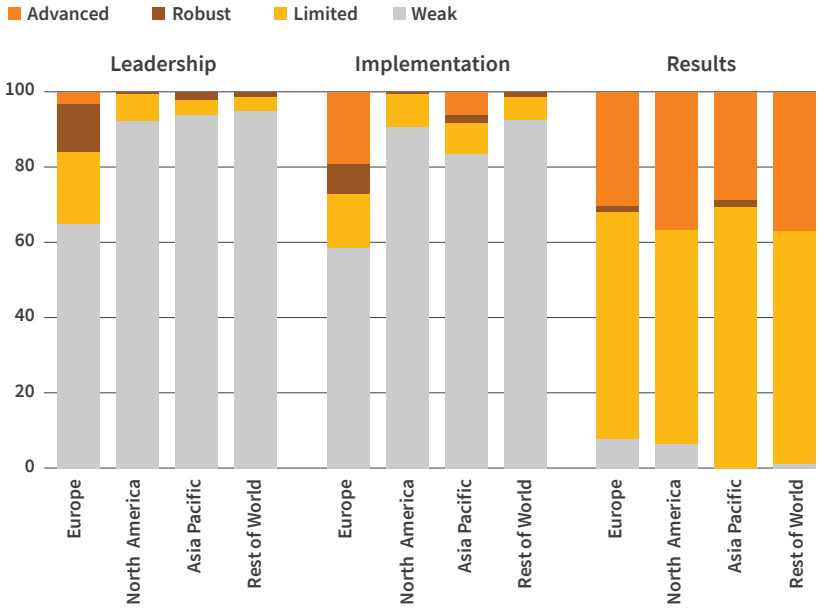
Robins is founder of the Financing the Just Transition Alliance (FJTA), which represents nearly 40 banks, asset managers (including Aviva Investors) and other financial organisations, along with trade unions and universities. It aims to identify ways in which finance can support the just transition; its work includes collaboration with governments on devising new investment products to channel capital towards the areas of greatest need.

One example of the just transition moving into financial reality is the UK's recent green sovereign bond programme. In 2021, following an earlier proposal from the Grantham Research Institute, the Green Finance Institute and the Impact Investing Institute, the UK government committed to raise £15 billion with green sovereign bonds this fiscal year, and recognised the just transition as part of its Green Finance Framework, pledging to report on the social co-benefits of its spending (for example, in terms of job creation).[22]

Engagement can also lead to results at a corporate level. By encouraging companies to take the social and political implications of the transition into account, investors can help drive positive change through the private sector.

"Investors are beginning to recognise that supporting a just transition helps mitigate broader systemic risks, along with specific

Figure 4: **Few energy companies are showing leadership on the just transition[24]**



Source: Grantham Research Institute on Climate Change and the Environment, 2018.

> *Human rights abuses are rife in corporate supply chains for the renewable sector*

transition risks faced by investee companies," says Louise Wihlborn, ESG analyst at Aviva Investors. "Companies need to be mindful of the social and legal 'license to operate' and the reputational risks that stem from ignoring the rights of employees and communities."

Recognition of the just transition is still at an early stage among companies. A 2018 study from ESG consultancy Vigeo Eiris found very few energy firms were incorporating social impact into their transition and restructuring plans (see Figure 4). To address this lack of urgency, the FJTA recommends investors take a more active role. It has published a framework for shareholder engagement that calls on companies to incorporate the just transition into remuneration, planning, risk management and scenario exercises; to safeguard the rights of workers and communities; and to apply labour, human rights and environmental due diligence across their supply chains.[23]

There are signs nascent investor engagement on the just transition can bear fruit: following shareholder dialogue at its annual general meeting in August 2021, the utility SSE became the first company to publish a just transition plan, setting out 20 principles for its operations, including robust stakeholder consultation and retraining initiatives.[25]

Nevertheless, there is a long way to go before such commitments become mainstream. One issue for investors is the difficulty in obtaining data on social metrics as a basis for asset allocation and engagement. Tracking human rights standards across convoluted international supply chains is a particular challenge, which is why Aviva Investors is calling for tougher legislation to ensure businesses are complying with the UN Guiding Principles on Business and Human Rights.

"We want to see it become a legal duty for companies to undertake environmental and human rights due diligence, and the development of a more robust social taxonomy to enable the shift of capital towards more socially sustainable activities," says Wihlborn. "Without robust processes, a just transition isn't achievable. Human rights abuses are rife in corporate supply chains for the renewable sector."

As an example, Wihlborn cites a recent study that found up to 40 per cent of the UK's solar farms were built using panels supplied by Chinese firms implicated in the forced labour of Uyghur and other mostly Muslim ethnic groups in the province of Xinjiang.[26]

A holistic approach

Initiatives in the pipeline could bring about greater transparency. The World Benchmarking Alliance is developing a dedicated Just Transition Benchmark, which will provide a ranking of companies

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continued

on social metrics (it is set to deliver an initial report on 180 companies at COP26, with the full benchmark due in 2023).[27] Companies are also being encouraged to use the Task Force for Climate-related Financial Disclosures (TCFD) to provide comprehensive reports on the social impact of their operations; this would represent a "natural evolution" for the platform, says Wihlborn.

Better data on the social and environmental dimensions of companies' operations might highlight opportunities. Julie Zhuang, global equities portfolio manager at Aviva Investors, cites companies helping nations adapt to rising water scarcity. For instance, her portfolio has a stake in one company that uses GPS and sensoring technologies to help farmers maximise crop yields while ensuring more accurate deployment of resources and minimising water waste. A second investment is in a company that provides water control and rainwater-harvesting systems to help conserve water resources and enables the filtering of safe drinking water in isolated disaster zones.

"It makes sense to be investing in companies that help the world adapt to the consequences of global warming, specifically droughts and water scarcity. This issue is only going to grow in importance," says Zhuang.

On occasion, it might make sense for investors to contribute to projects that would not pass muster when viewed through a purely environmental lens, but could be justifiable on socio-economic grounds. Real assets projects, for example, often bring a mixture of positive and negative outcomes, necessitating a case-by-case approach in which investors must liaise with a range of stakeholders to assess any trade-offs between 'E', 'S' and 'G'. It was as a result of such a due diligence process that Aviva Investors made a loan to a major state-owned company in Ivory Coast in 2018, the proceeds from which went towards funding improvements to an existing oil refinery.

The transaction lessened the country's reliance on energy imports, improved efficiency at the existing facility, and brought benefits to the local economy. Though it was a carbon-intensive project, it still aligned well with the UN's Sustainable Development Goals.

> *"A just transition will only be possible with the involvement of younger generations – the policymakers, scientists and entrepreneurs of the future"*

PART 4: A BIGGER PICTURE

As momentum builds behind the just transition, the current social and environmental trade-offs could disappear. But this will only be possible with the involvement of younger generations – the policymakers, scientists and entrepreneurs of the future.

After all, the question of justice is doubly relevant for young people growing up in regions scarred by a crisis they had no part in. Let down by a capitalist system that was built by and for others, witness to wildfires, floods and droughts that are devastating their communities, many young people are understandably suffering from climate anxiety.[28] However, they are increasingly channelling their sense of injustice into positive action, too.

"Policy incentives, regardless of how timely they may be, will accomplish very little if they fall on passionless, purposeless citizens," says Munang, who hails the mindset of "discipline, purposeful passion, unborrowed vision and selflessness" in Africa's young people.

This includes people like Nakate, who is leading important climate-related projects in Uganda and beyond through her grassroots Rise Up Movement; Elizabeth Wathuti, a Kenyan climate activist whose Green Generation Initiative devises nature-based solutions like tree planting and conservation schemes;[29] and Oladosu Adenike, a Nigerian ambassador for the African Youth Climate Hub.

Their work is inspiring millions of other people across the global south to tackle the twin crises of environmental breakdown and social injustice. If we are to properly address climate change, we can no longer leave them out of the picture.

VIVE LE CARBON TAX!

Recent events have shown that ignoring the broader socio-economic impact of climate policy can have serious political consequences, undermining faith in climate action and potentially delaying the transition.

Former President Donald Trump won electoral support by pledging to revive the US coal industry, bringing jobs back to communities that had suffered from poorly managed deindustrialisation. On his first day in office, he withdrew the US from the Paris Agreement – a serious setback for global climate action.

Another example is the *Gilets Jaunes* movement in France, which had its roots in a backlash against a carbon tax. Introduced in 2014, the levy was hiked in 2018 to bring it in line with rising fuel prices, but many large companies were exempt and the policy was therefore deemed regressive. The ensuing protests brought parts of the country to a standstill and the government was forced into an embarrassing climbdown.

By contrast, well-designed carbon taxes can win popular support, argues Sonja Klinsky, associate professor at the School of Sustainability at Arizona State University.

"When it comes to carbon taxes, the devil is in the detail. With a bit of imagination, policymakers can ensure these schemes are allied to progressive objectives. Take the Canadian province of British Columbia: it launched the world's first consumer end-use carbon tax, which came with a rebate programme for those on low incomes, who were actually better off under the policy."

Introduced in 2008, the British Columbia tax applied to both companies and households, with the amount rising in increments from ten Canadian dollars to C$30 by 2012. Bundled with other measures that lowered income tax and health insurance premiums, the policy garnered wide support and helped the province cut emissions by around as much as 15 per cent over the period, with no apparent economic costs. In fact, British Columbia's average GDP grew faster than most of its neighbours.[30]

The tax has been maintained since then with bipartisan political approval. By ensuring any increases in the tax are matched by credits and rebates for vulnerable groups,[31] the province has been able to maintain wide popular support for the policy – proof a just transition is more likely to be a successful transition

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50 SHADES OF GREEN

With the noise and interest in ESG investing reaching levels that would have been unthinkable a few short years ago, much of the analysis surrounding it is becoming polarised. A more sophisticated conversation and debate is required, argues Mark Versey.

> *As a recent Financial Times article pointed out, a greater contribution to government coffers could be used to fund socially useful areas like education, healthcare, social care, and other critical public goods*

What's not black and white, but grey all over?
Answer: ESG investing.

This might seem a strange assertion for a responsible investing advocate to make. Surely, I should be extolling the unbridled virtues of the discipline, particularly in the wake of recent high-profile criticisms of it? To do so would be disingenuous, however. Let me explain.

Part of the reason Tariq Fancy's[1] brutal, but to my mind overly simplistic, critique of responsible investing gained so much attention was that elements of what he said are true. The other, more worrying, reason is that we have completely lost our collective sense of nuance. Instead, we seem to crave crude answers to complex problems: ESG is either good or bad; finance equally so. Such a lack of sophistication in reasoning has serious implications.

A series of examples reveal the contradictions and inconsistencies that a simple – un-nuanced – ESG lens finds hard to reconcile.

When E and S collide

Let's take the recent strong performance of ESG investments. Firstly, while it is true that many responsible investment strategies have outperformed their broader benchmarks, this is largely confined to renewable and environmentally tilted stocks. Where it has applied to broader portfolios, large weightings towards tech companies tend to be found.

It is here where environmental factors start to collide with social ones, which are notoriously hard to define and measure. For example, tech companies pay little tax, particularly in jurisdictions where their activities have a large impact. As a recent *Financial Times* article pointed out, a greater contribution to government coffers could be used to fund socially useful areas like education, healthcare, social care, and other critical public goods.[2] Big Tech has also come under heavy criticism for its role in undermining democracy, amplifying hate speech and exacerbating mental health issues.

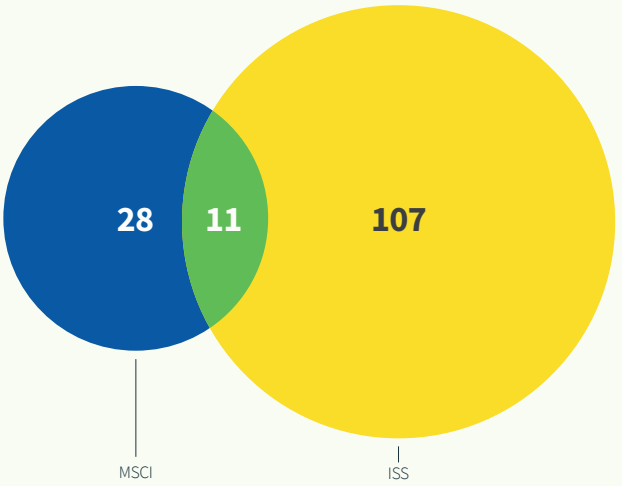
Of course, the opposite can also be argued – think of the Arab Spring and increased connectivity and social connection globally. As I said, things are rarely black and white.

To further illustrate the point, the World Benchmarking Alliance recently published a performance update on its Automotive Benchmark, which tracks the progress of 30 of the biggest companies in the sector in meeting the goals of the Paris Agreement. When they compared it with the Corporate Human Rights Benchmark, it revealed "almost no correlation could be found between a company's relative performance on either benchmark, suggesting an alarming disconnect between actions on climate and human rights issues".[3]

It is no wonder that benchmark and rating confusion exists: depending on the relative weightings providers apply to certain factors, the results will be different. A recent comparison of MSCI and ISS ESG datasets for companies' controversy scores found only 11 companies overlapped.

The authors of a paper entitled *Aggregate Confusion: The Divergence of ESG Ratings*[4] argue that to help rectify matters, "companies should work with rating agencies to establish open and transparent disclosure standards and ensure that the data is publicly accessible".

Figure 1: **Overlap between MSCI and ISS controversy scores**



Source: MSCI, ISS, Aviva Investors, as of March 8, 2021.

Voice and exit

Then you have the issue of divestment.

Understandably, many people do not want to hold 'dirty' assets like fossil-fuel companies or high carbon-emitting buildings on ethical grounds. However, even this seemingly clear-cut moral decision is not straightforward. Firstly, it assumes you can solve a demand issue simply by cutting supply. I wonder how many of the same people who balk at the idea of holding a fossil-fuel company, or so-called brown stocks, have also tried to eradicate their own demand for polluting products?

I understand the power of signalling, but there is also the question of voice and exit, as economist Albert Hirschman highlighted. Divesting equates to losing your voice. If you stay invested in a company and continue to wield the credible threat of divestment while speaking up on key resolutions at shareholder meetings, you will arguably make more of a difference than if you simply walk away.

> *In the US at least, energy firms are key innovators, producing more and significantly higher-quality green patents than other industries*

Furthermore, are all energy stocks equally bad? Could some of them not be transformed into major players within the green energy revolution? Of course, there are challenges to this line of thought, such as siloed thinking and operations, bureaucracy, domain-specific expertise, joint-venture structures and pressure to pay out dividends (which provide income for investors and retirees, by the way). But it is interesting to note that, in the US at least, energy firms are key innovators, producing more and significantly higher-quality green patents than other industries.[5]

Renewable waste

A supposedly more impact-driven way of clearing your conscience is simply to invest in clean technologies and renewable energy. Or is it?

Electric batteries rely on mining cobalt, lithium and nickel, among other rare-earth materials. Supply chain and human rights issues abound, with China controlling significant amounts of these crucial mineral supply chains. Furthermore, the mining of lithium in Chile has prompted legal fights over water in the Atacama and 70 per cent of cobalt is mined in the Democratic Republic of Congo, a country with an extremely bad track record when it comes to corruption and labour standards.[6]

With demand for these minerals set to soar, such issues are unlikely to go away. There is also the issue of waste which, being a relatively nascent industry, the renewable sector has yet to face up to. Wind turbines, solar panels and electric batteries all must be disposed of or recycled somehow – with the latter two containing particularly toxic metals like lead and cadmium. In the case of the former, the US will reportedly have more than 720,000 tonnes of wind turbine blades to dispose of over the next 20 years.[7]

Until it costs less to extract these elements from renewable wastage than to dump them in landfill and mine fresh raw materials from the ground, we will still have an issue. While I have confidence that the circular economy will be mobilised to tackle these issues, the current state of play proves again the need for nuanced thinking.

A 'just' transition

Next is the notion of a 'just' transition. While the hope is many developing nations can simply 'leapfrog' dirtier forms of energy as their economies and societies develop, is it really fair for developed nations to preach to developing countries about the moral and scientific dangers in using fossil-fuel-based economic expansion? The hypocrisy is clear: we have already ridden that wave, extracted (most of) the progress (and resources) required, only to have seen the light and turned over a new – greener – leaf.

This is why we recently helped fund an oil refinery in the Ivory Coast. It is also why we acknowledge some countries have deeper social issues and will need to rely on 'brown energy bridges' for some time. Only when you have food in your belly, a roof over your head and a feeling of security can you start to consider wider societal and environmental issues.

In reality, ESG cannot be reduced to simple binary arguments. It encompasses such a wide array of meanings and activities that to try and do so is foolhardy.

Macro stewardship

For those of you still wondering which parts of Mr Fancy's critique are true, it is his call for greater government and policy intervention. In investing terms, this equates to what we call 'macro stewardship' – which is another way of saying 'market reform'. But by anchoring it in the language of stewardship, our wish is to tether it more closely to the core principles of ESG investing.

Threats – or rather market failures – like inequality, climate change and environmental degradation cannot be solved by micro-level nudges alone (which, though worthy endeavours, impact investing and screening amount to). And while full ESG integration and engagement go a step further, they still fall short. As stewards of other people's money and given the growing number of net-zero commitments, we have a fiduciary duty of care to do more: to use our knowledge, influence and our clients' voice to push for systems-level change.

Navigating this ethical minefield in simple client fact-finding exercises, as laid out in the MiFID directive, is a start. Legal and industry standard definitions, alongside regulatory efforts like the EU's Green and Social taxonomies and the Sustainable Finance Disclosure Regulation, are also welcome. But as the level of comfort and sophistication grows, far more will be necessary to truly capture clients' preferences.

Language can be frustratingly malleable. Completely harmonising meanings in the minds of investors is desirable, but simply not possible. And while we must continue to better define the ESG landscape, it does mean that trust and faith in investment brands will be crucial in dealing with ESG in all its nuanced glory.

The truth is that it is extremely hard to neatly package up morals and then sell them on coherently and transparently. Mr Fancy, of all people, should know this ●

> *"In reality, ESG cannot be reduced to simple binary arguments"*

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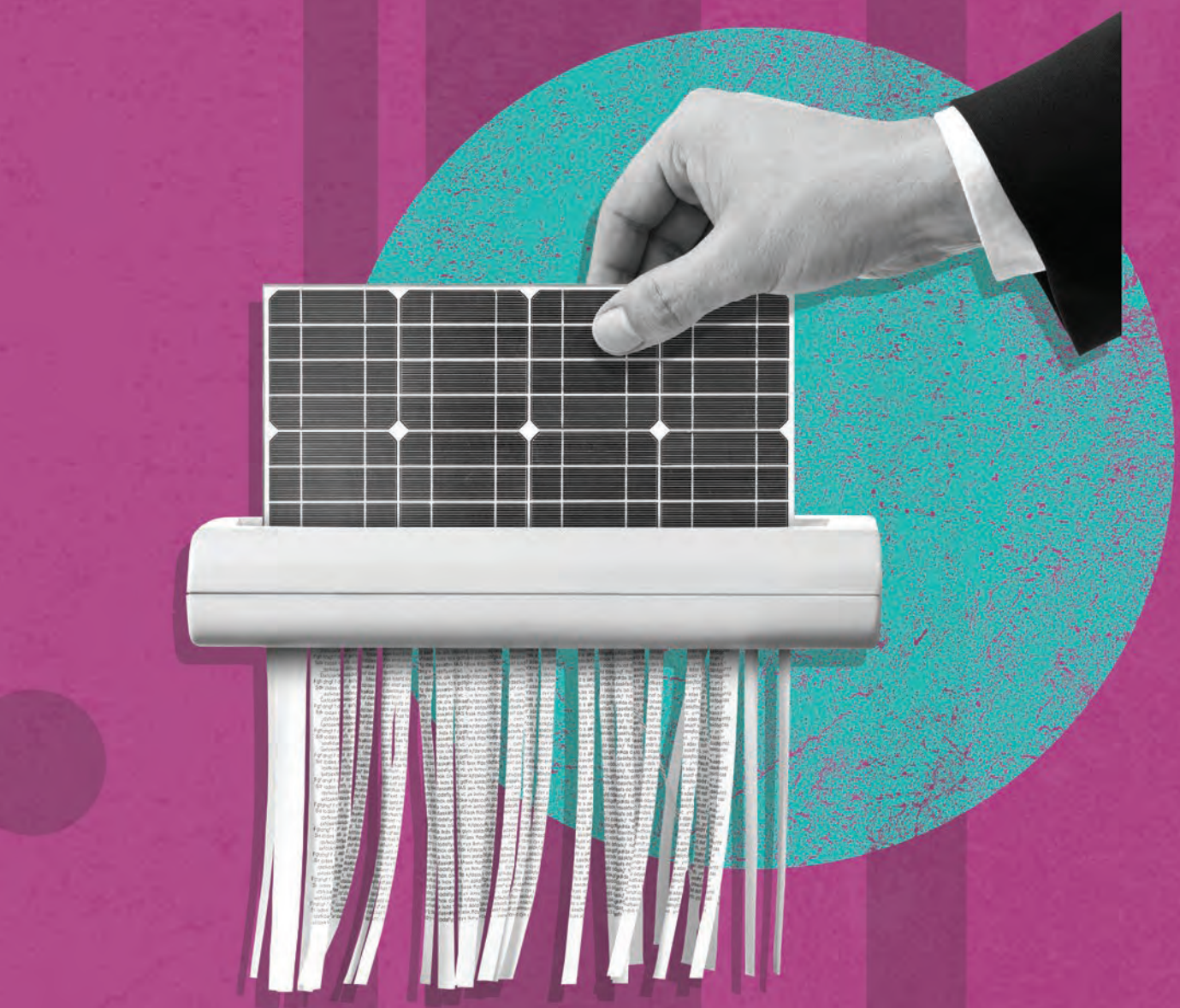
WE NEED TO TALK ABOUT WASTE

TACKLING RENEWABLE ENERGY'S DIRTY SECRET



WE NEED TO TALK ABOUT WASTE

continued

Renewable energy has a vital role to play if the world is to combat climate change. But its widespread adoption comes with a price. As older installations come to the end of their useful life, countries urgently need to work out what to do with the waste.

Amid all the excitement about renewable energy and the emergence of other new technologies to help countries tackle climate change, all too often two important challenges are overlooked.

The energy transition aims for a sustainable economy based on renewable, or low-carbon, power. But making the necessary wind turbines, solar panels, electric car batteries, and other 'green' products requires vast amounts of resources. Extracting them creates emissions of their own, as well as causing environmental degradation and, in many instances, social problems.

Take electric vehicles. While they may cause no emissions when being driven, the same cannot be said for the manufacturing process. As the technology begins to go mainstream, more 'circular' solutions will be needed. That is especially true of batteries, with the mining of materials such as nickel, cobalt and lithium threatening the environment.

Equally problematic is the challenge of recycling, storing and disposing of the waste created when products come to the end of their useful life. Even if tackling the waste generated by wind and solar is straightforward compared with nuclear, another form of low-carbon energy, it is an issue companies and investors alike have all too often overlooked.

Capacity surge

According to the International Renewable Energy Agency (IRENA), despite the economic disruption caused by the COVID-19 pandemic, the world added more than 260 gigawatts of renewable energy capacity in 2020, smashing previous records. That took global installed wind and solar capacity to more than 1.4 million megawatts, a near sevenfold increase in the space of a decade.[1]

IRENA reckons renewable energy capacity needs to grow eight times faster than the current rate to keep pace with rising demand for electricity and at the same time limit global warming. It believes $131 trillion of investment in renewables could be needed by 2050.[3]

Since most renewable installations are relatively new, waste has been largely limited to outdated or damaged installations. However, with some older wind and solar installations starting to reach the end of their useful life, questions are being asked about what will happen to the waste, especially since the amount currently being generated will be dwarfed by what lies ahead.

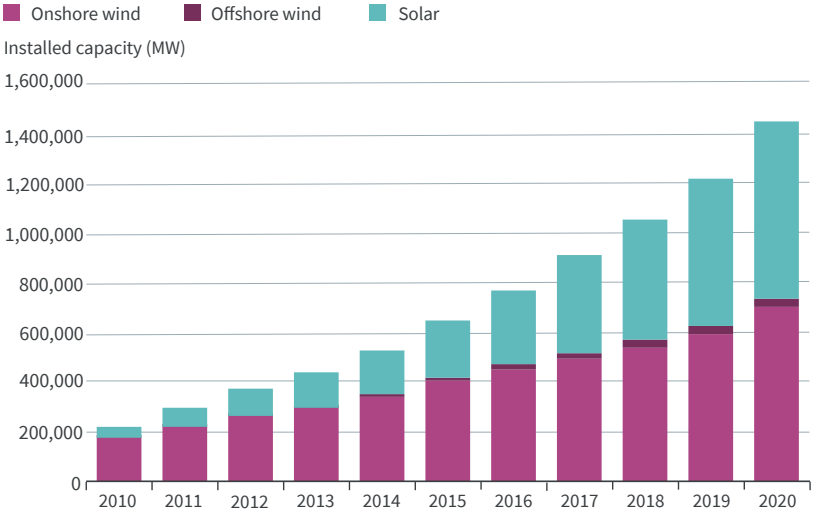
"Industry has generally turned a blind eye to this area, but with net-zero commitments, it will be challenging not to start thinking about lifecycle emissions. This will naturally shine a light on disposal and dismantling issues from renewables," says Ed Dixon, head of ESG, real assets, at Aviva Investors.

Across the world, thousands of wind turbines are set to be dismantled over the next few years. While most components, including steel, copper wire and electronics, can be recycled, the blades have bedevilled energy developers and waste management experts. Made of a tough but pliable mix of resin and fibreglass, they are difficult to crush or recycle. They are also massive – some are longer than a Boeing 747 wing – and strong, built to withstand hurricane-force winds.

In most countries, blades are usually cut down and buried in landfill sites. The problem is that in the US alone, around 8,000 blades are due to be removed in each of the next four years. According to one report, the country will have more than 720,000 tonnes of blades to dispose of over the next 20 years. [4]

The issues associated with dumping turbine blades in landfill sites may seem trivial compared with those associated with burning fossil fuels and dealing with nuclear waste. Nevertheless, the public image of an

***Figure 1:* Trends in renewable energy[2]**



Source: International Renewable Energy Agency, 2021.

> *Wind developers are exploring ways to recover materials to safeguard their green reputations*

industry keen to promote its environmental credentials threatens to be tarnished, especially if the mass disposal of blades overwhelms existing landfill capacities as some fear. The race is on to find a better solution.

Circular economy

According to the European Union's 2020 Circular Economy Action Plan, adopted in March 2020, developing a truly circular economy will be "one of the main blocks" of the European Green Deal and a prerequisite for achieving climate-neutrality. Already, four EU countries have banned composites, including wind turbine blades, from going into landfill, while France and Germany are implementing or considering specific legislation on turbines and blade circularity.

While some blades are burned in power plants, wind developers recognise this is a sub-optimal solution and are exploring ways to recover materials to safeguard their green reputations. In January, a consortium of ten companies launched a project seeking to commercialise recycling techniques for up to 95 per cent of each blade.[5]

One member of the consortium, GE Renewable Energy, recently announced a multi-year agreement with Veolia North America for a blade-recycling programme. The scheme involves shredding blades at Veolia's Missouri facility, then using the output as a raw material for cement. Better still, according to a company news release, this process could reduce net emissions from cement production by a quarter.[6]

German company Neocomp has a similar solution, using flakes of composite material for the production of concrete, while another US company, Global Fiberglass Solutions, grinds blades up into chocolate chip-sized pellets for use in decking materials, pallets and piping. Its aim is to create a "circular, zero-waste solution to bypass land-filling of fibreglass waste and to reduce the world's carbon footprint".

Danish renewable power group Orsted says since recycling technologies will differ from market to market, it will assess the best locally available solutions on factors such as price, capacity, and environmental footprint.

"With a range of solutions likely to be on the market by 2025, recycling is unlikely to cost any more than landfilling," says the company's head of sustainability, Filip Engel.

However, others remain to be convinced new technologies can be successfully commercialised, or whether facilities can keep pace with demand. WindEurope, a trade association representing 400 companies across Europe's wind power industry, says while an increasing number of companies offer various recycling technologies, "these solutions are not yet mature enough, widely available at industrial scale and/or cost competitive".

Mark Nelson of US firm Radiant Energy Fund, which advises non-profit organisations and industry bodies on energy policy, says recycling technologies may "take some of the sting" out of the issue of wind turbine waste, but there is no escaping the fact there will be a public cost associated with the growing need to deal with materials from damaged or retiring wind turbines.

"Recycling is not going to completely make up for the fact that suddenly there's a thing called wind turbine waste, where in the public mind there was no such thing ten years ago," he says.

Solar's record growth

Although the world may have been building wind farms at a rapid rate, the sector's growth pales in comparison with that of solar energy. According to the International Energy Agency, solar output grew more than any other source of energy for the first time in history in 2016.[7]

Despite snags in supply chains as a result of the pandemic, a record 138.2 gigawatts (GW) of solar capacity was added in 2020, according to trade association Solar Power Europe, an 18 per cent increase on 2019. The top five markets were China, US, Vietnam, Japan and Australia, which added new capacity of 48.2, 19.2, 11.6, 8.2 and 5.1 GW respectively.[8]

The sector's exponential growth has been driven by a dramatic fall in the cost of producing solar panels. Between 1976 and 2019, the price of a photovoltaic module collapsed from $106 to $0.38 per watt.

Solar's growth looks set to continue for two reasons. First, the cost of panels is likely to drop further. At the same time, new technologies mean they will continue to get more efficient – conversion efficiency is estimated to grow at a rate of around 0.5 per cent a year.

Solar Power Europe believes global installed capacity will more than double by the end of 2025, and under optimal conditions could be three times larger than today. Some countries look set for even quicker growth. Wood Mackenzie, an energy research and consultancy group, estimates the size of the US solar fleet will more than quadruple by 2030.[10]

However, while the rapid growth in solar power generation is welcome from the perspective of tackling climate change, it comes with an important caveat. In an industry where circular solutions such as recycling remain woefully inadequate, the sheer volume of discarded panels could become a key issue.

WE NEED TO TALK ABOUT WASTE
continued

> *The sheer volume of discarded solar panels could become a key issue*

As Figure 4 shows, according to the US Department of Energy, solar uses more raw materials per unit of electricity generated than all other energy sources, in most cases by a significant margin. A report published by the International Energy Agency Photovoltaic Power Systems Programme and IRENA in 2016 said up to eight million tonnes of waste were expected to have accumulated by 2030, rising to as much as 78 million tonnes by 2050.[13] Some believe these forecasts are conservative since they assume households hold on to panels for the entirety of their lifespan, which IRENA estimates at roughly 30 years.

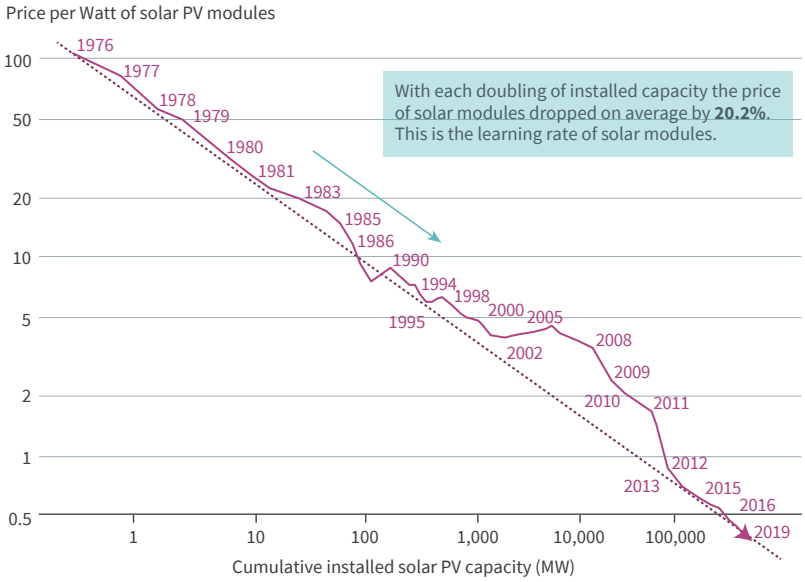
Three business school professors cast doubt on these forecasts in a recent article in the *Harvard Business Review*. They said three variables are crucial in determining replacement decisions: the installation price, the going rate for selling solar energy back to the grid, and the efficiency of panels.[15]

Should prices decline and efficiency improve as expected, consumers may decide to upgrade far faster than IRENA expects, regardless of whether their existing panels have reached the end of their useful life. Moreover, "with commercial and industrial panels added to the picture, the scale of replacements could be much, much larger", the authors wrote.

As studies suggest solar panels retain upwards of 80 per cent of their original operating efficiency after 25 years of use – one study claims as much as 94 per cent – a solution that has been touted is to ship second-hand panels to poorer nations. After all, the World Bank reckons in 2019 there were 759 million people in sub-Saharan Africa and Asia without access to electricity and a further billion people with an unreliable grid.[16]

Since many of these countries have plenty of sunshine, this potentially offers them a cost-effective way of keeping emissions down. *BloombergQuint* in August reported one recent deal saw 25 megawatts-worth of panels (weighing as much as 2,000 tonnes) shipped to Afghanistan from the US.[17]

Figure 2: **The price of solar modules declined by 99.6% since 1976[9]**



Note: The prices are adjusted for inflation and presented in 2019 US$.
Source: Our World in Data, 2020.

The World Bank says more than a billion people gained access to electricity between 2010 and 2019. While some of that gap was closed by new power lines and other transmission facilities, most of it was achieved by installing small solar systems designed to power a village, farm or even a single home. As of last year, 420 million people got their electricity from off-grid solar systems. According to the World Bank, that number could nearly double by 2030.

Orphan waste?

However, while this may on the surface appear a win-win solution, not everyone agrees. Every solar panel eventually reaches the end of its useful life. By shipping panels to developing countries, richer nations are arguably shifting the burden of dealing with waste in a responsible fashion to other countries less able to meet the challenge.

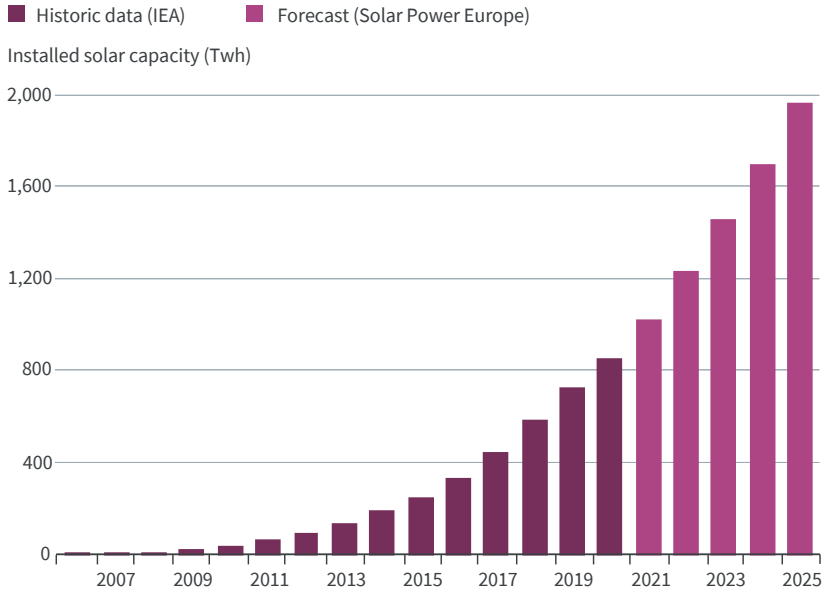
The issue of solar waste is not only one of volume. Solar panels contain toxic metals like lead, which can damage the nervous system, as well as cadmium, a known carcinogen. Both are known to leach out of existing e-waste dumps into drinking water supplies. According to Michael Schellenberger, author of the 2020 book *Apocalyse Never* and long-time advocate of nuclear energy, solar panels create 300 times more toxic waste per unit of energy than nuclear power plants, by volume.

In any case, given the scale of the problem, shipping panels to developing countries offers no more than a partial solution. The widespread adoption of recycling technologies will still be needed. There are two main types of solar panels – silicon based and thin-film based. While both can be recycled, different industrial processes are needed.

The process of recycling the former begins with separating the aluminium and glass parts. Almost all of the glass can be reused, while all external metal parts are used for re-moulding cell frames. The remainder of the materials are heated to 500°C to separate

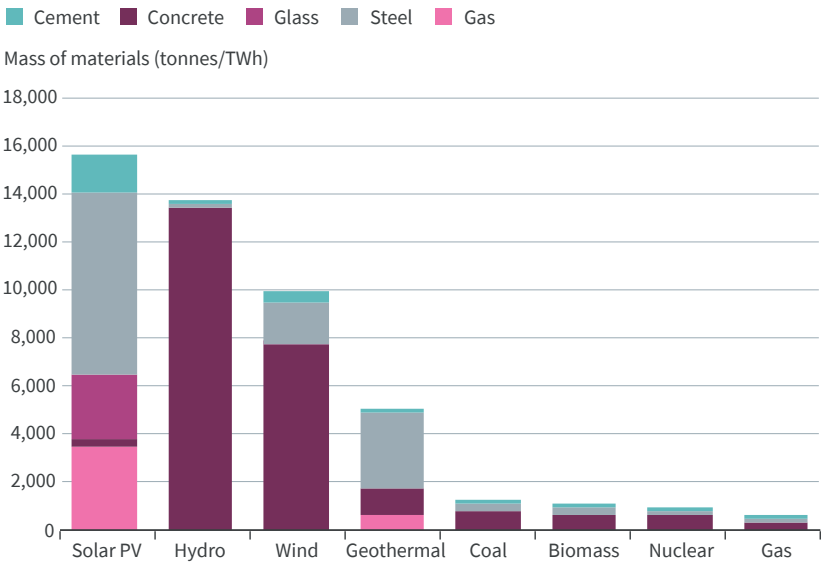
> *Outside of Europe, the lack of regulation and unfavourable economics means most waste ends up being dumped*

Figure 3: **Solar catching alight[11,12]**



Source: IEA, June 2020 and SolarPower Europe, July 2021.

Figure 4: **Materials usage by energy type[14]**



Source: Quadrennial Technology Review: An Assessment of Energy Technologies and Research Opportunities, Table 10.4, page 390. US Department of Energy.

the constituent parts, with up to 80 per cent capable of being re-used.

As for thin-film based panels, they are shredded before being separated using a rotating screw. On average, 95 per cent of the semiconductor material is reused, while as much as 90 per cent of the glass elements are saved for re-manufacturing.

The (current) problem is that while panels contain small amounts of valuable materials such as silver and copper, it costs more to extract these elements from the panels than to dump the used panels in landfill and mine fresh raw materials from the ground.

Take it back

In an effort to tackle the problem, Europe has since 2012 required solar panel producers to take back and dispose of modules sold in the bloc in a more environmentally sound fashion. The EU's Waste Electrical and Electronic Equipment directive mandates member states to adopt waste-management programmes. Under the legislation, which was updated in 2018, producers are responsible for recovering up to 85 per cent of the waste generated and reusing or recycling 80 per cent of the recovered amount.

The EU's aim is twofold: to encourage the industry to develop products that are easier to recycle and use fewer raw materials; and secondly, to get producers to factor in the cost of the collection and end-of-life treatment of their products into the cost paid by consumers.

However, some see flaws in the legislation, arguing that while up-front recycling fees make sense in theory, they do not always work well since they are complicated to implement. The danger is that less scrupulous operators will look to game the system and will not be in business by the time their panels are being dismantled.

A second criticism of the directive is that it is all too easy to fulfil by recovering just the glass and the aluminium – the main raw materials – and that regulators need to target the

WE NEED TO TALK ABOUT WASTE

continued

recycling of materials, such as silicon, which have a much higher carbon footprint.

That said, the situation is bleaker elsewhere. Outside of Europe, the lack of regulation and unfavourable economics means most waste ends up being dumped alongside the larger global stream of electronic waste.

While many are confident photovoltaic recycling technology can and will be improved, at present there is insufficient economic incentive to invest in recycling capacity. Until that changes, some other solution needs to be found: leave the panels where they are; dismantle them and put them in storage until recycling capacity is available; put them in landfills; or ship them to developing countries. None are attractive economically, environmentally or socially.

The US government-funded National Renewable Energy Laboratory concurs. "There is little incentive for private industry to invest in PV recycling, repair, or reuse due to current market conditions and regulatory barriers," it says.[18]

It is calling for government support into R&D and the creation of other policies to spur private investment into designing PV modules that are more easily repaired, reused, or recycled.

The Association for Renewable Energy and Clean Technology, a UK trade body, agrees. It says while legislation exists which ensures that solar waste is not a harm to the environment, "this does not guarantee it will be used for the most environmentally conscious purpose".

"Policy measures to increase the UK's capacity for managing the recycling of old solar components, and incentives that encourage the appropriate disposal of old solar units, would be beneficial," the UK group's chief executive Dr Nina Skoprupska says.

She believes if the recycling/upcycling supply chain were to become more firmly established, it is feasible that making reconditioned solar panels could become comparable in cost to making them from scratch.

However, Nelson, who in 2017 became one of the first people to highlight the issue of waste in the solar energy industry, disagrees. He says even if the cost of recycling is not especially high for utility-scale solar, as with wind turbine blades, sending them to landfill will remain cheaper, even when more effective recycling techniques emerge.

"The problem is that while recycling metals is profitable, very little else is. We may be dismayed by the toxicity and lack of usability of recovered materials, or pleasantly surprised by their value. But while solar may be easier to recycle than plastic, which is little more than a marketing scam, it will never be profitable, even at scale," he says.

That said, few believe the extra cost of dealing with the waste in a more environmentally friendly fashion will seriously undermine the favourable economics of solar energy.

Nimbyism and nuclear

Nowhere is the waste challenge more evident than in the nuclear energy industry. Providing about ten per cent of the world's electricity from around 445 reactors, it is the second largest source of low-carbon power.

However, more than sixty years after the first commercial power plants began operating, the world has yet to build a single permanent disposal facility. The International Atomic Energy Agency said in 2018 that, as of 2013, the global civil nuclear industry had generated 370,000 tonnes of high-level radioactive waste in the form of spent fuel. With just under a third estimated to have been reprocessed for re-use in reactors, the remaining 250,000 tonnes – with an equivalent volume of approximately 22,000m^3 – is being held in temporary storage facilities.[19]

In May, Finnish waste management company Posiva Oy, announced the start of excavation on a deep geologic nuclear waste repository. Operation is expected to begin in 2023, with the project estimated to cost about €2.6 billion ($3.4 billion). About a dozen other countries are planning deep geological repositories for their nuclear waste. But the discussions have been bedevilled by political opposition, with few wanting long-term depositories built on their doorstep.

In October 2020, the company responsible for disposing all of Sweden's nuclear waste said it had already won approvals from all necessary courts, authorities and even the municipality where it wants to build the site – but not the Swedish government.

The Scandinavian country is running out of space to store the waste produced by its six reactors, which supply about a third of the nation's power. Without a decision soon, nuclear operators including Vattenfall AB say they will have to start halting plants in just three years. That would trigger a national power crisis and put Sweden's net-zero target at risk.

In the US, a long-standing proposal to build a repository beneath Yucca Mountain in Nevada was approved as far back as 1987 by President Ronald Reagan. The site was supposed to begin accepting spent fuel in 1998. However, the legislation, which became known as the "Screw Nevada Bill", faced stiff opposition from the public, a native American tribe and state politicians.

Having drifted in and out of favour with changes in the political landscape, it appears the plans have finally been killed off as President Joe Biden goes back to the drawing board. In June, US Energy Secretary Jennifer Granholm said while it was a priority to fund and find a long-term disposal solution to nuclear waste, "it's not going to be Yucca Mountain".[20]

For now, waste accumulates mainly where it is generated – at the power plants and processing facilities. Some of it has been sitting in interim storage for decades. According to one report, with the cost of that effort having already grown to $7.5 billion by 2019, the government expected the eventual cost would rise to $35.5 billion. Since the longer it dithers, the higher the cost, others within the industry reckon the government will end up with a significantly higher bill.[21]

> *Attractive investment opportunities could arise once the regulatory landscape becomes clearer*

While it remains to be seen how important a role it will play in helping the world combat climate change, the nuclear industry's inability to find a permanent home for its waste has been a long-standing impediment to more widespread adoption of the technology.

Darryl Murphy, managing director of infrastructure at Aviva Investors, says the nuclear waste problem provides a salutary lesson to investors in renewables why they need to confront the issue head on, even if the problem of dealing with waste from wind and solar pale in comparison.

"Given the need to look at the lifecycle of assets when assessing their carbon credentials, investors are going to have to start to care about the decommissioning stage, which I don't believe they have done adequately to date," he says.

Murphy believes this means companies providing support services or new technologies to the green energy sector are well placed to grow rapidly over time. That should in turn provide attractive investment opportunities once the regulatory landscape becomes clearer.

In July, Redwood Materials raised more than $700 million from investors to expand operations, valuing it at $3.7 billion and making it worth more than any other US battery recycling group. The company expects to process 20,000 tonnes of scrap and has already recovered enough material to build 45,000 electric vehicle battery packs.[22]

However, Aviva Investors' global equity fund manager Will Malcolm says even if the extra costs do not badly damage the case for renewables, this could present challenges to the energy providers themselves, which for the past two decades have largely focused on lowering costs.

Government action needed

"It is becoming increasingly evident all stakeholders involved in the wind and solar industries – governments, the companies themselves and investors – need to ensure the potential problems of tomorrow prove manageable," he says. The faster the renewable energy industry gets to grips with its waste issue by creating a more circular economy, the better for all concerned.

As for Nelson, he believes it would be unwise to rely on the generosity and good stewardship of renewable energy investors and vendors or on the value of the bulk of the solar and wind materials themselves. Rather, governments need to start acting quickly if the necessary investment in wind and solar waste handlers is to happen before it is too late.

While there's no denying the critical contribution of renewables to combatting climate change, for waste to be dealt with in an environmentally friendly way, people need to have confidence governments are taking the issue seriously by mandating recycling.

"You need to start by admitting it comes with a cost and then work out who pays. The sooner governments make up their mind the better," Nelson says ●

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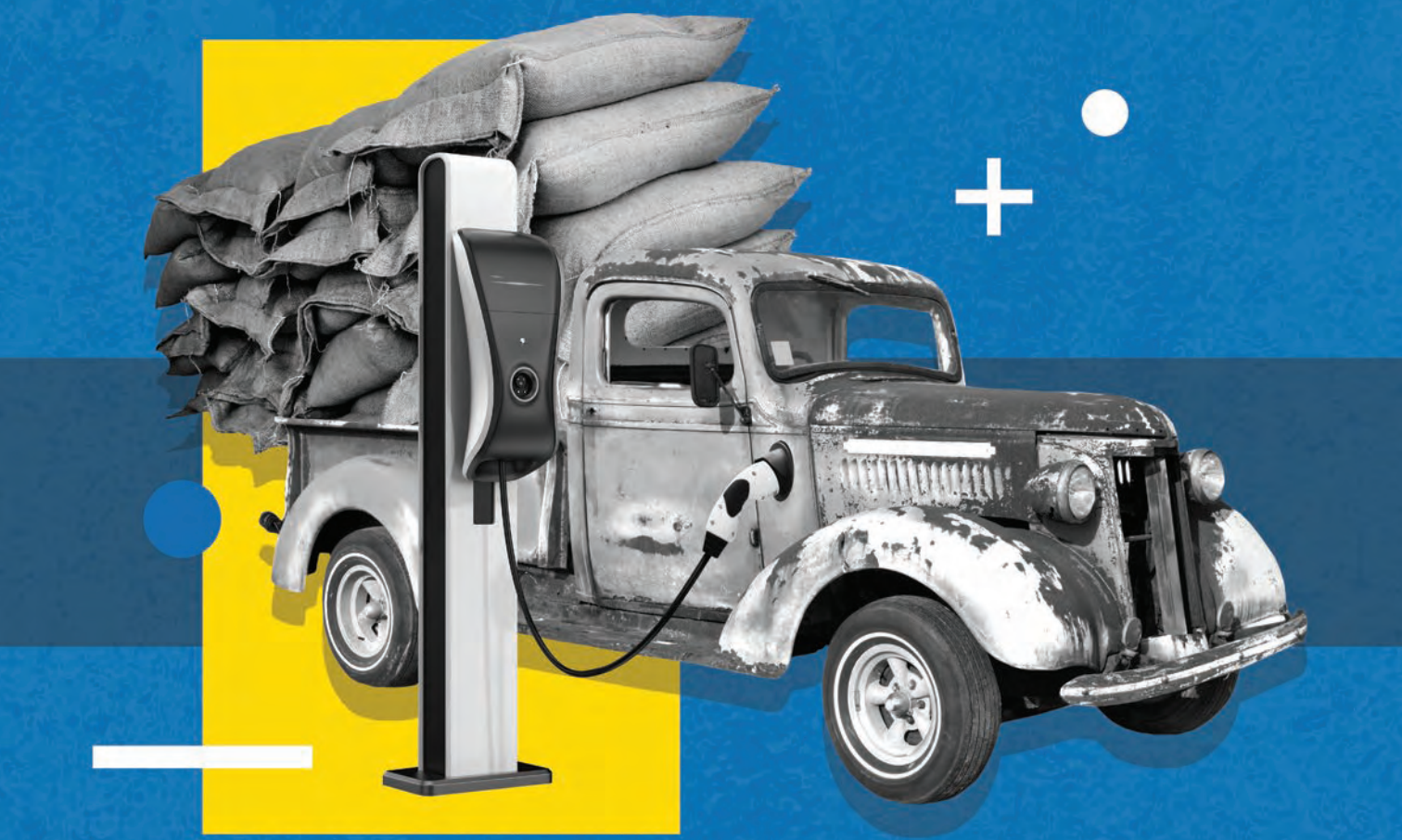
SUPPLY-CHAIN RIPPLES

THE POSITIVE SPILLOVERS OF DECARBONISING UPSTREAM EMISSIONS



Some of the world's biggest companies are setting ambitious net-zero targets, with significant implications for their supply chains. How impactful could the ripple effect be in helping to meet the goals set out in the Paris Agreement?

Anyone who has stood by a calm lake may have been tempted to throw in a pebble and watch as the soothing wavelets ripple outward in perfect circles from where the pebble broke the surface.

This image is often used in macroeconomics to talk about the multiplier effect, and nowhere is this more apt than in the role large companies can play to achieve net-zero emissions by influencing their supply chains.

Recent Boston Consulting Group (BCG) analysis for the World Economic Forum shows that while Western economies are making efforts on the home front, they continue to import high volumes of emissions, especially from Asia (see Figure 1). This means a relatively small number of Western companies can reduce emissions in developing economies by engaging with their suppliers; as the effects ripple throughout industry supply chains, the chances of reaching net-zero global emissions by 2050 increases significantly.[1]

According to the BCG report, four major grain traders account for more than 75 per cent of global demand in the food value chain. If they joined forces to take action with suppliers and define standards on agricultural emissions and deforestation-free agriculture, they alone could affect a substantial reduction in overall emissions.

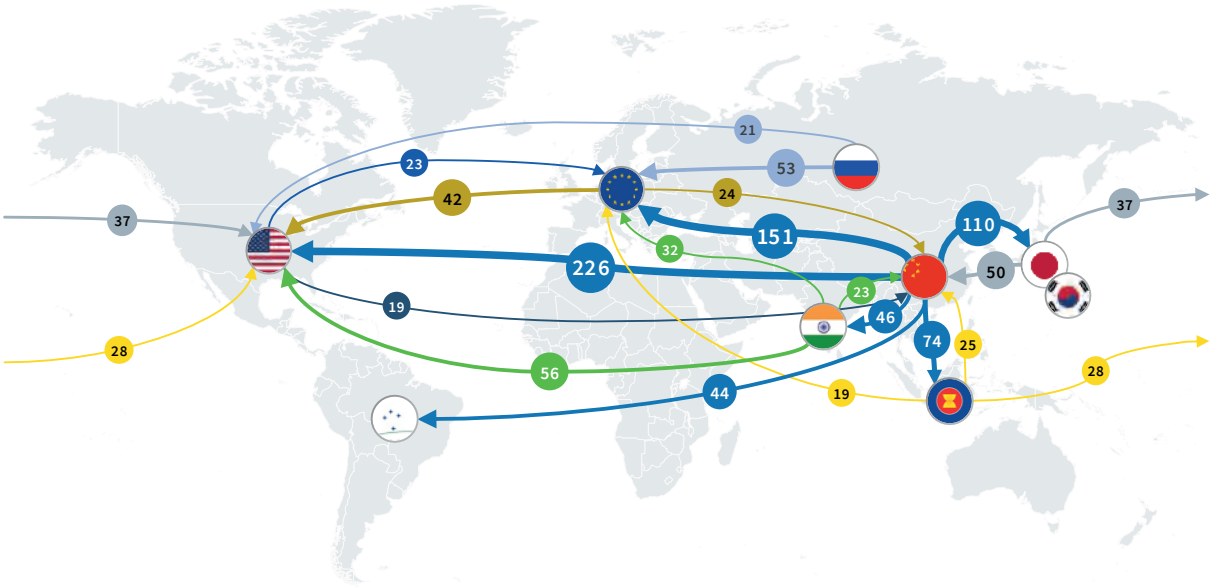
The calm waters of global supply chains

The numbers speak for themselves. Just eight sectors emit more than half the world's greenhouse gases (see Figure 2), and in most of them over 80 per cent of emissions are in the upstream supply chains rather than under the control of the end-consumer companies.

"Up to 95 per cent of an organisation's full value chain emissions typically sit outside its own operational control, so it is important to address supplier emissions," says Hugh Jones, managing director, advisory, at the Carbon Trust, an independent non-profit organisation.

> *Up to 95 per cent of an organisation's full value chain emissions typically sit outside its own operational control*
>
> **Hugh Jones**
> Managing director, advisory, at the Carbon Trust

Figure 1: **Action in supply chains can reduce imported emissions (Top 20 global CO_2 export flows, Mt CO_2, 2015)**



Note: Excluding mining activities and services.
Source: BCG, OECD data, as of January 2021.

SUPPLY-CHAIN RIPPLES
continued

"Large companies will have a significant impact by corralling their suppliers into action, helping to raise awareness of the goal, making the business case for change as well as helping to share knowledge and know-how," he adds.

It could be argued decarbonisation should be the responsibility of firms across the supply chain. However, not only do end-consumer companies have far more clout to trigger ripple effects, they generally have much greater financial means than their suppliers as well.

If they redesigned their procurement processes and supplier relationships to incentivise the adoption of low-carbon practices, rather than through a separate corporate and social responsibility budget, they could transform the global economy.[2]

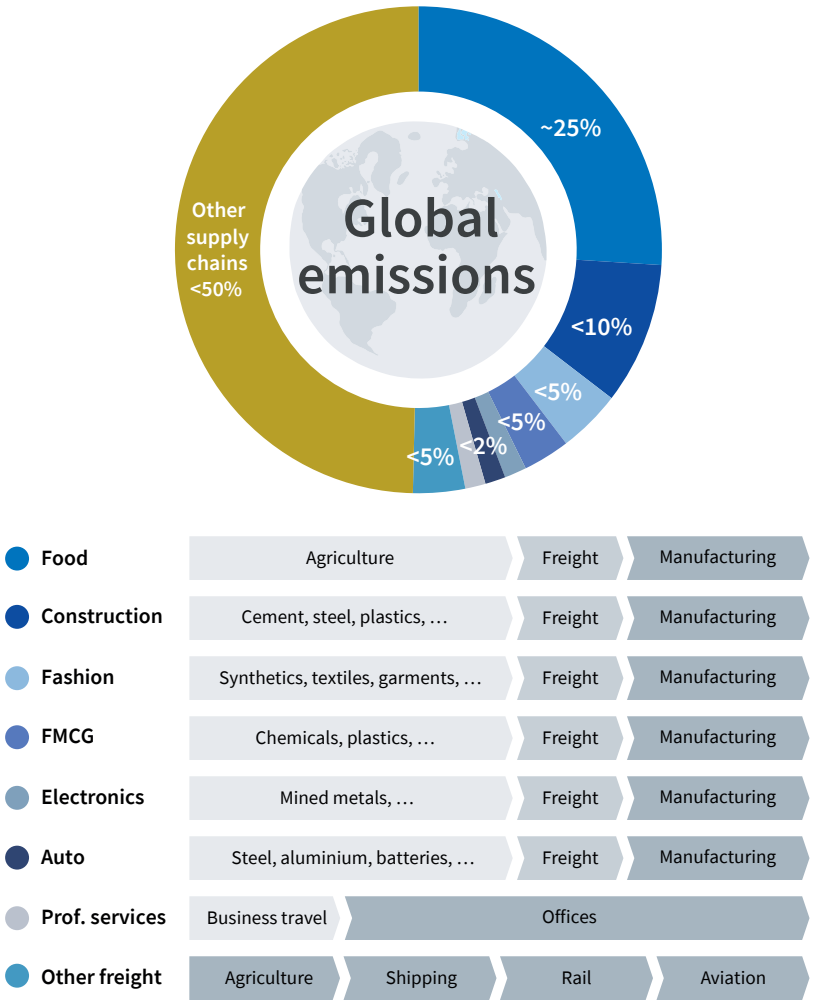
"A major food retailer's carbon footprint from transport accounts for approximately a third of its overall emissions," explains Julie Zhuang, global equities portfolio manager at Aviva Investors. "If it can electrify its truck fleet, that is an obvious win in getting closer to net zero. Obviously, it would pay a premium to the truck manufacturer for that solution.

"On the flipside, in the US, trucking still represents 80 per cent of overall transport. For companies like Union Pacific Rail, seeing firms making zero-carbon pledges is a good incentive for them to encourage a switch of some of that truck transport to rail. There are consequences as you go beyond Scope 1 (to Scope 2 and 3) emissions, and activities like transportation have a huge role to play in helping these companies meet net-zero targets. Those are good examples of going down the supply chain and finding that ripple effect," she says.

However, several obstacles stand in the way.

> *While Western economies are making efforts on the home front, they continue to import high volumes of emissions*

Figure 2: **Eight sectors are responsible for more than 50 per cent of global emissions**



Note: Only selected value chain steps are shown here; value chain steps not shown at scale; Other supply chains = <50%; FMCG = fast-moving consumer goods.
Source: BCG, as of January 2021.

Dam busting: The challenges to a ripple effect

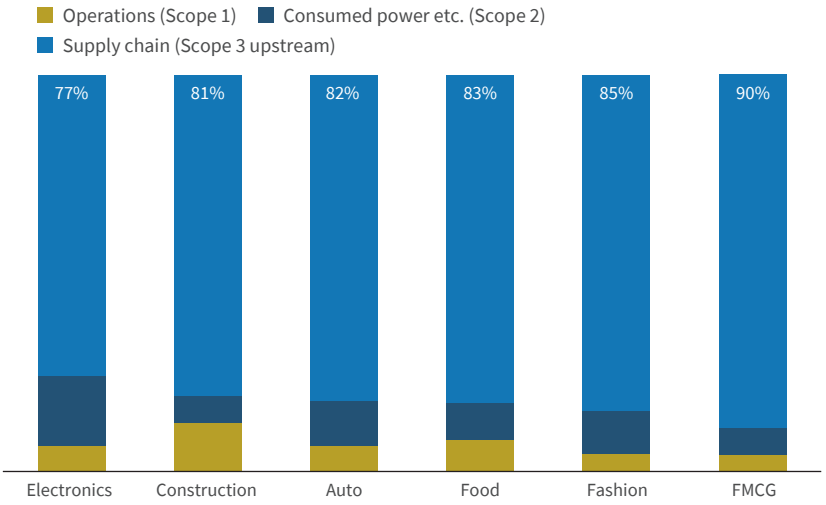
A key challenge is that consumer companies have complex supply chains. Their direct suppliers (tier one) often subcontract portions of large orders to other firms or through purchasing agents. Consumer companies typically have no contact with tier-two or tier-three suppliers, giving them little access to data on the emissions of their suppliers' suppliers. Until consumer companies identify the sustainability problems in their supply chains, they cannot begin to work with their suppliers on solving those issues.[4]

"It's one thing when Microsoft says it's going to be carbon negative, but it's got a huge number of suppliers, from big to small," says Zhuang. "And they all have to get on board to help Microsoft live up to its commitment. Just how easy is it?"

In addition, even direct suppliers may be reluctant to act. They may not be aware

> *Direct suppliers may be reluctant to act and anxious about potential costs and the investment required*

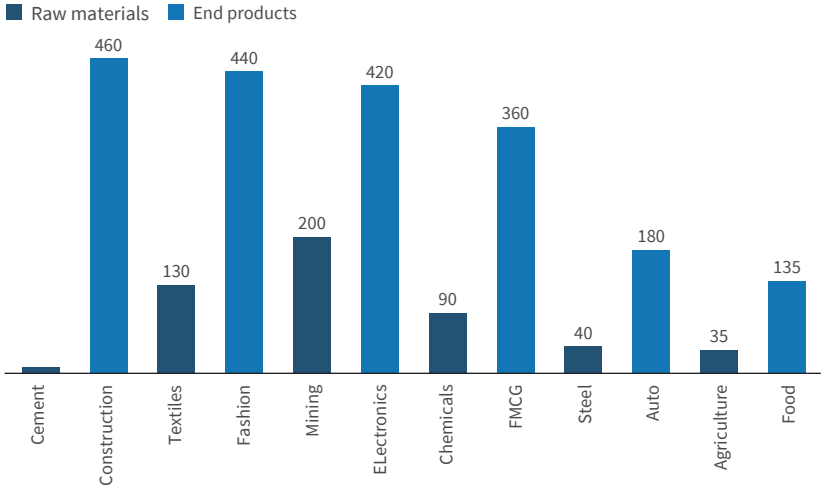
Figure 3: **In many high-emitting sectors, over 80 per cent of emissions are in supply chains (CO_2e, 2019)**



Note: Top companies selected based on number of reported Scope 3 upstream categories and industry fit; FMCG = fast-moving consumer goods.

Source: BCG, CDP, as of January 2021.

Figure 4: **Consumer-facing industries often have greater financial means than their suppliers (Net income in €/t CO_2e Scopes 1-3 upstream, 2019)**



Note: Top companies selected based on number of reported Scope 3 upstream categories and industry fit; FMCG = fast-moving consumer goods.

Source: BCG, CDP, as of January 2021.

of potential levers such as efficiency and circularity, or may be anxious about potential costs and the investment required.

For heavy industry or freight transport companies, undertaking deep decarbonisation efforts without long-term offtake commitments from their customers can be a significant investment and technology risk. In agriculture, farmers may need to invest upfront and "rest" their land before they can manage crops sustainably. Without guarantees customers will pay more for their produce, or that they will be paid for the carbon they sequester, this can be daunting.

The lack of policy support or sector-level targets from industry bodies can also make the hurdle appear unnecessarily steep, particularly for first movers.[5] Yet data, relevant incentives and collective action can help remove those barriers.

Multiply the pebbles, multiply the ripples

"It's important companies understand the impact their suppliers have on their overall emissions through robust data collection," says Jones. "This data should help identify the emissions 'hotspots' and these can then be used to help prioritise areas for collaboration to reduce emissions."

Collecting and analysing supplier data can help companies and their suppliers gain visibility over the entire supply chain and enable tier-one suppliers to audit and manage their own suppliers. Good data can also help firms evaluate product roadmaps, to ensure new products are future proofed.[6]

"Data quality will likely improve year-on-year and companies should support their suppliers to ensure this happens, tracking improvements over time. Working together in this way will mitigate risks within the supply chain and ensure greater transparency which, in turn, can help identify broader issues beyond carbon," adds Jones. Relationship building will be key.

SUPPLY-CHAIN RIPPLES
continued

> *Will there be a market for more expensive steel, cement, plastics, fertilisers?*
>
> **Anders Åhlen**
> Aassociate partner, Material Economics

Setting standards and incentives

Setting procurement standards for suppliers can then become one of the most powerful direct levers. However, it is not sufficient in and of itself. Decarbonising supply chains will often require sustained collaboration, for instance on joint abatement and circularity projects.

"Companies should work with suppliers to raise awareness of the need for action on climate change, communicate their commitments or targets, and signal their requirements so that suppliers can prepare, adapt and innovate," says Jones.

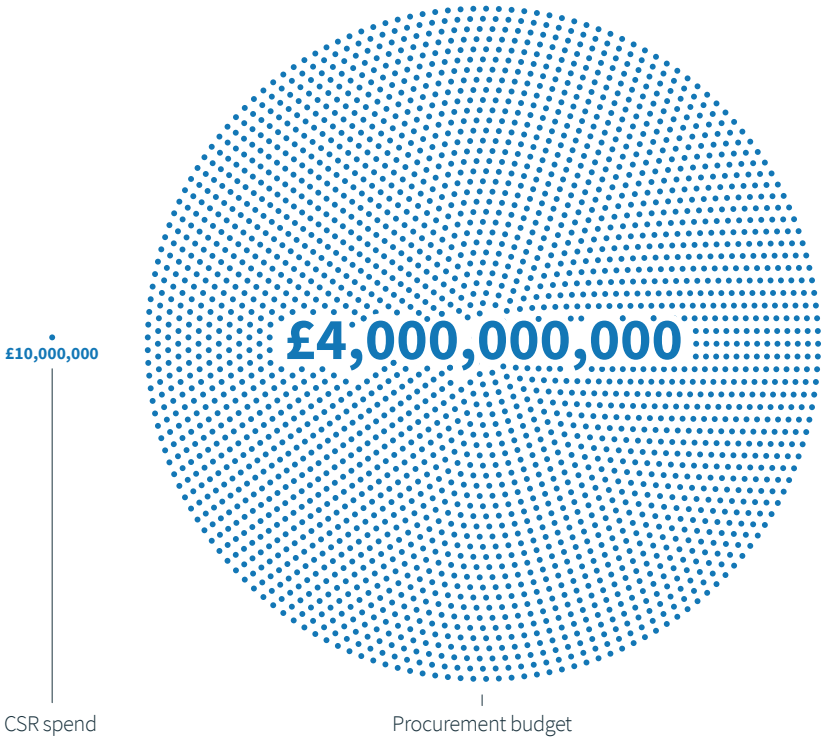
"A good example is O2 (Telefonica)," he adds. "We have certified the company to the Carbon Trust Standard for Supply Chain and it has achieved the highest certification level, which requires companies to demonstrate reductions in specified parts of the supply chain. O2 achieved this through contractual engagements with suppliers to enrol in carbon reduction programmes."[7]

Incentives and rewards for suppliers' decarbonisation efforts are also needed, such as improved payment terms, supporting suppliers to buy renewable energy through power purchase agreements, co-investments, or offtake agreements to share the risk of innovations, especially where these require significant upfront investments.[8]

"There is a big market risk to this," says Anders Åhlen, associate partner at consultancy Material Economics. "Will there be a market for more expensive steel, cement, plastics, fertilisers? Many companies on the demand side are now setting net-zero targets, but it is hard to know for certain that those companies will be willing to pay a sufficient green premium for products." There is also the question of whether they can and will then pass those costs onto the end consumer.

Yet Jones argues even smaller suppliers stand to benefit from decarbonisation efforts.

Figure 5: **Procurement budget versus the average CSR spend of average FTSE 100 companies[3]**



Source: Social Enterprise UK, 2019.

"Reducing waste and improving efficiency are at the core of a well-run business – so taking these steps will enhance rather than hinder operations," he says. "Implementing circular economy practices, for example, can also help cut costs and/or generate revenues through the opening up of new opportunities. Identifying disruptive ways of providing a lower-carbon product or service helps differentiate a business and provide growth opportunities.

"Engaging with suppliers in developing countries to adapt to these changes will improve their resilience and should help ensure their long-term survival. Often, these are the suppliers who may be impacted sooner or to a greater extent by climate change, so there are additional reasons to prioritise them," he adds.

Stronger together

Companies have recognised the benefit of collective action to move an entire sector, allay concerns around competitiveness and make common policy recommendations. The latter are particularly important in heavy industry sectors where governments tend to be the largest buyers, such as cement and steel.

"The price of hydrogen could come down if we began to produce hydrogen at scale, but nobody's going to buy it at a scale until the cost comes down," says Lord Adair Turner, chair of the Energy Transitions Commission, an international think tank. "As we've seen in solar PV and batteries in the past, there is a role for governments to subsidise so we can move rapidly through that chicken and egg

> *Nobody's going to buy hydrogen at a scale until the cost comes down*
>
> **Lord Adair Turner**
> Chair of the Energy Transitions Commission

phase. That is what is going on in things like hydrogen electrolysis."

Joint initiatives include the Mission Possible Partnership[9] for harder to abate sectors, the Sustainable Apparel Coalition,[10] the Supply Chain Sustainability School,[11] which funds the development of skills within the construction sector, and the CDP Supply Chain programme.

"The CDP Supply Chain programme brings together more than 150 major purchasing organisations from around the world to work with their suppliers to encourage disclosure, transparency, and continuous environmental improvements, thus building resilient supply chains," Jones explains.[12]

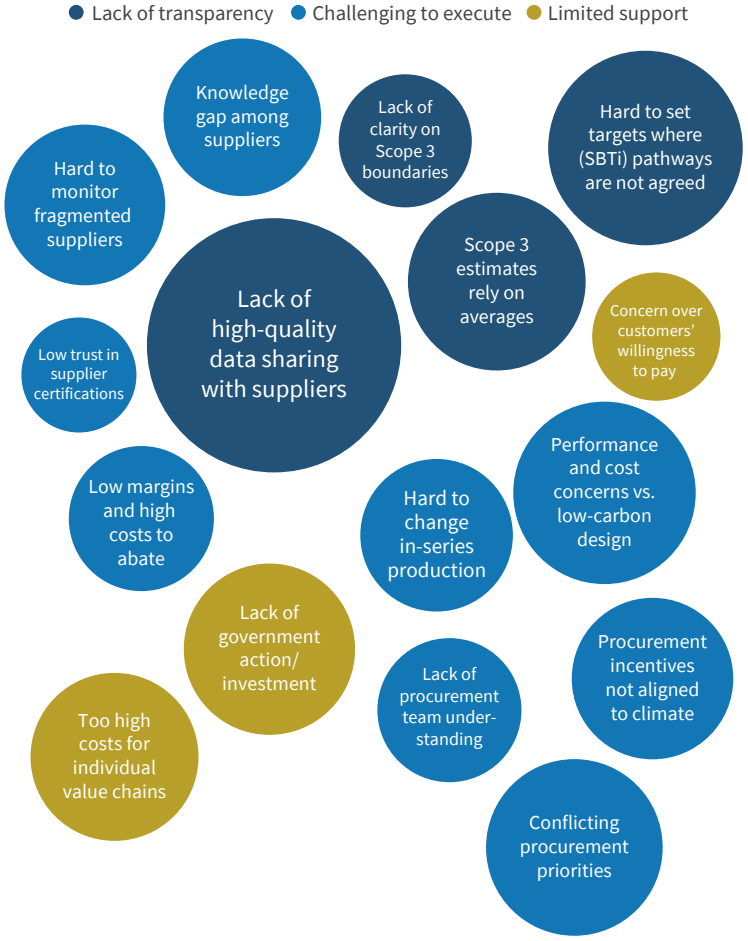
Finally, companies need to align all these initiatives to their own internal targets, embed them into their purchasing strategy and ensure the targets are adequately cascaded across the organisation. Where this may result in higher spending, they should develop mechanisms to release the necessary funds. They should also link their procurement teams' key performance indicators and compensation to supply-chain decarbonisation initiatives.[13]

"Net-zero targets can be very impactful if supported with a robust implementation plan that includes science-based targets and is sufficiently resourced. It is important to have the capability and budget to invest in the organisational changes and innovation required to achieve these targets," says Jones.

"Having a target helps to crystallise the significant shift organisations, governments and citizens need to make and helps organise activity behind a common goal. In addition, making these commitments or targets public also helps encourage wider action, urgency and competition – which, in turn, drives innovation," he adds.

Peer pressure, consolidated disclosure and transparency and net-zero commitments should combine to create ripples throughout supply chains; it will not be enough to just focus on Scope 1 and 2 emissions. Acting as large pebbles, the seemingly calm lake of business activity could well be transformed into a swirl of choppy but ultimately positive change ●

Figure 6: **Barriers to reducing upstream emissions**



Source: BCG, interviews with 40 climate-leading CEOs and their teams, Q3-Q4 2020.

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THE GOING GETS TOUGH

CAN HEAVY INDUSTRY DECARBONISE?

Heavy industry and heavy transport are hard to decarbonise, but this must be done to reach net-zero emissions by 2050. Can companies, policymakers and investors join forces to make it happen? The race is on…

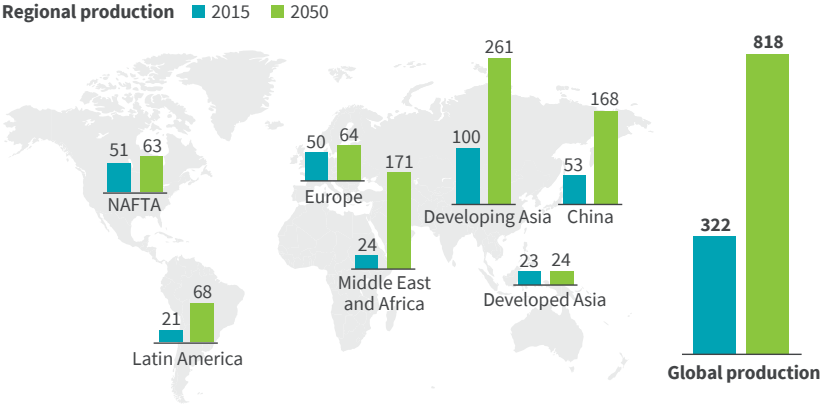
> *The clock is ticking, and if we don't halve emissions by 2030, we won't ever get to net zero. We must go all-in for 2030*
>
> **Maria Mendiluce**
> Chief executive officer of the We Mean Business Coalition and founding partner of the Mission Possible Partnership

2030 is less than nine short years away. Making a meaningful dent in greenhouse gas emissions is within the mandate of most CEOs and government leaders, who can no longer leave it to their successors to resolve.

"It's great that CEOs have committed to net zero, but they now need to take the actions necessary for their companies to be able to get there, and they need to start today," says Mendiluce. "The thing no one has yet realised is that this is massive.

"The fact that the US has a 55 per cent emissions reduction target in the next nine years is going to transform all industries, and the hard-to-abate sectors are a very important part of it," she adds. "They might not be able to completely halve their emissions because some of the technologies need to be developed, but they need to get close; if they don't start today, they will not get to net zero."

Figure 1: **Global annual plastics production could increase by up to 150% by 2050**



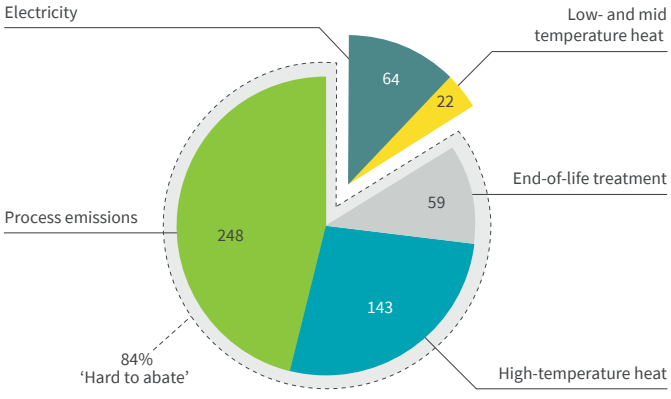
Source: Material Economics, Energy Transitions Commission, 2018.

According to the World Economic Forum (WEF), heavy industry and heavy-duty transport are responsible for nearly a third of global carbon dioxide (CO_2) emissions, a share that will double by mid-century unless action is taken.[1] From steel to cement, plastics to transport (for global supply chains), these sectors are deeply embedded in our economies, and demand in developing countries is projected to grow significantly over the coming decades.

As they are so necessary, we must find ways to decarbonise them, but they are 'hard to abate'. In other words, the technological solutions needed to reduce their emissions are either in their infancy or more expensive than in other industries. Developing technologies like carbon capture, use and storage (CCUS) or green hydrogen on a commercial scale will require huge upfront investment.

Can industries, their customers, governments and investors join forces to reduce the risk, scale-up innovative low-carbon options at pace and replace existing carbon-intensive assets in time?

Figure 2: **84% of emissions from steel, cement, plastics and ammonia are hard to abate**



- **Electricity** Production of 213 TWh to serve industrial processes
- **Low- and mid temperature heat** For e.g. plastic polymerisation and processing
- **End-of-life treatment** Carbon built into the plastics is released when plastics is incinerated at the end of life
- **High-temperature heat** 1100-1600°C for core processes of melting and forming steel, steam cracking,and clinker production
- **Process emissions** From carbon used as an integrated part of the process chemistry of materials production, e.g. carbon used in reduction of iron ore, calcination of limestone, and hydrocarbons in fuel-grade by-products in steam cracking

Note: 100% = 536 Mt CO_2 (total 2015 CO_2 from these industries).
Source: Material Economics, 2019.

THE GOING GETS TOUGH
continued

30%
of CO_2 emissions are caused by heavy transport, aviation and shipping

PART 1: ASSESSING THE CHALLENGE

"Harder-to-abate heavy industries have traditionally been seen as too difficult technologically, too expensive, and perhaps too critical for other needs in terms of employment or infrastructure," says Robert Watt, communications director at the Stockholm Environment Institute (SEI) and head of partnerships at the Secretariat of LeadIT.[2] "It's not that people aren't aware of the emissions associated or that they don't want to do anything about it but, previously, there was a feeling the moment wasn't right."

Heavy transport, aviation and shipping together account for around 10 gigatonnes (Gt), or 30 per cent, of total global CO_2 emissions, but if current trends continue they could account for 16Gt by 2050 and a growing share of remaining emissions as the rest of the economy decarbonises.[3] In addition, while most sectors can decarbonise by switching their power source to electricity, in heavy transport and heavy industry it is either very hard or meaningless.

"Producing cement is a chemical process in which you take calcium carbonate and you make it into calcium oxide. That chemical process produces CO_2, so even if you only use electricity to produce heat for it, it doesn't provide the answer," says Lord Adair Turner, chair of the Energy Transitions Commission, a thinktank focusing on economic growth and climate change mitigation.

"Similarly, it may be possible in the very long term to use electricity to turn iron ore into pure iron, but for the moment you need a reduction agent such as coking coal," he adds. "In aviation, we will be able to electrify short-distance aviation, but today a battery would be far too heavy to get a jumbo jet across the Atlantic. Essentially, with hard-to-abate sectors it will either take us a long time to electrify or the route to decarbonisation has to be something other than electrification."

Sora Utzinger, senior ESG analyst at Aviva Investors, says the core of the issue is the substitutability of current raw material inputs because the energy density balance of fossil fuels remains far superior to low-carbon alternatives.

Utzinger explains the storage to bridge the energy density gap and supporting distribution infrastructure are still works in progress that require high upfront investment to develop, while governments must also think about the additional energy demands on current systems if all hard-to-abate sectors were to transition. Power sources will face capacity constraints as the world electrifies.

Malini Chauhan, ESG sector analyst at Aviva Investors, adds companies in the chemicals sector consistently struggle to set Scope 3 emissions targets because their supply chains are so broad and globalised. "The companies are having difficulty getting their full emissions profile data, and I suspect their suppliers would need help," she says.

Betting on the right horse

Because the technologies are at such an early stage, it creates uncertainty for companies in terms of choosing the right option.

"In my experience speaking to companies like BHP on their emissions reduction trajectory, they've been coy about making outright commitments because they are sitting on the fence in terms of specific technology bets," says Utzinger. "They are between a rock and a hard place. On the one hand, they have a clear idea of how they want to decarbonise their own operations, but with respect to Scope 3, it is so technology dependent that they have not been able to make the types of commitments we are seeing in other sectors like oil and gas, which has been able to look back on a much richer history of renewables."

While policy guidance and support are necessary to create a level playing field and give direction, it may still not be enough. Some companies are entering into partnerships and exploring various technological options to identify the ones that will eventually emerge as the most efficient to scale up.

"If we look at steel, all the large players are exploring different options," says Antoine Chopinaud, credit research analyst at Aviva Investors. "ArcelorMittal alone probably has four or five different projects running that use different sets of technologies because, although it has committed to 2050 net-zero targets, the way to meet them is uncertain."

Until the way forward becomes clear, many firms' net-zero plans remain heavily reliant on carbon offsets.

Assets: Live long, and fester

Another difficulty is that the lifespan of assets in these industries is extremely long. From foundries to aeroplanes, iron-ore mines to cargo ships, anything built today is likely to still be in operation in 2050.

"There are big sunk costs, and that is one of the difficulties about making a transition," says Watt. "In some sectors, they have just reached that tipping point where they need to think about reinvesting. They can either reinvest in carbon-emitting technologies or in a decarbonised process."

Watt explains this also differs from place to place, with many steel plants in Europe and parts of India coming to the end of their life, while in other areas of India, some private companies' steel plants are quite modern but still using coking coal.

"2050 is only one investment cycle away, and new low-carbon technologies would have to reach a commercial threshold by the end of the decade to really make a meaningful impact," says Utzinger. "Otherwise, we risk being locked into a higher-carbon emissions pathway for two to three decades."

Turner says the good news is that we are already beyond tipping points in terms of ambition and commitment. "If you look

> *Companies are trying to identify which technology will eventually emerge as the most efficient to scale up*

across hard-to-abate sectors, leading companies are making commitments that will drive change. ArcelorMittal, the second biggest steel company in the world, and Maersk, the biggest container shipping company, say they will be net zero by 2050. Aviation companies are beginning to make serious commitments regarding the pace at which they will reduce emissions. Truck providers like Volvo have said that by 2040 they will only be selling zero-carbon trucks, and primarily battery electric fuel-cell trucks. As a result, there is also commitment to the early stages of new technology," he says.

"It will take a long time to work through the capital stock and turn it over, but it's a revolution in the level of commitment," he adds. "We have clarity on what the major technologies probably are, and the first orders are coming in."

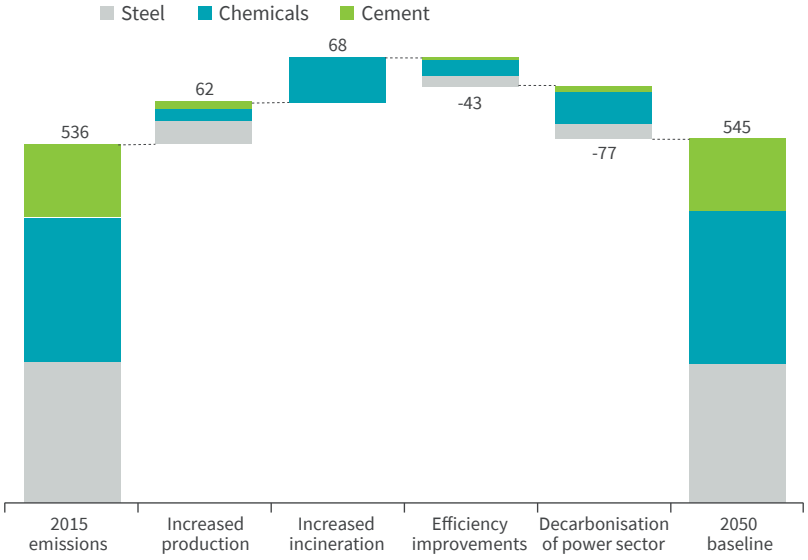
Dependencies and infrastructure

One stumbling block is that decarbonising these sectors cannot happen one foundry or aircraft at a time. The sectors are embedded in a whole network of suppliers and infrastructure, all of which must be transformed.

"It is a physical dependence in that you need access to ports, pipelines, electricity grids, or other kind of infrastructure," says Max Åhman, associate professor of environmental and energy systems studies at Lund University in Sweden. "These industries need to develop long-term plans for where they want to go, and that must include infrastructure.

"That is usually in the realm of governments: maybe not to build everything, but at least to plan and grant permissions, in some areas more than others. Gas pipelines are typically well planned and often have geopolitical implications, especially when they cross borders, whereas ports are more locally planned and built on demand," he adds.

Figure 3: **Steel, chemicals and cement emissions in a baseline scenario (Mt CO_2/year)**



Source: Material Economics, 2019.

He explains that because industry players typically sign long-term contracts to use the infrastructure, which contribute to their financing, negotiating early breaks will be an issue. "The next ten years are a problem," he says. "The contracts are in place; they're not that easy to evade, and they will make it difficult for the transition."

Governments therefore need to be proactive and start planning as part of their net-zero commitments. Much of the current energy infrastructure was built through central government planning, and similar decisions need to be made now for the future. Åhman explains the Central European gas infrastructure, for instance, can be partially repurposed for hydrogen, something for which European gas grid operators have begun planning.

"Existing fossil-based infrastructure is a physical lock-in; to move to something else, we need another kind of infrastructure based on renewables," says Åhman.

"That has to be planned and built or repurposed, and governments can create opportunities, ensuring it runs smoothly. In turn, businesses can also plan and start putting in orders. That's how to break the dependencies. These are huge investments and you need certainty."

From a societal perspective, the jobs transition dimension is also a crucial dependency that should not be forgotten. "There needs to be a way for this to work for both companies and societies. It can be solved, but it is a big extra challenge," he says.

Yet without these changes, CO_2e emissions from heavy industry alone would remain above 500 Mt a year.

The good news is it is technically possible to decarbonise all harder-to-abate sectors by mid-century at a total estimated cost of well under 0.5 per cent of global GDP. That is a positive starting point.[4]

THE GOING GETS TOUGH
continued

PART 2: TECHNICAL SOLUTIONS EXIST

Some of the technical solutions are still hotly debated and unproven, particularly at commercial scale. But technological breakthroughs could be a huge driver to transition hard-to-abate sectors more quickly and cheaply.

"For flights, the current expectation is that a lot of shorter-distance trips may electrify," says Turner. "Optimists would say that by 2035 we'll have planes coming out that could fly 1,000 kilometres and 100 passengers but, at the moment, nobody is assuming that we will get batteries light enough to fly a plane across the Atlantic."

However, he is confident hard-to-abate industries can be decarbonised, even with only those technological improvements that are already well under way and relatively predictable.

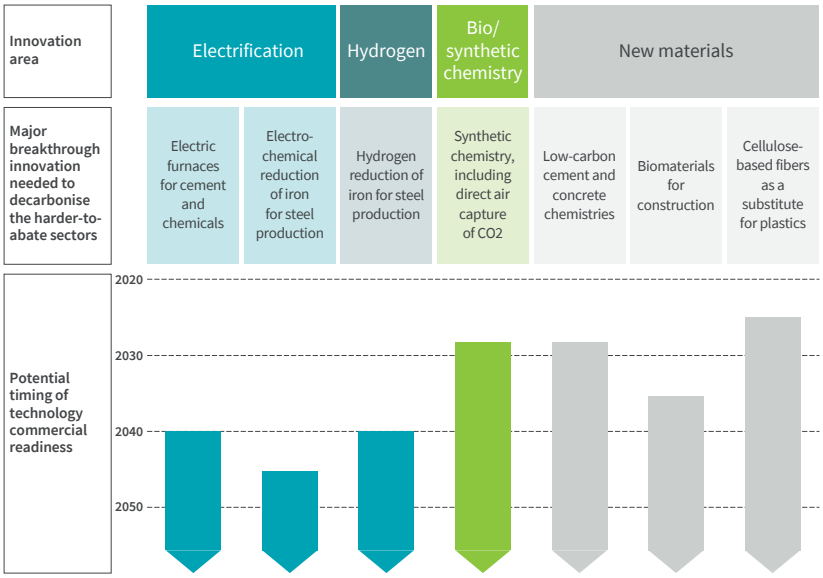
"We are very confident we can get the 'EBIT' sectors – energy, buildings, industry and transport – to around net zero by mid-century with technologies that already exist," says Turner. "Some need to be scaled up and cost reduced, but we don't need to develop entirely new things."

Three areas, six innovations

Research shows that in addition to technologies such as hydrogen and carbon capture, materials efficiency, energy efficiency and a more circular economy are essential to reduce costs and achieve full decarbonisation.[5]

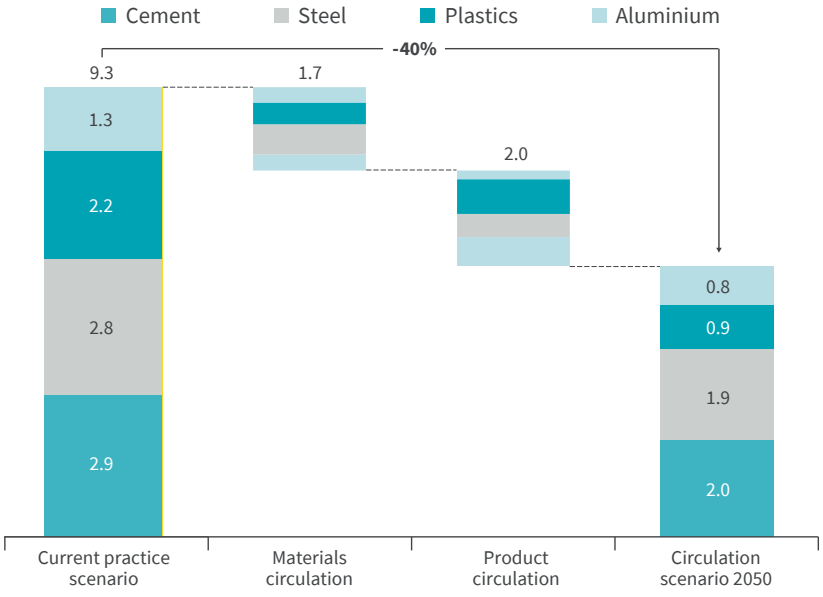
"A good way for companies to look at this is to ask where your company and industry will need to be ten years from now, 20 years from now, and how you build your transition journey from a wide base of solutions because then there is a lot of value to transition solutions, incremental improvements and so on – low-hanging fruit," says Anders Åhlén, associate partner at Material Economics, a consultancy firm advising businesses on how to reduce their environmental footprint.

Figure 4: **Breakthrough innovation could accelerate full decarbonisation**



Source: SYSTEMIQ analysis for the Energy Transitions Commission, 2018

Figure 5: **A more circular economy can cut hard-to-abate emissions by 40 per cent by 2050 (Gt CO_2 per year)**



Source: Material Economics analysis for the Energy Transitions Commission, 2018

> *Companies should ask where they need to be ten years from now, 20 years from now*
>
> **Anders Åhlen**
> Aassociate partner, Material Economics

"All companies should go after those," he adds. "It will take time before more novel solutions are commercialised, so we need to have a parallel approach of bending the curve now to get emissions down with things like energy and materials efficiency, switching to low-carbon fuels like biofuels where possible, electrifying parts of your processes that are easier, and developing circular offerings."

Mendiluce says this entails innovation in six major areas.

"The first one is materials efficiency and circularity," she explains. "This is about improving product and equipment design, and materials, processes, systems. Sorting out traceability and recycling is very important. In some of these products, like plastics, the collection infrastructure is not fully in place, especially in developing countries, and plastic leakage is having major impacts on the environment.

"Efficiency means less cost for companies. A circular economy can also create new revenue streams from the reutilisation of waste that would otherwise end up in landfill," she adds.

Mendiluce lists electrification and hydrogen as the second and third innovation areas, which are going in the right direction. "We also need to develop electric furnaces for cement and chemicals, and the electro-chemical reduction of iron, so electrification is really important – with renewables, of course," she says.

The fourth is biochemistry and synthetic chemistry, where interesting things are beginning to happen, although more progress is needed. New materials are the fifth area of innovation. "It is really interesting to see some substitutes for coal and cement, as well as new bioplastics," she says.

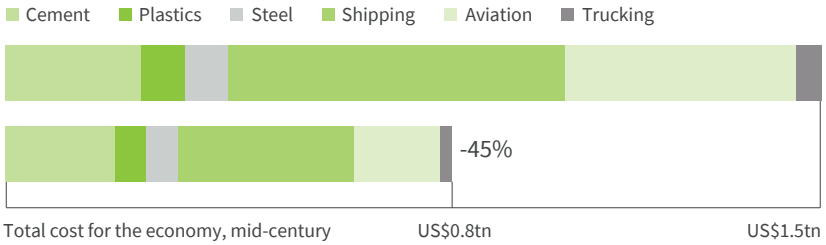
Last but not least is CCUS.

Figure 6: **Why energy efficiency and demand management matter**

In hard-to-abate sectors, energy efficiency improvements and demand management can:

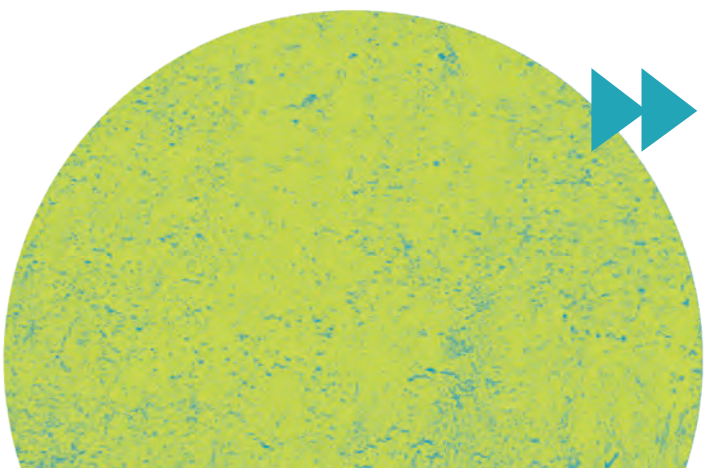
Reduce CO_2 emissions

Reduce costs



Reduce the scale at which decarbonisation technologies need to be deployed

Source: Material Economics analysis for the Energy Transitions Commission, 2018.



THE GOING GETS TOUGH
continued

> *The majority of the associated costs in aviation will be passed through to customers*
>
> **Cristiano Mela**
> Credit research analyst, Aviva Investors

Figure 7: **Three steps to a net-zero economy**

1. Use less energy

- Deploy more efficient equipment, transport modes and production processes
- Use less primary material input to deliver the same goods
- Change consumption patterns using fewer products and services to achieve same living standards

2. Scale up clean energy provision

- Multiply by 10-15 zero-carbon electricity generation
- Scale up zero-carbon hydrogen production to reach 700-1,000 Mt p.a.
- Build biofuel and synthetic fuel supply chains

3. Use clean energy everywhere

- Drive massive clean electrification of buildings, transport and industry
- Use hydrogen where you can't electrify
- Decarbonise remaining energy use using CCS/U and sustainable bioenergy

Source: 'Making Mission Possible', Energy Transitions Commission, September 2020.

PART 3: ESTIMATING THE COST OF DECARBONISATION

There is ongoing debate on the social impact of decarbonisation, as the added costs are likely to be passed on to end consumers.

"If you look at aviation, they have been trying to be more stringent on carbon control but the majority of the associated costs, especially in Europe, will be passed through to customers," says Cristiano Mela, credit research analyst at Aviva Investors. "This raises questions about the viability of their long-term strategy because the transition will basically be implemented through the end customer paying a higher price."

The good news is that while cost increases are considerable in cases like aviation, most price increases for end customers look like they will be negligible.

"We have looked at the numbers very carefully and have examples showing that for the end products for a customer – a car or a plastic bottle, a building and so on – the cost increase does not have to be high, in the order of one per cent. So from a societal perspective, there is not that much cost," says Åhlén.

"But the cost increase in the B2B part of the value chain is very high, so that's the really big challenge for the industry, especially for the first tonnes produced with breakthrough technologies, as well as the transition's effects on jobs – reskilling and in some cases relocation," he adds.

On the production side, the cost of decarbonisation will vary by sector. Research commissioned by the Energy Transitions Commission found that abatement costs will be more moderate in heavy industry and decline in the longer term as technologies come to maturity and scale.

They may range from $25 to $60 per tonne of steel, and from $120 to $160 per tonne of cement. The cost would remain higher for plastics – over $200 per tonne excluding a switch to renewable feedstocks, and this is where materials efficiency and recycling will have a crucial role.

The same report found that for long-distance shipping and aviation, abatement costs will remain significant even in the long term, up to $180 per tonne of CO_2 for aviation and $300 for shipping.[6]

In each sector, the most cost-effective route to decarbonisation will likely vary by location, depending on the availability of resources. In particular, the choice between electricity based, biomass and carbon capture options will be strongly influenced by the price at which zero-carbon electricity is available locally.

"The geopolitical picture used to be about who had the oil," says Julie Zhuang, global equity portfolio manager at Aviva Investors. "Now, it's the opposite. It's about who's got the sun, the wind, the hydro."

However, Mendiluce says most of these routes will incur more cost, which will vary by location, and carbon markets alone will not drive progress. "We need strong policies that create incentives in

In sectors exposed to international competition, we need to create a level playing field

Maria Mendiluce
Chief executive officer of the We Mean Business Coalition and founding partner of the Mission Possible Partnership

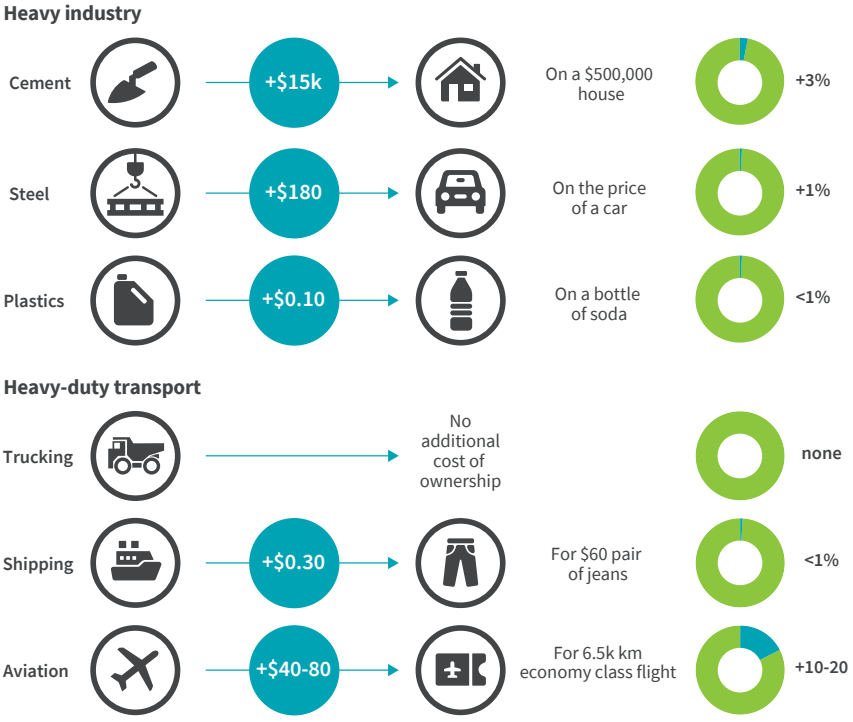
Abatement costs will be more moderate in heavy industry and decline in the longer term as technologies come to maturity and scale

these industries," she says. "In sectors exposed to international competition, we need to create a level playing field, so that we incentivise all players to embark on the transition."

Utzinger agrees, explaining that if we are serious about decarbonising hard-to-abate sectors, a global industrial policy is needed. "At the moment, there is no hint of that," she says. "At the recent G7 meeting [held in Cornwall, England, in June 2021], no serious steps towards climate change were made despite the headlines. That does not bode well for COP26."

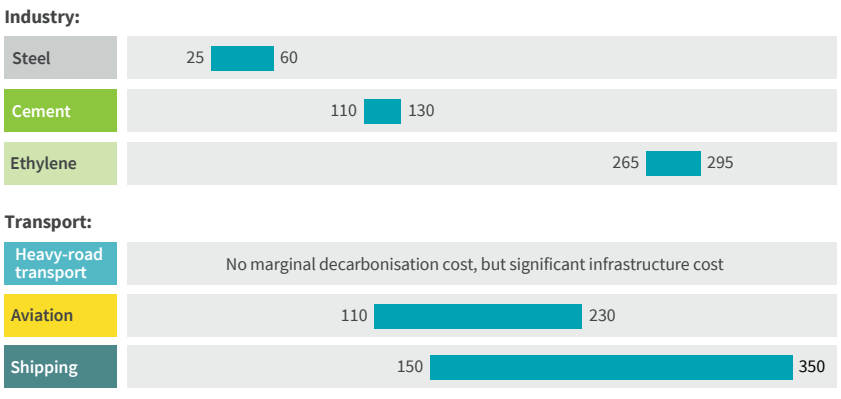
Zhuang believes setting a realistic price for carbon will be critical. "Maybe we are wrong to say the technologies are very expensive; they just seem expensive because we are not pricing carbon properly," she says. "If governments imposed a carbon tax, a lot of these technologies would suddenly make sense economically."

Figure 8: **The cost to consumers of decarbonising hard-to-abate sectors will be small**



Source: 'Making Mission Possible', Energy Transitions Commission, 2018.

Figure 9: **The costs of supply-side decarbonisation vary greatly by sector (US$/tonne CO_2)**



Source: 'Making Mission Possible', Energy Transitions Commission, 2018. Data sources: Industry: McKinsey & Company; Shipping: UMAS analysis for the Energy Transitions Commission; Other transport: SYSTEMIQ analysis for the Energy Transitions Commission, all as of 2018.

THE GOING GETS TOUGH
continued

> *The greater customers' commitments to buy net zero, the easier it becomes for producers to make the necessary investment decisions*

PART 4: JOINING FORCES

Building a zero-carbon economy by mid-century will require a dramatic acceleration in the pace of investment. While it is affordable, it will not happen unless countries set clear targets, design policies to support key technology developments, price carbon, drive energy efficiency and ensure key infrastructure developments.

Some investments will be made at the government level, such as certain parts of infrastructure, but much will depend on companies. For them to be able to make decisions to invest millions into each plant, they need to find a business case that works for themselves and their customers.

"There are a number of risks in these investments," says Åhlén. "They are usually large, one-off investments. There is the technology risk: are we betting on the right horse? There is also an issue with the costs of ramping up, in that producers must bear a lot of costs in the beginning but only get paid later, when they start producing the materials at scale.

"Then, there is a big market risk," he says. "Will there be a market for more expensive steel, cement, plastics, fertilisers when you start production? Many companies on the demand side are setting net-zero targets, but it is hard to know for certain they will be willing to pay a sufficient green premium for products."

Finally, if competitors don't move at the same pace, their cost base will remain lower, adding to the market risk for first movers.

This is why demand is crucial: the greater customers' commitments to buy net-zero steel, cement or plastics, the easier it becomes for producers to make the necessary investment decisions. Offtake agreements in particular can make a significant difference.

One element that can support demand is the ability to translate slightly higher prices into an attractive end-consumer promise, such as living in a net-zero building or, for a freight company, buying net-zero trucks that don't just run on electricity but are also made from net-zero steel.

"It's important to understand the best total business case. Policy support is important, but the demand side also needs to help and can gain a strategic advantage," says Åhlén. "For example, steel producers can't be experts on how carmakers can market a car with low-CO_2 steel in the best way. Understanding how customers – e.g. carmakers – can get the highest benefit out of the end product at the lowest cost is part of the business case and there is much potential in strategic collaboration between steelmakers and their customers."

However, the ability to turn this into attractive propositions depends on the sector. "If you take retail, their shipping costs a tiny bit more," says Turner. "Because it's spread across everything, it's more difficult to turn it into an advertising advantage with customers. Saying, 'Come to my store because the shipping is zero carbon' is a tricky thing to turn into a compelling customer proposition."

Coming together

Coordinating the moving parts of value chains is essential and at the heart of some of the most influential initiatives to decarbonise hard-to-abate sectors, such as the Mission Possible Partnership, the UN's LeadIT and the We Mean Business Coalition.

Mendiluce adds the industries need to agree on a roadmap to net zero, developed jointly by all stakeholders, so they can establish ambitious, science-based targets and start to act and show real progress against the roadmap. "That's where the investor community plays an important role, because by incentivising, supporting and pushing these companies to go faster, we can drive real change and transformation," she says.

Turner agrees. "Within the shipping sector, we are engaging not only with shipping companies like Maersk, COSCO or the Mediterranean Shipping Company, but also with the ports," he explains. "If somebody buys a ship which burns ammonia, they've got to know that at Rotterdam, Dubai, Singapore, there are tanks full of ammonia, and the pipes to refuel with it.

"We must try and get the whole value chain there. It's the shipbuilders, engine makers, ship operators, ports. All have got to move in lockstep," he adds.

"One of the key success factors for any decarbonisation initiative in heavy industries is that it can't be done by policy or industry on its own," says Watt. "It needs to be done in a public-private partnership where the enabling environmental policy must also make the business case viable. There are even roles to play for public finance and de-risking some of these transition technologies."

Public procurement and investment

Governments are therefore key to supporting the transition.

"Public procurement policy is another demand signal that can help on the cost of finance," says Watt. "Once you know you can sell low-carbon products, you can go to the banks. It's then a lower-risk investment for them, so the cost of capital might be a sliver lower."

Lund University's Åhman agrees subsidies and public procurement are vital, particularly since many of the materials concerned are used in infrastructure. "It's unrealistic for a government to ask for zero-emissions materials in public procurement today, but at least they can tell suppliers to disclose their emissions and come up with, for example, a ten per cent reduction for the first round, then a 20 per cent reduction

Figure 10: **The Mission Possible Partnership approach aims to develop shared roadmaps**

Forge a shared vision

Convene high-ambition stakeholders within a dedicated net-zero sector initiative:

- Industry players across value chain
- Major buyers across value chain
- Lenders
- Shareholders
- Asset managers
- Governments
- International governing bodies

Select net-zero roadmap and metrics

Develop comprehensive roadmap to net-zero by 2050 with five-year increments:

- Demand projections
- Technology deployment
- Policy and demand prerequisites
- Corporate investment needs
- Infrastructure investment needs
- Asset retirement plan
- Role of transitional offsets and nature-based solutions
- Resulting GHG trajectory

Align on relevant metrics of climate-alignment:

- CO_2 emissions targets
- Other relevant KPIs demonstrating sectoral decarbonisation

Commit to action

Agree on relevant targets and commitments with a focus on 2025-2035 timeframe:

- Emissions targets
- Investment commitments
- Demand signals
- Procurement rules
- Lending guidelines
- Investment principles
- Government R&D
- Government procurement
- National policies

Support implementation

Develop practical resources and toolkits to help operationalize commitments:

- Collaborative R&D
- Blueprint for zero-carbon value chain pilots
- Green product labels and standards
- Demonstration and scale-up financing blueprints
- Assessment tools
- Monitoring of commitments
- Develop emissions traceability protocols to underpin commitments and enable verification
- Integrate metrics into existing climate disclosure frameworks

Source: Mission Possible Partnership, as of June 2021.

the following time. That's a process to get it started," he says.

The risk of stranded assets could also impact companies' balance sheets and hamper their access to capital; those businesses could need financial support when this happens.[7]

Turner adds a number of the new technologies will require public investment in research and development. "You have a chicken and egg situation," he says. "The price of hydrogen could come down if we began to produce hydrogen at scale, but nobody's going to buy it at a scale until the cost comes down. This defines the role the government has to play, whether by carbon pricing or upfront subsidies for the initial development of a technology. Sometimes, they can also support early R&D, although support often needs to go beyond this and into the deployment stage."

Chauhan gives the example of aviation, where public financing of new aircraft development is well established. "Just to develop a normal plane, public money generally helps finance it, as the cost is in the billions," she says. "If we're thinking of a brand new, energy efficient, hydrogen aircraft, it would need public support, particularly if we want to start developing these technologies today given the investment cycle."

> *"Coordinating the moving parts of value chains is essential"*

THE GOING GETS TOUGH
continued

> *The technological alternatives in petrochemicals are unclear*

PART 5: INVESTMENT OPPORTUNITIES AND RISKS

In turn, the 2018 *Mission Possible* report notes investors could help accelerate decarbonisation by: better evaluating climate-related risks and opportunities; establishing clear plans to shift their investment portfolios; and developing 'green investment' products with the support of development banks to facilitate sustainable infrastructure investment in developing countries.[8]

The investment case for this is beginning to shift. For instance, a group of banks including ING, Société Générale, Citi, Goldman Sachs, Standard Chartered and UniCredit have created the Steel Climate-Aligned Finance Working Group to align their portfolios with climate targets in the steel sector to unlock investment and innovation.[9]

"The divestment movement to, by default, not finance fossil infrastructure is a major change," says Åhman. "There are different views on this, but in Europe at least it has had some effect. Just asking the question: 'Should we really take this risk?' has led to some change.

"It's not in all sectors, but steel – and even cement – are reaching a tipping point whereby business and policymakers see the risk of continuing the current fossil-fuel path to be greater than the risk of investing in net zero," he adds.

Challenges ahead

However, this is not yet happening in petrochemicals because the technological alternatives are unclear, many oil-producing countries are still investing in downstream moves in the value chain to secure a higher value for production, and global demand continues to grow.

"Whereas steel and cement are relatively saturated markets, our consumption lust for plastics is increasing, especially in the transitioning and rapidly developing world," says Åhman.

Chopinaud says that even in steel, there is some way to go before the investment case becomes compelling. "The sector is benefiting from strong market conditions but that won't last. It has had poor margins, high fixed costs and been oversupplied," he says. "It is an industry that has been restructuring for some time and now they are talking about decarbonisation, which would call for a heavy investment pipeline. That will further weaken the industry."

Given the conflict of interest of companies investing large amounts in technologies that will make their current asset base redundant, and with higher spending potentially diluting margins, the pace of decarbonisation will largely depend on how stringent regulation becomes. "If we don't think that is going to happen, decarbonisation will probably take much longer," says Mela.

Opportunities emerge

On the other hand, Chopinaud sees cause for optimism in subsidies, like those that supported the early development of renewable energy. "Steel and fossil fuels receive huge subsidies across the world in different shapes and sizes," he says. "Could those be redirected to develop solutions and decarbonise heavy industry?"

This kind of support could create a stronger investment case for hard-to-abate industries. "There are also opportunities for middle-income countries," adds Watt. "They could become suppliers to new markets, which is a great opportunity, and something they are keen to look into."

Watt also sees opportunities in the companies that provide infrastructure for net-zero technologies, from hydrogen transport and storage to CCUS plants and electrolyser technology.

Chopinaud sees opportunities in parts of steel as well, in electric arc furnaces capable of incorporating scrap steel. This is currently limited to supplying areas like construction, while aerospace or vehicles still require primary steel, but it could change as the technology evolves and steel quality improves. "In Europe and in Asia, particularly China, there is a lot of room for growth for electric arc furnaces, and so for scrap steel," he says. "Oversupplied markets haven't called for a market replacement yet, but we could see an acceleration of the switching of capacities from blast furnaces to electrical furnaces."

Zhuang sees potential in other areas too, from substitution solutions such as rail to replace aviation and new materials to replace carbon-intensive steel or cement, to industry leaders in relatively new technologies like sustainable biofuels. "For heating buildings, heat pumps have a negative green premium," she says. "They are more efficient than current higher-carbon heating technologies, so the economics are in your favour as an investor."[10]

Will they, won't they?

"Let's remember that, while a good contribution, these 2030 and 2050 targets are not legally binding for companies," says Åhlén. "We are optimistic companies will spur each other into action in a race to net zero, but the next five to ten years will be crucial.

"And if those investments are to happen, if this is to be proven at scale by 2030, there need to be productive discussions today among all stakeholders," he adds. "Decisions need to start happening now – and the positive thing is we are starting to see a lot of activity" ●

1 'Tackling the harder-to-abate sectors: join the conversation on 7 July', World Economic Forum, July 1, 2020.
2 LeadIT is the UN's Leadership Group on the Industrial Transition, created in 2019 at the behest of the UN Secretary General.
3-5 'Mission Possible: Reaching net-zero carbon emissions from harder-to-abate sectors', Energy Transitions Commission, November 2018.
6 'Making Mission Possible: Delivering a net-zero economy', Energy Transitions Commission, September 2020.
7 'Stranded! When assets become liabilities', Aviva Investors, February 28, 2020.
8 'Mission Possible: Reaching net-zero carbon emissions from harder-to-abate sectors', Energy Transitions Commission, November 2018.
9 'Areas of focus: Steel', Center for Climate Aligned Finance, 2021.
10 'Cut it out! The complex quest to decarbonise heating', Aviva Investors, March 16, 2021.

GROW THE PIE

AN INTERVIEW WITH ALEX EDMANS

Interest in ESG investing is expanding at a seemingly exponential rate – and with it the risks of greenwashing only grow. However, Alex Edmans explains why it is possible for companies and investors to create win-win situations for all stakeholders.

Both the level of interest and scrutiny on environmental, social and governance (ESG) investing has arguably never been higher. This is to be welcomed. The power of finance, if directed correctly, could be immense. But this means going beyond impact investing to ensure the entire financial system cleans up its act. Numerous blind spots, loopholes and inconsistencies exist.

Alex Edmans could help us through many of these. A professor of finance at London Business School and author of *Grow the Pie: How Great Companies Deliver Both Purpose and Profit*, Edmans is an industry insider turned observer having decided to switch from a career in investment banking to one in academia. He now focuses his attention on corporate governance, responsible business, and behavioural finance.

> *Investors are dumping holdings of irresponsible companies, when it may be more responsible to hold onto such stocks and engage*

Edmans' findings are often provocative and non-intuitive. Data-led and wary of anecdotal stories, a few recent examples of research he has either contributed to or helped promote include the surprising amount of green patents produced by fossil-fuel companies, the role of share buybacks in creating value and the lack of evidence for diversity enhancing corporate performance.

AIQ interviewed him to find out more about his views on ESG investing, as well as diversity, equity and inclusion.

Your work portrays quite a rosy view of the world, seeming to suggest companies can do good, benefit everyone and be profitable. What underpins your optimism that companies will voluntarily do the right thing and not just greenwash?

You are right that I portray a rosy view of the world in that companies can both benefit shareholders and society. However, I don't claim companies will do the right thing – they instead may greenwash.

There are two tensions. First, my book stresses that the pie only grows in the long term. For example, my study on employee satisfaction shows it takes five years for the benefits of employee satisfaction to be fully reflected in stock prices. Executives may be concerned with the short-term stock price, and you can temporarily boost it by attracting ESG investors through greenwashing.

Second, executives may not be concerned with the stock price at all (either long term or short term) but being seen as the saviour of capitalism. Thus, they may either greenwash, or jump on the bandwagon of whatever ESG issue happens to be the order of the day, even if it is not material to their business model.

On that note, have you seen any changes in company behaviour and/or investor preferences and analyses? How can we push for more change in corporate and investor behaviours?

We have seen many changes in both. However, they are not always for the better. There is lots of appetite for ESG, which is fantastic, but the most radical changes are not always the best ones – 'more haste, less speed' is called for. For example, many companies are tying pay to ESG metrics, and investors are demanding such changes as well. However, research consistently finds that tying pay to metrics – whether financial or non-financial – backfires because people can 'hit the target, miss the point'. This is particularly a problem with ESG, where many key dimensions are qualitative and thus difficult to measure. Or, investors are dumping holdings of irresponsible companies, when in fact it may be more responsible to hold onto such stocks and engage with them.

Asking "how can we push for more change in corporate and investor behaviours?" might not actually be the right question. We don't necessarily want more change, but more effective change – just like crash dieting might not be the best way for someone to lose weight, even though it is more radical. The way to push for more effective change is to base it on rigorous evidence, which is what I hope to contribute to the topic.

You make a distinction between Pieconomics and enlightened shareholder value (ESV). Indeed, you point out that measurement and analysis of corporate investment decisions are extremely hard and that measuring the externalities associated with ESG is even harder. How can people get behind something so hard to measure?

There are slightly different concepts. You are right that 'ex ante' (i.e. before an executive has made an investment decision), it is extremely hard to predict all the benefits of that investment. For example, if you decide to give employees more parental leave, it is difficult to predict how much more motivated they will be and how much this will translate into higher productivity.

However, for an investor to assess a company, this is 'ex post' – i.e. the quality of a company's current ESG based on its past decisions. While it's very difficult to measure ESG, even ex post, it is possible to assess it. Assessment involves measurement, but also qualitative factors that can't be measured. People frequently fret about how there is less-than-perfect data on many aspects of ESG, but people make decisions all the time based on qualitative factors. They choose their job on far more than just the salary, their spouse on (hopefully) far more than just his/her earning potential, and who to hire on far more than exam results.

Similarly, for companies, where reliable ESG metrics exist we should use them. But for other aspects, it involves having 'boots on the ground' and getting into the weeds of a company – meeting its management, visiting its stores, even talking to its employees and customers as investors like Peter Lynch [a renowned US fund manager] used to do. As a finance professor, I certainly believe in the power of data, but I am also cognisant of its limitations, and investment decisions cannot be made from a desktop.

What, if anything, does the sacking of ESG-friendly Danone CEO Emmanuel Faber tell us about investor patience for sustainability initiatives and values?

It is popular to tell the story of Danone as a heroic visionary CEO unfairly dismissed by pesky impatient shareholders, but let's look at the evidence. Danone's stock price was flat during his six-and-half year tenure, compared to a nearly 50 per cent rise for its closest competitor Nestlé and around the same for the French stock market overall. Note the time period; so, it's not that investors were impatient. Nor is it clear Danone was an ESG leader.

Faber certainly was able to draw a lot of attention to himself, claiming to have "toppled the statue of Milton Friedman" – but a truly purposeful CEO is about quietly creating long-term value for shareholders and society, not writing headlines. Danone's poor performance led to it having to cut 2,000 jobs at the end of 2020, despite being the first company to become an "entreprise à mission" – pledging to serve society rather than just shareholders.

> *"People fret about less-than-perfect ESG data, but people make decisions all the time based on qualitative factors"*

> *Metrics are useful, but should only be one factor that enters into an investment decision*

One of the themes you explore is whether there is evidence companies that score well on ESG metrics also perform better relative to peers. It is such a nuanced area – what has your research revealed?

My research shows some dimensions of ESG do indeed pay off. For example, my paper on employee satisfaction shows the *Best Companies to Work For in America* delivered shareholder returns that beat their peers by 2.3-3.8 per cent per year over a 28-year period. However, not all dimensions pay off. For example, charitable donations harm shareholder value, yet serve to increase CEO pay and protect the CEO from being fired from poor performance – particularly if the CEO donates to charities their directors are affiliated with. In addition, scoring well on material ESG issues is linked to long-term shareholder value, but not immaterial issues.

Part of the recent critique of the ESG investment community by Tariq Fancy from The Rumie Initiative asserts "sustainable investing is not a substitute for the rule changes we really need". Where do you see the greatest need for rule changes to deliver a sustainable future for all? In carbon taxation, developing accounting frameworks and mandatory reporting – or somewhere else?

Few serious people within the ESG investing industry claimed it was a substitute. Some of Mr. Fancy's criticisms are valid, but he criticises a straw man – and had the incentive to make his critiques as extreme and sweeping as possible to attract attention. Thus, one should not take his assertions as representative of the whole industry.

It's not binary – either ESG investing or regulation. Indeed, many ESG investors strongly support regulation. In July 2021, investors representing over $6 trillion in assets called for a global carbon price. Indeed, this is where I think regulation is most needed – to correct market failures by internalising externalities.

Given the need to transform businesses significantly by 2030 if we are to reach net zero by 2050, is a five-year horizon for "long-term shares" to be paid to executives still too short?

Not necessarily, because CEOs are given new shares for each year of their tenure. For example, if a CEO is hired in 2021 and given five-year shares, although they will vest in 2026 the CEO will also have been given shares in 2025 that will vest in 2029. So, the CEO's horizon is longer than five years.

In addition, five-year shares do not equate to a five-year horizon. Stock prices are forward-looking –Tesla's current stock price is extremely high despite its profits being so low because of its future prospects. Thus, the value of shares in 2026 will depend on the company's outlook far beyond then.

What are your thoughts on directing investment decisions to create social value? What does the investment community need to factor in and understand better, and what are the most common pitfalls for those that set themselves up with ambitious social goals?

"Directing investment decisions to create social value" is often interpreted as investing in high-ESG companies and divesting from low-ESG companies. That is certainly a good strategy to improve long-term shareholder returns – as mentioned earlier, certain ESG factors are linked to shareholder returns.

However, we need to be realistic about whether this will actually create social value. Divesting from low-ESG companies doesn't deprive them of capital, because you can only sell if someone else buys – indeed, it might be better to hold onto those companies to have a seat at the table and engage. There is nothing wrong with integrating ESG into stock selection as a means of improving returns, but the ESG industry should be realistic about the extent to which this will create social value. (This is one of the critiques by Mr. Fancy I agree with.)

Another common pitfall is the use of ESG metrics. Metrics are certainly useful but should only be one factor that enters into an investment decision, since they ignore qualitative factors. Also, many metrics capture 'do no harm' rather than 'actively doing good' (growing the pie). For example, MSCI's warming tool studies the contribution of your portfolio towards global warming. I'm on the responsible investment advisory committee for an asset manager; we ran our portfolio through this tool and found the worst offenders were semiconductor companies since the manufacturing process releases perfluorocarbons, which are even worse than CO_2 in trapping in heat. But semiconductors may power the solutions to global warming.

What is your view of public versus private ownership and the increasing concentration (oligopolistic nature) of many industries? For example, you talk quite positively on Apple but do not mention the fact most of the technologies the iPhone make use of were publicly-funded.

I indeed talk positively about Apple, to highlight how companies create shareholder value as a by-product of serving other stakeholders. However, I do not argue that its success was due to private ownership; indeed, in Chapter 8 of the book where I give the example of Vodafone launching M-Pesa, I highlight how it partnered with the UK Department for International Development.

The role of private vs. public is beyond the scope of the book, but it probably won't surprise you my view on this is that both are important, just like my view on most things is balanced. To repurpose capitalism, we need companies, investors, the government and citizens to play their part.

You argue we need to get rid of the 'them' and 'us' mentality in finance, where the person on the street does not feel connected to the people making financial decisions on their behalf. How have ordinary pension holders become so far removed from the assets they own?

Many pension holders may not understand how pensions work, since financial literacy is almost never taught at school. In addition to my position at London Business School, I also have a position at Gresham College. Gresham College is an unusual institution in that it doesn't offer any degrees, but only free lectures to the public, similar to how Michael Faraday used to give free public lectures on science.

Chris Whitty, the UK government's Chief Medical Officer, is the current Gresham Professor of Medicine, and I am the Gresham Professor of Business. My fourth and final lecture series for 2021-2 is entitled "The Principles of Finance" and aims to make basic financial literacy available to everyone. It's available on the Gresham website – both the lectures and the accompanying notes.

Your views on diversity, equity and inclusion are interesting. As an advocate for more diverse organisations, you also caution against reading too much into consultant studies that purport to prove the business case. This seems slightly contradictory; can you elaborate?

There is no contradiction. Many studies claim to have uncovered a clear business case – that increasing diversity causes a company's profits to go up. Ignoring the causation/correlation issue, there isn't even a corelation to begin with. One study, unfortunately by London Business School, ran 90 regressions relating diversity to EBITDA and found none were significant, yet still claimed in bold "these results suggest gender-diverse boards are more effective than those without women".

The McKinsey study has been shown to be irreplicable, even with its chosen performance measure (EBIT) and preferred methodology. Moreover, there is no link between diversity and other performance measures – gross margin, return on assets, return on equity, sales growth, or total shareholder return – or when using more established methodologies. Yet despite both studies being so flimsy, they have been lapped up uncritically due to confirmation bias; people want them to be true, so they don't scrutinise the findings.

Why there is no contradiction with my advocacy of diversity is that my advocacy is not based on the business case, but the ethical and moral case. I am arguing for more diversity - not because doing so will make more money, but because it is the right thing to do. I buy organic food, not because it is good for my bank balance, but because of the ethical and moral case.

Will it ever be possible to measure diversity of thought across organisations?

No, but this is not a problem. You can assess it – for example, by asking management about the processes they put in place to encourage people to speak up and share their views. There seems to be an obsession with measuring everything, and people are uncomfortable with ESG factors that can't be measured. But as Albert Einstein is quoted as saying, "not everything that counts can be counted; not everything that can be counted counts".

We can't measure a CEO's competence, trustworthiness, credibility, or leadership ability, but we can assess it. As mentioned earlier, we make many important decisions in life on more than just metrics – without them being arbitrary or finger-in-the-air – and the same is true for investment decisions ●

This is what climate action looks like

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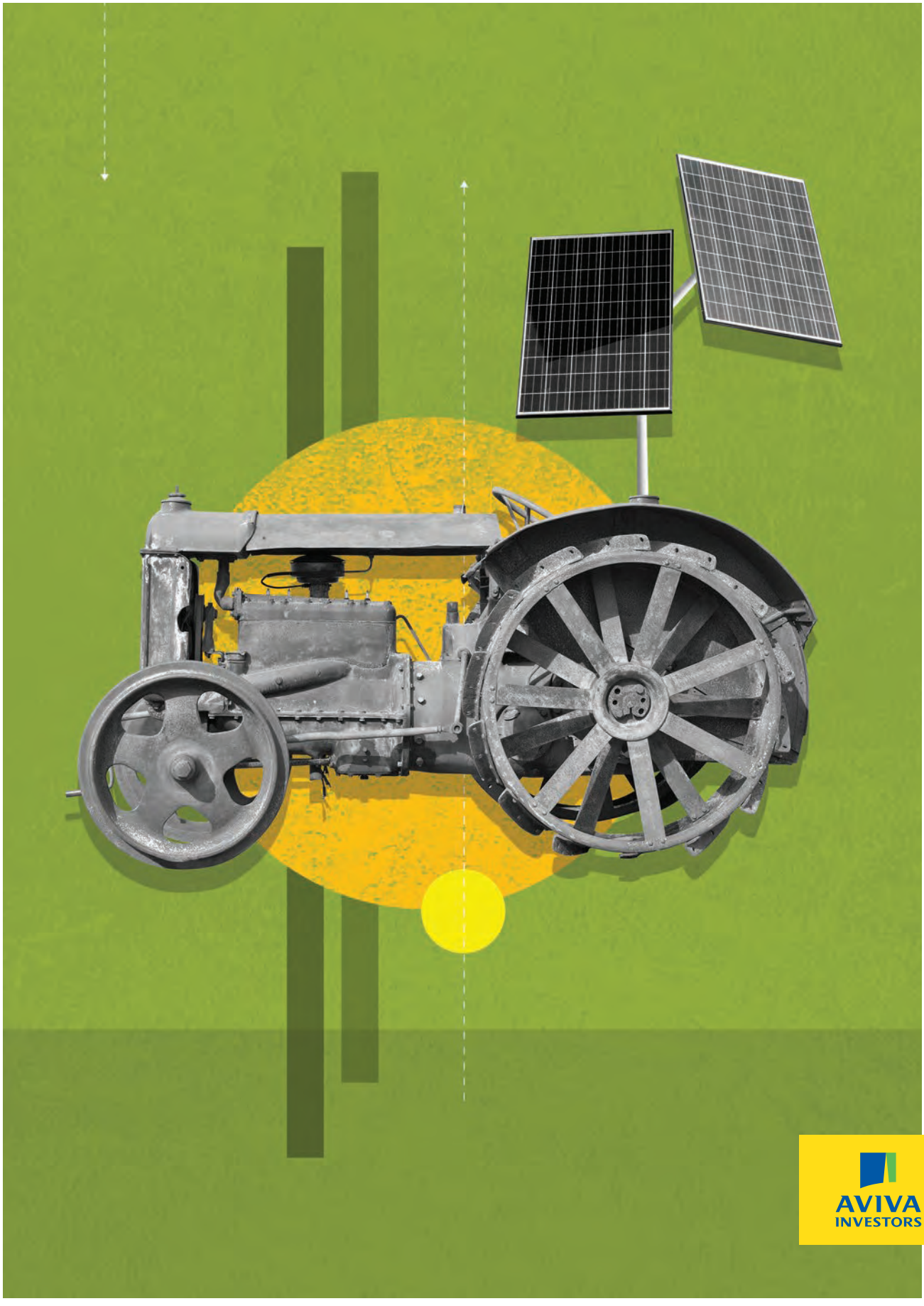

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