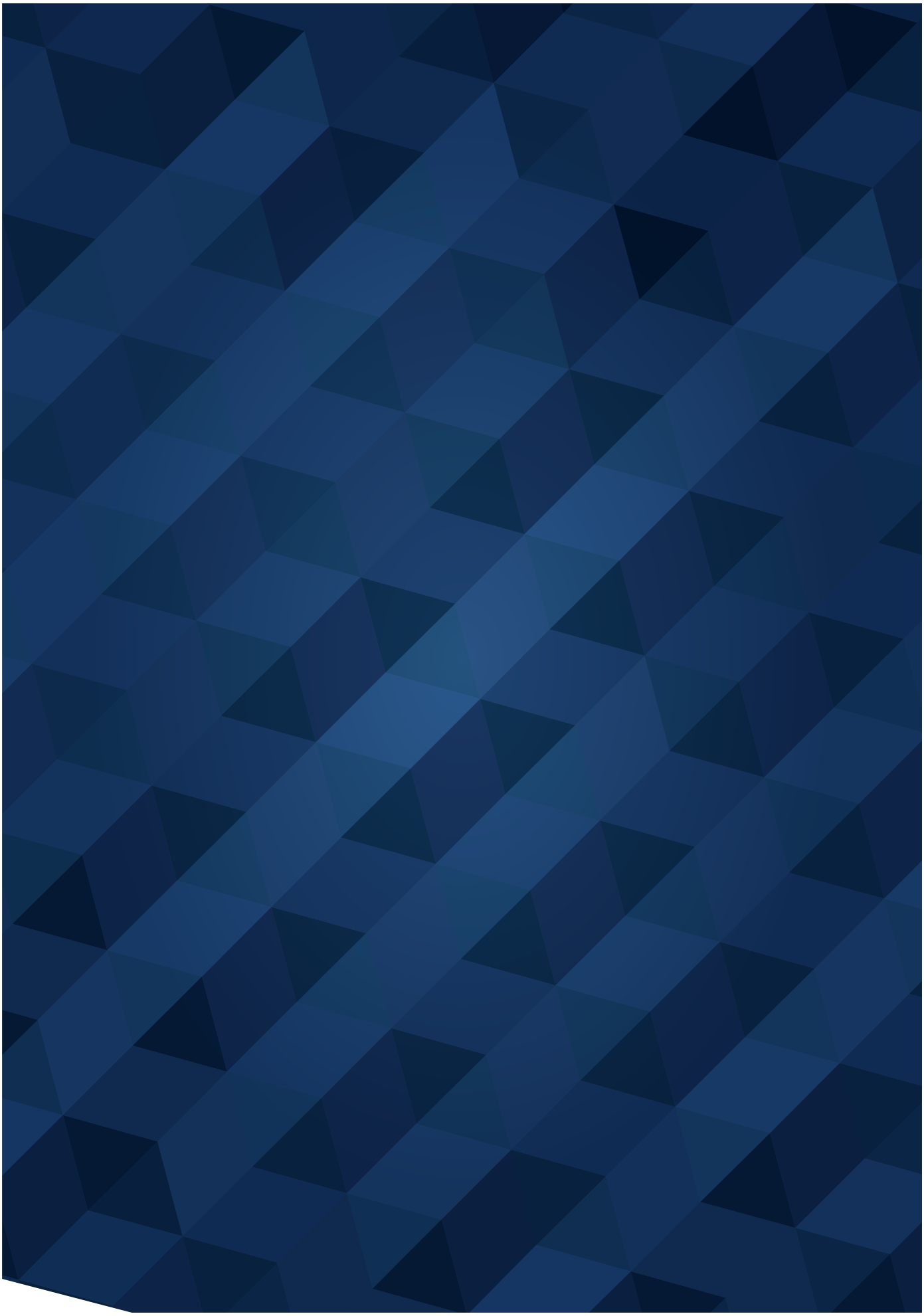
COLUMBIA THREADNEEDLE INVESTMENTS

Responsible Investment Quarterly

Q2 2022



Contents

Foreword: sustainability themes play out on global stage

Roger Wilkinson
Head of EMEA Equity and Responsible Investment Research

The second quarter of this year continues to be dominated by the effects of macro and geopolitical events on some of the key sustainability themes on which we are focused: energy and food security and the intersection with climate change.

In the US, President Biden took steps to support the acceleration of renewables, and particularly solar. He said solar panel parts will be allowed to be imported free of tariffs from certain south-east Asian countries. This decision effectively halts an ongoing tariff investigation and will, temporarily, allow US solar developers to source modules and cells for solar panels from these countries which represent a significant part of the solar power imported to the US. This is a tailwind for US solar, and Biden said he would continue to push Congress to pass clean energy investments and tax cuts to promote US domestic manufacturing of clean energy technologies.

Continuing this theme, in May Australia voted in a government with much stronger pledges on climate. Australia is one of the world's highest per-capita emitters of greenhouse gases and widely viewed as a climate change laggard. Its position as the third largest exporter of fossil fuels globally previously created an economic conflict to rolling out renewables, but the new prime minister, Anthony Albanese, declared "together we can take advantage of the opportunity for Australia to be a renewable energy superpower."[1] If any country can benefit from solar, surely it's Australia.

Sadly, there has been no end to the conflict in Ukraine, and the significant impact on European gas supply and price. At the end of June Germany activated stage 2 of its three-stage gas alert plan. This followed a cut in

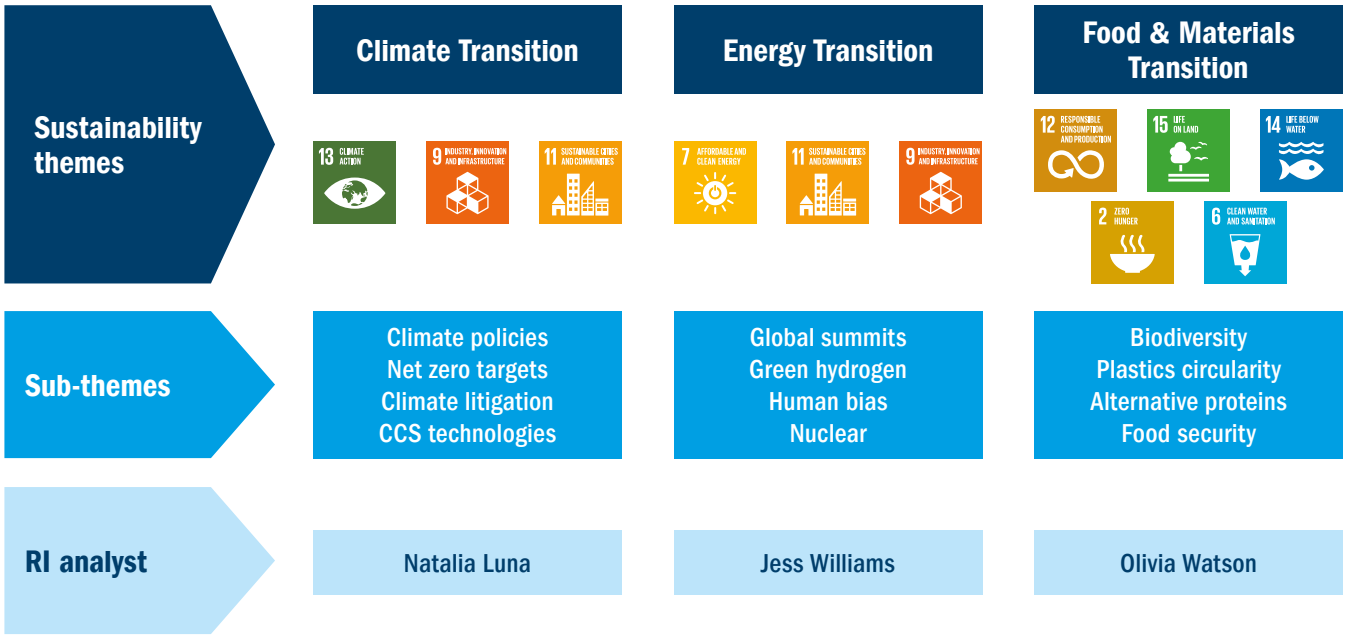
RI research team philosophy

We believe responsible investment (RI) research is fundamental research, so our RI analysts are embedded within the global research team. The team's philosophy reflects this integration with its mantra: "Educate, Collaborate, Engage".

Our RI analysts **educate** portfolio managers and fundamental industry analysts on RI themes and developments based on our intense research in three overarching sustainability themes: climate transition, energy transition, and food and materials transition. We then **collaborate** with our portfolio managers and industry specialists to highlight risks and opportunities within industries and sectors. Through this collaboration we identify companies we want to **engage** with on the risks and opportunities we have identified linked to that particular RI theme. Finally, we integrate these learnings into our investment selections and decisions. This approach allows us to support and provide actionable investment insights.

Our overarching sustainability themes are linked to the UN Sustainable Development Goals, which we believe increasingly shape the economic and investment landscape, and our RI thematic research focuses on investment-relevant sub-themes within these.

Our RI themes and sub-themes



gas supplies from Russia in mid June and continued high pricing on the gas market. Industrial firms in Germany face the prospect of even higher energy costs or forced shutdowns should Russia turn off the supply, which could push Germany to enact stage 3 and potentially apply energy rationing.

As we highlighted in the Q1 2022 edition of Responsible Investment Quarterly, the urgency on energy security stemming from the Russia/Ukraine conflict does not pose a threat to the energy transition – rather the opposite. The ongoing energy crisis, coupled with rising climate ambition, has renewed momentum to diversify and decarbonise the energy system, increasing and accelerating the long-term commitment to renewables.

Persistent energy crises also exacerbate the importance of energy efficiency, with the International Energy Agency (IEA) referring to it as the "first fuel" at its global conference in January.[2] It estimates doubling the rate of energy intensity improvement from 2% to 4% a year this decade can not only contribute to reaching net zero, but also strengthen energy security by achieving significant energy savings and reducing oil and gas demand. Companies offering solutions in material efficiency/recycling in industry, renovation and insulation in buildings, and electrification in manufacturing should benefit from increasing investor attention.

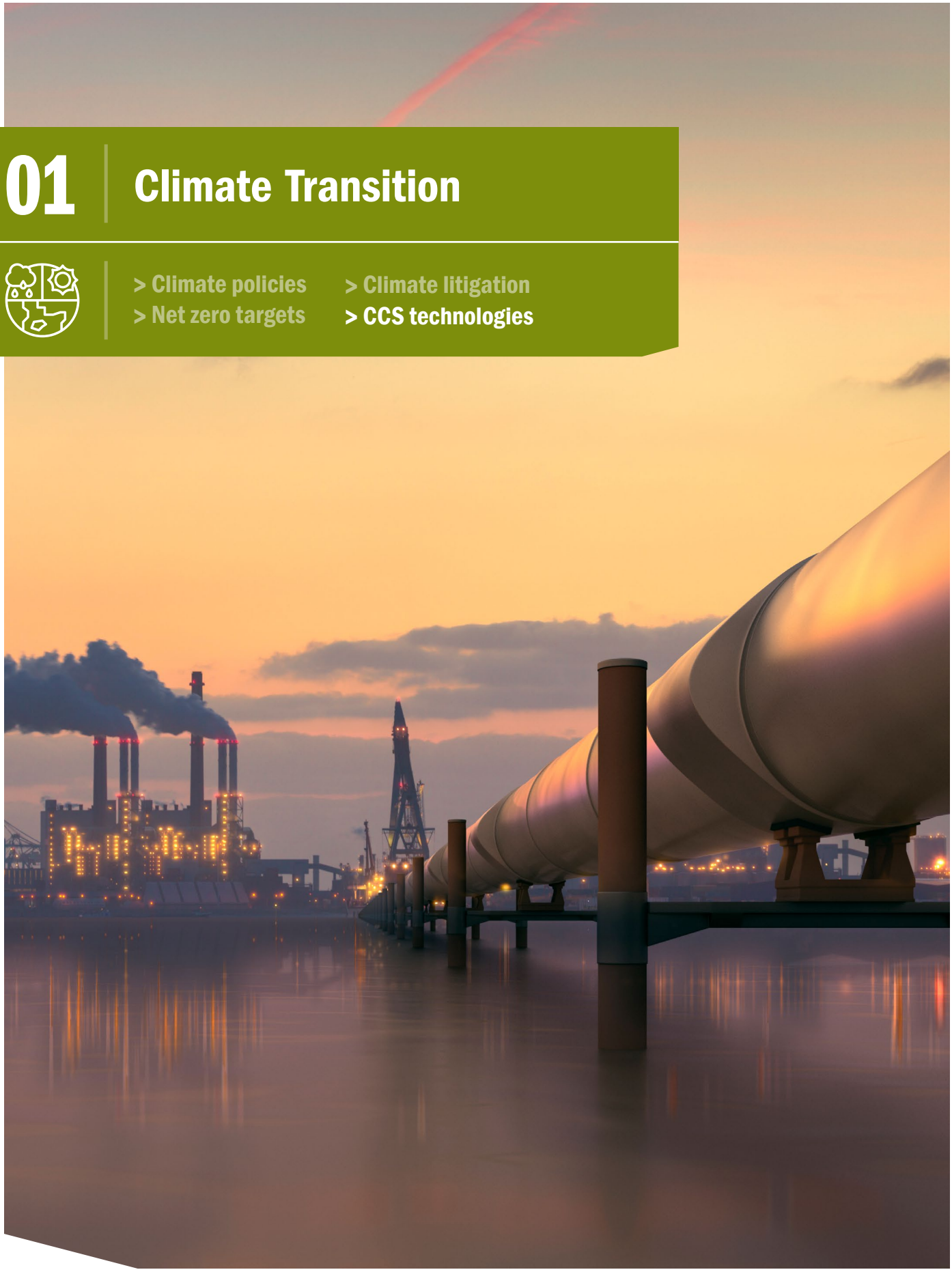
Conversely, the impact of the conflict and elevated gas prices in Europe continue to affect fertiliser production which, coupled with trade disruption and ongoing climate shocks, translates into elevated food prices. We think this inflationary environment will help catalyse a more rapid shift towards technologies that can support a more sustainable food system and reduce pressures on biodiversity. This transition should create some attractive investment opportunities. However, although grain stores are beginning to flow from Ukraine, overall food supply remains disrupted and adverse weather could worsen the impact, particularly on food-importing countries in the Middle East and Africa.

In this issue, Natalia Luna looks at the growing importance of the role of carbon capture and storage technologies to meet net zero and the rising policy support and investment in this market. Jess Williams analyses the impact of human bias on predicting progress in clean technologies and how it often caused policymakers to overestimate cost and underestimate potential. Olivia Watson then explains why biodiversity is a relevant topic for investors and highlights the industries most impacted by the risks and opportunities. We hope you enjoy reading our analysts' viewpoints.

1 Energy Vice, Australia aspires to be 'renewable energy superpower' after decisive climate change election, 2022
2 World Economic Forum, Energy efficiency is the world's 'first fuel' - and the main route to net zero, says IEA chief, January 2022

01 Climate Transition

> Climate policies
> Net zero targets
> Climate litigation
> **CCS technologies**



Why CCS technologies are capturing investor attention

Natalia Luna
Senior Thematic Investment Analyst, Responsible Investment

There is an increasing realisation that carbon capture and storage (CCS) technologies play a crucial role in meeting net zero. Even though a number of CCS technologies have existed for some time, it hasn't been until the past year or so that there has been growing interest and appetite.

Recognition of its importance will translate into growing policy support and investment, which in turn will accelerate the development of the CCS market over the next decade. We believe this will provide investors with investment opportunities across the value chain.

What is CCS and why is it a growth area?

CCS refers to a combination of technologies that capture CO_2 from its point of source of emissions, for example directly from fuel combustion or industrial facilities. It is then transported, usually via pipeline, to a site where it can be injected into deep underground rock formations. In some cases, the CO_2 is used for a range of applications such as enhanced oil recovery (EOR) or the production of fertilisers and some beverages and food. Either way, the aim is to prevent its release into the atmosphere.

Intrinsic to the development of this market is the goal to achieve net zero emissions. Countries accounting for more than 80% of global emissions have made net zero commitments, as have around 700 of the world's largest public companies[1]. These actors are increasingly embracing CCS technologies as crucial elements to deliver their net zero plans and hit their targets.

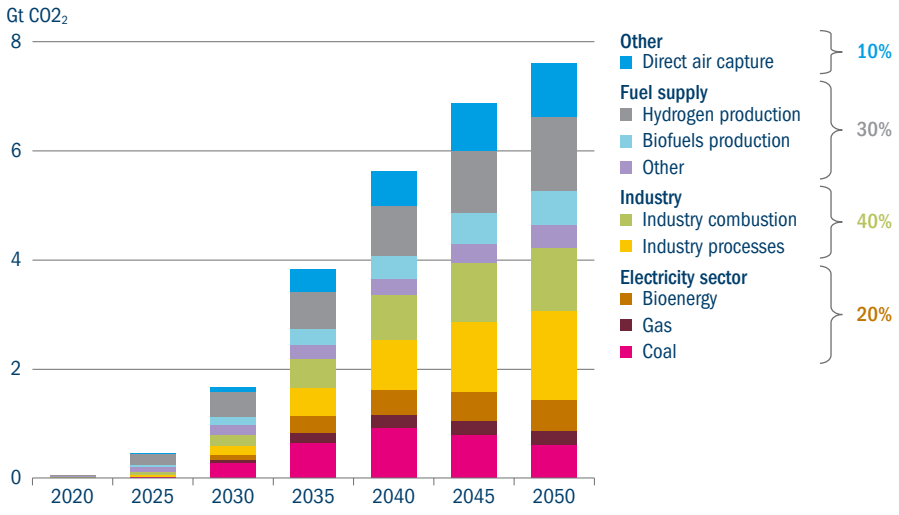
For heavy industries in particular there is no alternative to using CCS to abate emissions stemming from their processes. For example, the emissions created by the chemical processes involved in the production of cement cannot be addressed using renewables or electrification, so it must attempt to capture the CO_2 after the production process. As such, the IEA estimates that CCS can help reduce global emissions by around 15%, hence they are an important pillar of the net-zero roadmap.

In addition to CCS, there is an increasing scientific consensus – especially after the latest IPCC report[2] in April – that the use of wider carbon removal technologies is "unavoidable" to achieve net zero. The leading technology in this space is Direct Air Capture (DAC). This uses chemical reactions to pull CO_2 out of the air before it is either injected deep underground for permanent storage or used elsewhere.

In line with this, the Science Based Target Initiative (SBTi), a partnership between the Carbon Disclosure Project, the United Nations Global Compact, the World Resources Institute and the World Wide Fund for Nature, includes in its net zero standard that "any remaining emissions (up to 10% not covered by the long-term target) must be neutralised with permanent carbon removals".[3] Therefore, the increasing view is that carbon removals have a key role in climate change mitigation strategies – in addition to, not instead of, rapid decarbonisation efforts.

As per the International Energy Agency net zero scenario, most of the CO_2 captured will have been produced by heavy industries and fossil fuels, followed by the wider power sector and by DAC (Figure 1).

Figure 1: CO_2 captured in net-zero scenario



Source: IEA net zero roadmap, 2019

What drives CCS costs?

There are three main cost components in the CCS process: the cost of capture, the cost of transport and the cost of storage.

Capture generally accounts for around half of total costs and is mostly driven by big capex requirements due to the large equipment required within the process. There is also high operational expenditure due to large energy requirements and other operating costs associated with this process.

Transport costs are driven by the large investment required to build the infrastructure to transport the CO_2. Location is key, and long distances from the emissions source to the storage will obviously drive higher costs.

Storage itself requires site exploration and assessment, which are generally drawn out and costly bureaucratic processes. The limitation here is not geological, as there is ample storage capacity globally[4]. However, there are few injection-ready sites.

As per Figure 2, there is a wide range of costs of CCS technologies across different applications. Natural gas processing is the most mature, and hence the cheapest, while others are more complex and under development are above $100 per tonne of CO_2 captured. Many at-point sources of emissions such as hydrogen, cement and chemical production can realise a capture cost of around $50-$70, which is below the current EU carbon price of $80. However, when the cost of transport and storage is added most become uneconomical – unless they can tap into government funding to help cover these costs.

The difference in the cost of capture is driven by the level of CO_2 concentration within each application. The higher the concentration the lower the capture cost as it is less energy intensive and easier to capture the CO_2. This is why DAC is the most expensive technology as, per its definition, the CO_2 is very diluted in the atmosphere.

Why now for CCS?

There are important and rapid developments occurring in three key areas that will support this market:

Policy support: strengthened policies, such as the US Infrastructure Deal or the EU and UK Green deals include significant government funding to support R&D and expand demonstration projects.

Economics: higher carbon prices and tax incentives are improving the economics of these projects. For example, EU prices doubled over the past year and in the US 45Q tax credits are providing important subsidies for CCS investments.

Market dynamics: the rise of industrial hubs that share not only innovation but also the costs of transport and storage are becoming a key driver of economies of scale.

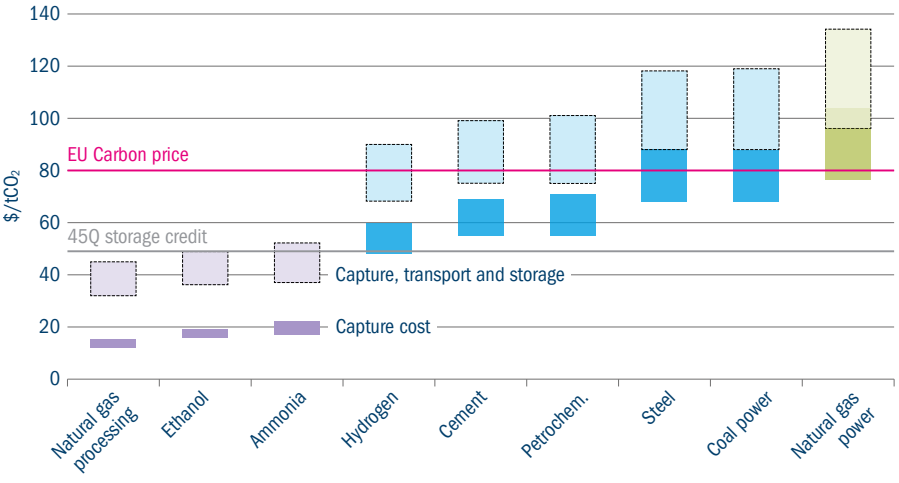
We therefore expect developments in these areas to support the adoption of CCS technologies and the growth of this market. For example, the expansion of tax incentives in the US (under the Inflation Reduction Act) and Canada, as well as higher carbon prices in EU in the range of $100, will make CCS increasingly economical. In addition, market evolution such as rising demand for low carbon products and the development of voluntary carbon markets that allow corporates to buy offsets to fund these projects will become important catalysts.

In terms of the potential size of this market, the current amount of CO_2 captured represents less than 1% of global emissions. To meet IEA net zero targets, whereby CCS would contribute reductions of around 15%, the average capture rate would need to increase 10x by 2030. The project capacity announced to date will require investment between $140 billion and $1.1 trillion – significantly more than the $3 billion spent in 2020. However, to meet the IEA's targets will require much more, with estimates ranging from $760 billion[5], $1.6 trillion[6] and $3 trillion[7].

The development of this market, however, faces challenges. Although there has been progress, global climate policies and carbon pricing is not yet supportive of DACs economics to such a level to meet the IEA net zero roadmap, so more policy support is required. In addition, a simpler and shorter permitting process is needed as the regulatory approval can be lengthy, as well as limited liability protection to finance projects.

The market also needs to counteract public opposition to CCS that presents as local resistance to projects on the grounds that CCS might prolong dependence on fossil fuels as well as require significant amounts of energy and water, for example.

Figure 2: CCS costs per tonne of CO_2 across different applications



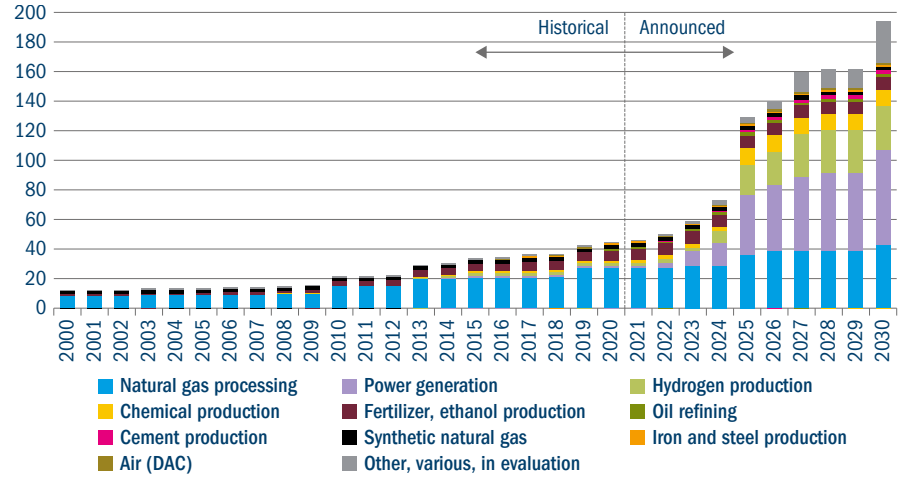
Source: BloombergNEF, CCS Market outlook, 2021

How can investors play this theme?

Corporate exposure to this market comes in a variety of forms. Companies that own and operate CCS assets, for example, are pure players that are mostly private as it stands but increasingly attract external funding. Companies that sell CCS equipment and services, such as oil and gas majors as well as energy services that are important enablers of this market, and companies that will be users of CCS to reduce their emissions and/or as an input to industrial processes, such as industrial gas companies as well as key industry groups in which CCS strategies will play an increasingly important role, will help drive demand for this market.

With the need to reduce global emissions becoming ever-more urgent, and the policy support and economics increasingly improving, the adoption of CCS technologies is poised to be a huge growth area over the next decade.

Figure 3: Global capacity installed by point source, historical and announced



Source: BloombergNEF, CCS Market Outlook, 2021

Climate transition engagement: CCS technologies

Company

Sector and country

Energy, US

Why we engaged

As part of our thematic engagement on the back of our research into carbon capture and storage (CCS), we engaged with OXY to better understand the technologies and associated economics that will drive its net zero strategy.

How we engaged

The engagement was led by Fixed Income and Equity analysts, in addition to an RI analyst, and took the form of a video conference call with OXY's Deputy Counsel, an executive from the Environmental and Sustainability Group, and a representative from investor relations.

What we learnt

OXY considers the achievement of net zero a strategic priority. The economics of its plan will require further and ongoing consideration, but could prove to be attractive under reasonable carbon price/incentive scenarios. Furthermore, OXY appears uniquely positioned in terms of its ability to employ direct air capture (DAC) and carbon capture, utilisation and storage (CCUS) strategies, which will form a key component in helping to decarbonise several hard-to-abate sectors.

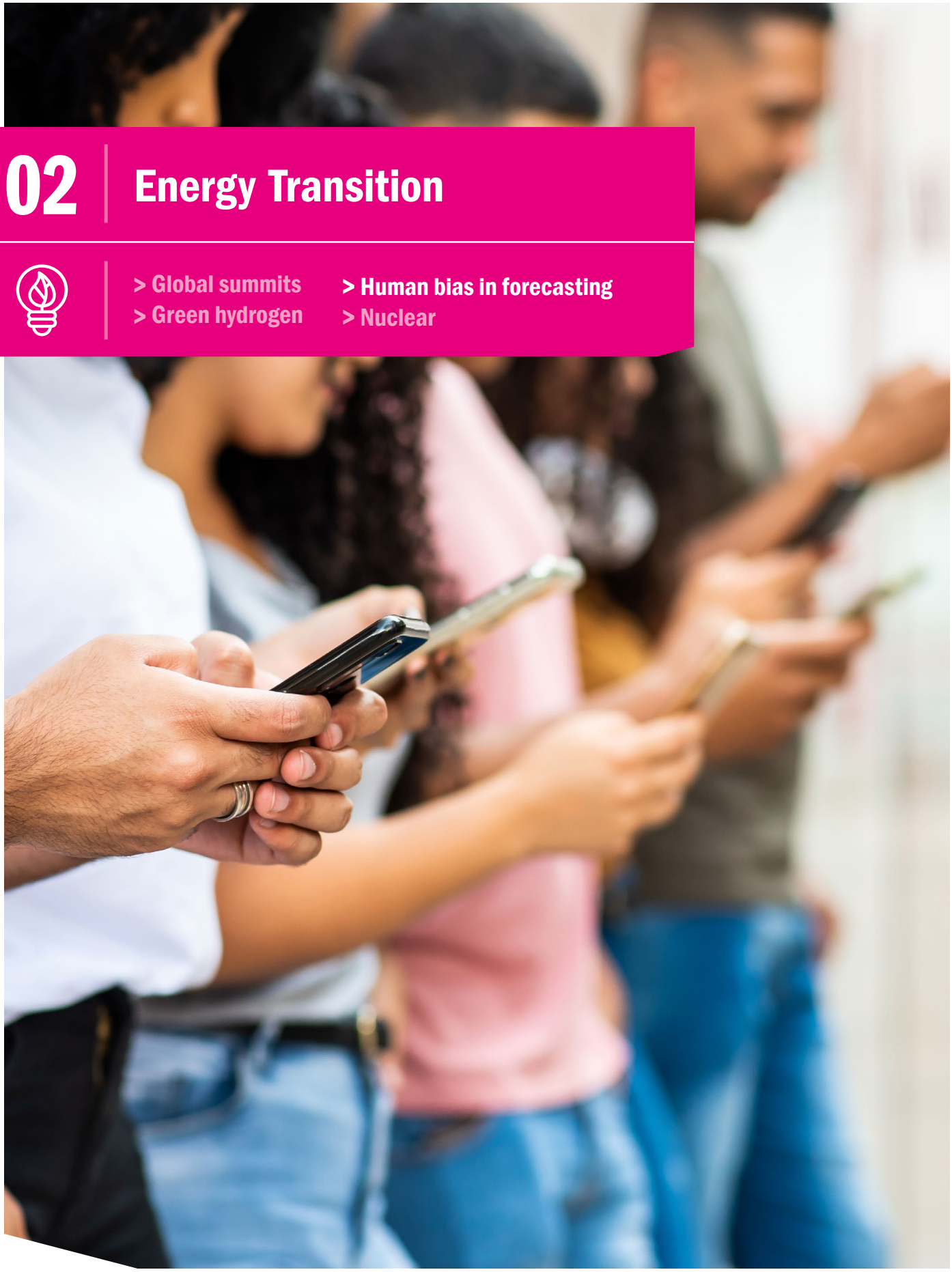
Outcome

The meeting gave us a better insight and understanding of the economics of DAC projects and the role of this technology for OXY's net zero plans. The meeting also enabled us to emphasise the increasing importance of environmental, social and governance (ESG) disclosure, encourage the adoption of more granular targets and highlight the growing scrutiny that carbon-intensive sectors will face going forward.

1 Net Zero Tracker, 2022
2 IPCC Sixth Assessment, April 2022
3 Science based targets, The Net-Zero Standard, as at August 2022
4 IEA, Energy Technology Perspectives - the worlds guidebook on clean energy technologies, as at August 2022
5 IEA, Net zero by 2050, 2021
6 Morgan Stanley, Carbon Capture: a hidden opportunity, 2021
7 Goldman Sachs, Green Capex, 2021

02 Energy Transition

> Global summits
> Green hydrogen
> **Human bias in forecasting**
> Nuclear

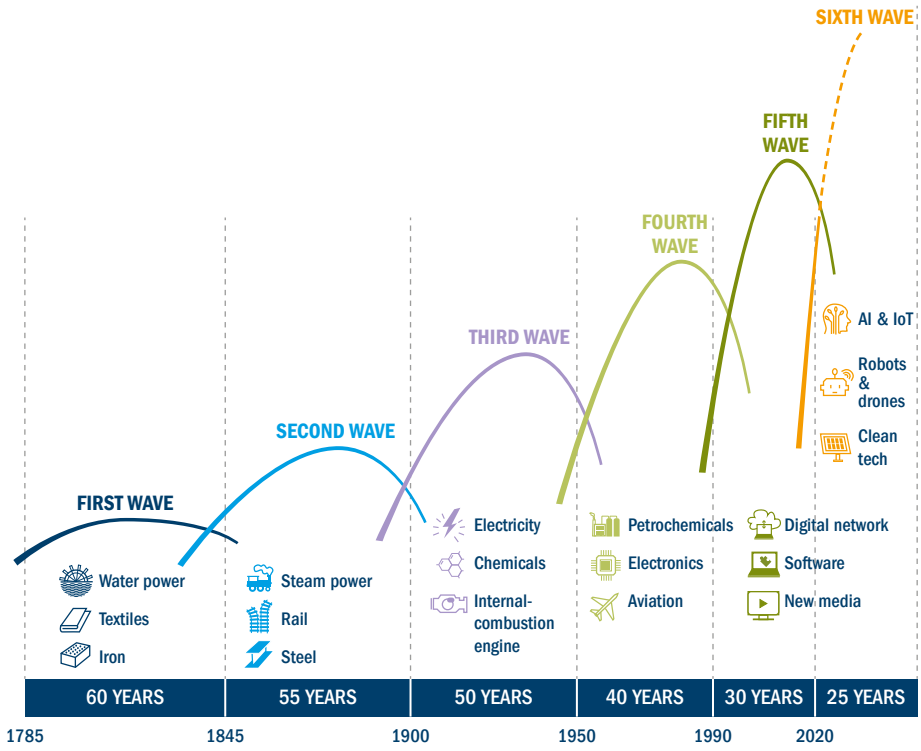


The exponential problems of predicting the future

Jess Williams
Senior Thematic Investment Analyst, Responsible Investment

Ben Kelly
Senior Portfolio ESG and Impact Analyst

Figure 1: Waves of technological change



Source: Visual catalyst and Edison Institute, 2021

Technological change is an area in which individuals have consistently underappreciated pace. Through the decades our ability to adopt/consume technology has increased significantly (Figure 1). However, as humans, we regularly fail to appreciate this fact and as such disruptive technologies are often initially overlooked.

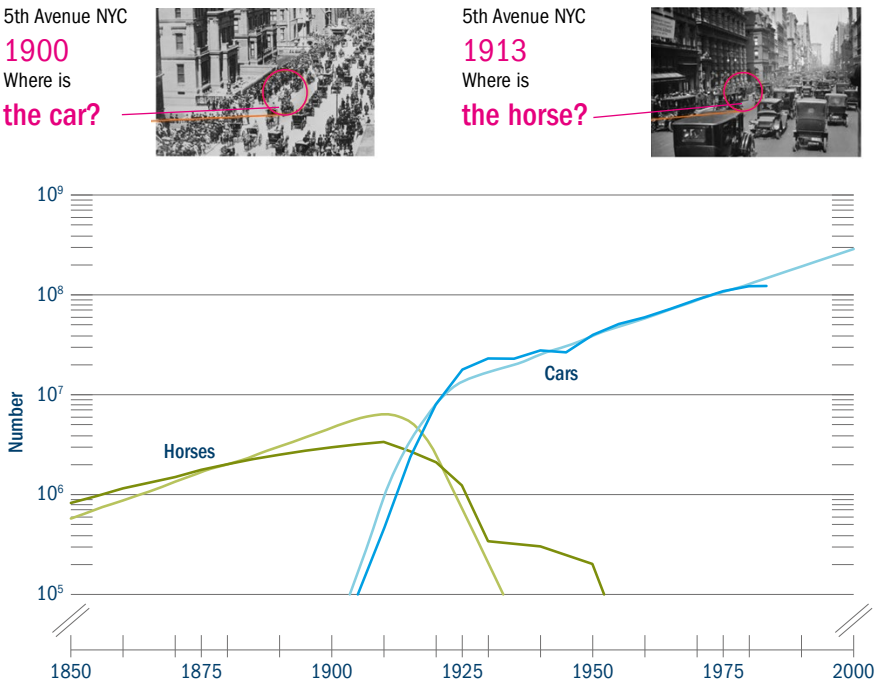
A famous example of the underappreciation of the pace of technological change is telecommunication firm AT&T asking McKinsey in the 1980s to forecast mobile phone adoption in the US in 2000. At the time handsets were clunky, calls were filled with static, data services were non existent and coverage was patchy – yet it was already becoming clear that mobile technology had practical benefits. McKinsey ultimately concluded there would be 900,000 mobile phone users

in the US in 2020; the actual figure was just over 100,000,000. McKinsey had failed to account for the significant cost reductions in the core components of handsets coupled with the growing capabilities of networks such as the introduction of data services. Thus, a £3,000 phone in 1984 became a £200 handset in 2000.[1]

A key tenet of human behaviour is the systematic tendency to incorporate heuristics, for example rule of thumb, into decision making and/or the construction of narratives. However, this can often be inherently limiting. For example, one of the most pervasive biases in human decision making is anchoring, whereby individuals confronted with figures have a systematic tendency to fix upon some available reference point, adjust their responses around it and provide a linear extrapolation to arrive at their projection.

Forecasting is one such discipline where the anchoring bias is particularly prevalent but overcoming it is challenging. In the short term a forecaster may get lucky and be correct as an exponential curve at this point is closer to being linear, but as time moves on the divergence of the exponential effect increases and the forecast becomes less and less accurate. Successful forecasters tend to unshackle themselves from the anchoring bias and are able to consider the future in a nonlinear manner.

Figure 2: How New York became a one-horse town

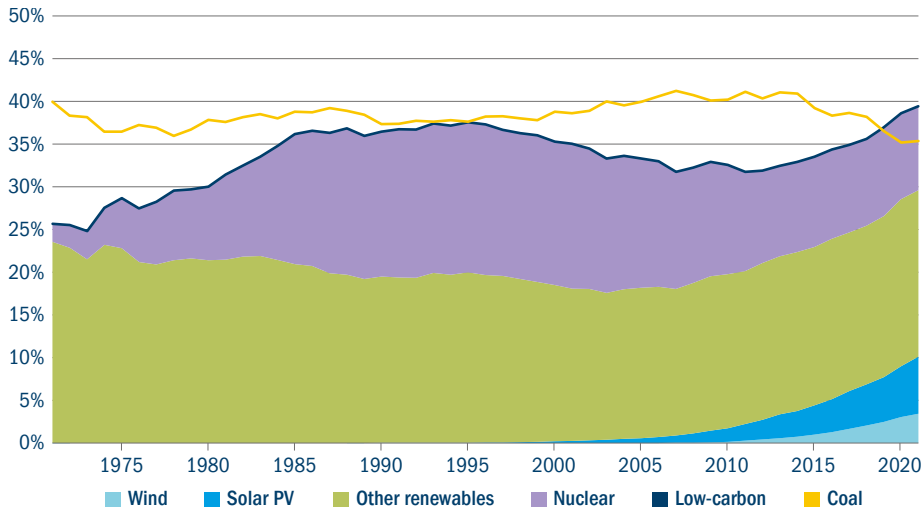


Source: An age structured demographic theory of technological change, Jean-Francois Mercure, 2013

History is littered with examples of forecasters failing to do this and with hindsight it is easy to mock. However we are living through a period where the social and environmental risks to the global economy have arguably never been higher and this is likely to drive technological progression at an unprecedented level, thus providing significant investment opportunity for those able to ride the wave. On the other hand, there will likely be financial consequences for those who fail to anticipate the rapid rates of adoption of some of these technologies.

In 1890 there were 13,800 companies in the US in the business of building carriages pulled by horses. And in 1900 in New York alone there were 6,000 horses hauling New York trolleys – more

Figure 3: Share of low-carbon sources and coal in world electricity generation



Source: IEA 2021

than in all US cities combined. But just 17 years later the horse-pulled trolley took its last trip, and by 1920 only 90 carriage building companies remained[2]. This disruption was driven by the exponential rise of the automobile shown in Figure 2.

In 1903, the year Henry Ford founded Ford Motor Company, 11,235 automobiles were sold to Americans. Just a decade later Ford flipped the switch on the first assembly line, cutting the time it took to build a car from 12 hours to 2.5 hours. That year the number of cars produced in the US mushroomed to 3.6 million – a 300-fold increase. By 1923 the country was producing 20 million automobiles a year.[3]

The next rapid transition?

Climate change is impacting decisions at all levels of the global economy, ranging from governments through to corporates and individuals. A key driver in the world's decarbonisation plans is renewable energy and specifically the ability for swathes of the economy to increasingly run off variable renewable energy sources such as wind and solar energy. Today, all forms of renewable energy (including hydropower and nuclear) account for just under 40% of total electricity produced globally (Figure 3). This has been driven by an exponential reduction in renewable energy costs which have come about initially through policy support and a necessity for emissions reductions.

However, the snowball effect and magnitude of this increase in renewables was not anticipated. In fact, the International Energy Agency (IEA) has systematically underestimated the amount of electricity generated by solar power in the past 20 years (Figure 4). In 2009 it predicted that by 2015 there would be 5GW of solar power installed globally. In fact, the actual figure for 2009 itself eventually turned out to be 8GW. In 2010 the forecast for 2015 was upgraded to 8GW, and in 2011 to 11GW. In 2012 the IEA further revised its prediction for 2015, this time to 24GW, and in 2014 the forecast for 2015 was for 35GW of solar capacity. In the end the actual capacity installed by 2015 was 56GW. This trend of underestimating continued, and by 2019 the annual growth forecast for 2020 was off by 100%.

This demonstrates two characteristics (and biases) about human behaviour.

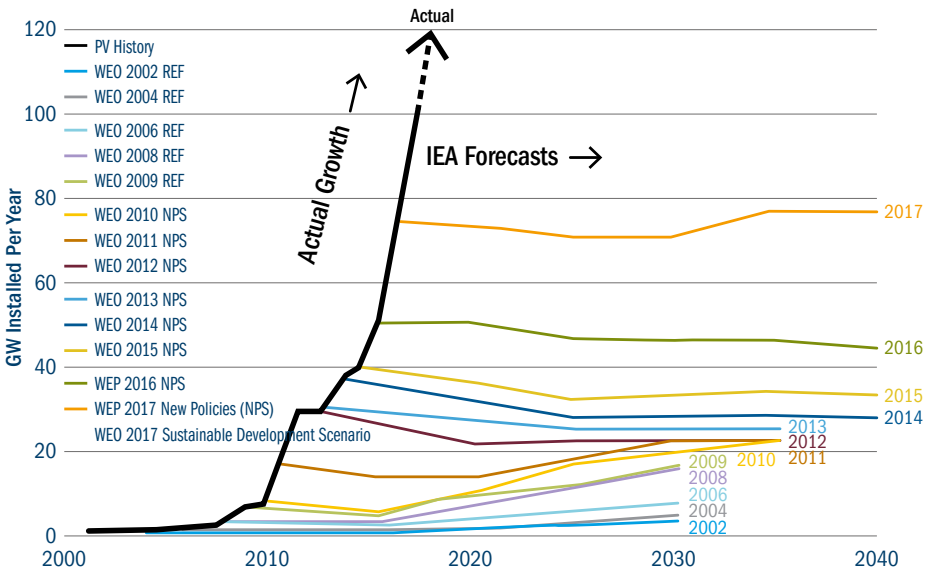
1. Changing our initial belief is emotionally challenging (Confirmatory Bias)

2. We struggle to forecast exponentially (Anchoring)

These biases can influence policy and investment decisions by overestimating the costs of the energy transition and underappreciating the potential for disruptive non-linear change. Models that often inform policy decisions are regularly based on assumptions that fail to capture the exponential nature of technology change. The IEA forecasts are a perfect example of this.

Other relationships such as feedback loops are poorly incorporated into most models. Doctor Matthew Ives from the University of Oxford gives the example of electric vehicles (EVs), whereby the uptake of EVs drives the demand of additional electricity which in turn furthers the experience curves of renewable generation, which in turn drives cost declines for renewable energy as well as reducing operational costs for EVs – further accelerating EV uptake[4]. Examples of this include Daimler, which forecast 2021 sales for new EVs to be 2x 2020, but the first half (H) year results of 2021 actually showed them at 4x; and Mercedes, which expected it would almost double its EV share in 2021 from 7% to around 13% – however EV sales more than quadrupled in H1 2021 alone to a share in excess of 10%[5].

Figure 4: IEA new solar additions per year, forecast versus actual



Source: Visual Capitalist/IEA 2019

Cost parity between internal combustion engine (ICE) vehicles and EVs is likely to occur around 2024-26[6], which could well prove to be a tipping point for further acceleration. Other tipping points could be related to overcoming range anxiety and concerns around secondary market resale value. Resale value concerns apply to both EVs and ICEs: for the former, while the technology is still new and a small share of the market, resale value is less certain at the point of purchase; and for the latter resale value uncertainty increases as governments introduce low emissions zones which make ICE operating costs higher relative to EVs. These non-cost-related drivers make forecasting even more difficult as they have the potential to accelerate exponential uptake.

Wright's Law

In contrast to large energy models, there are already empirical models that can more accurately predict the cost declines associated with new technologies. One example is Wright's Law which shows that cumulative production creates a consistent decline in costs – i.e. the more we deploy the more we learn. Hence cost-decline graphs are often referred to as "learning curves". A US aeronautical engineer named Paul Theodore Wright observed this relationship while making planes in world war two (WW2)[7].

In 2016 academics J Doyne Farmer and Francois Lafond applied Wright's Law and the similar Moore's Law to multiple technologies and found that they enhanced forecast accuracy across many of them[8]. For solar photovoltaics, Wright's Law has accurately predicted cost declines since 2016, even with recent polysilicon price increases (Figure 5).

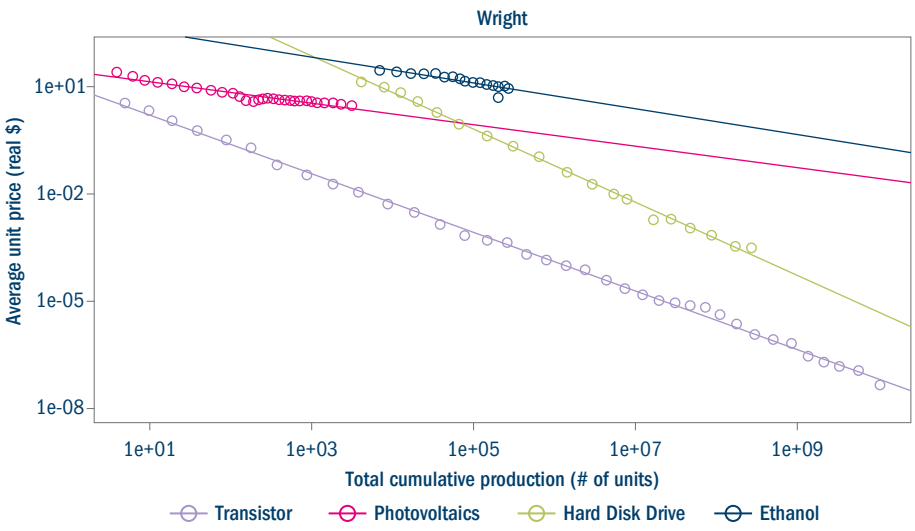
Using this research, Doctor Ives and his team found through using Wright's Law that renewable energy has the potential to disrupt the current energy system. This exponential growth starts from a relatively small base today but from 2025 starts to have a significant and non-linear effect (Figure 6).

This scenario sees an 80% emissions reduction by 2040, without the need to deploy carbon capture and storage technologies (in contrast to the IEA scenarios). Furthermore, it is based purely on technology economics and does not factor in any benefits from climate change mitigation.

Technology leap frogs

Partially as a result of such learning curves we have seen instances of "technology leapfrogging", whereby developing markets can skip the adoption of a precursor technology. Two notable examples are telecoms and banking in emerging markets (EMs), where the widespread use of landlines has been bypassed and countries have leapfrogged straight from having no phones to using mobile phones; and in banking where certain countries have leapfrogged large traditional banking branch networks and moved straight to digital banking in the first instance.

Figure 5: Wright's Law applied to different technologies



Source: Farmer and Lafond, 2016. The graph shows how the average price decreases as the total number of units produced increases. Both axis use a log scale.

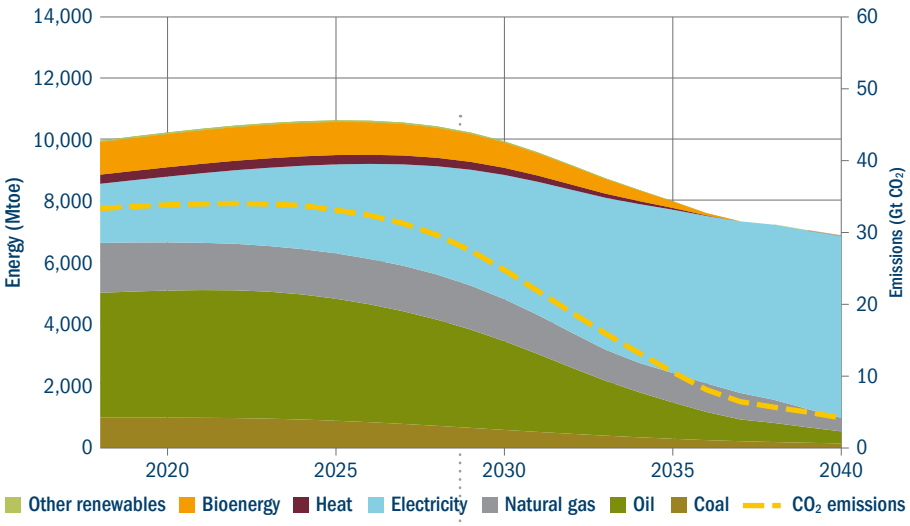
It is likely this phenomenon will occur to some extent with the energy transition. As renewable technologies become increasingly competitive, they will likely serve some of the demand that would otherwise have been met with fossil sources. In emerging market regions new demand is being met by leapfrogging straight to renewables. Indeed, according to independent think tank Carbon Tracker, in 2019 87% of the growth in electricity supply came from non-fossil sources in emerging markets ex-China[9].

Overcoming anchoring and conditions for exponential growth

A critical question is why certain technologies grow exponentially and how these areas can be identified. Exponential growth is driven by the convergence of new technologies which trigger causal feedback loops within and across markets and sectors. Historically, these loops interact with and amplify one another, accelerating the adoption of new technology in a virtuous cycle while accelerating the abandonment of old technology in a vicious cycle. The relationship between EVs and renewable energy highlighted above has the potential to be one such example.

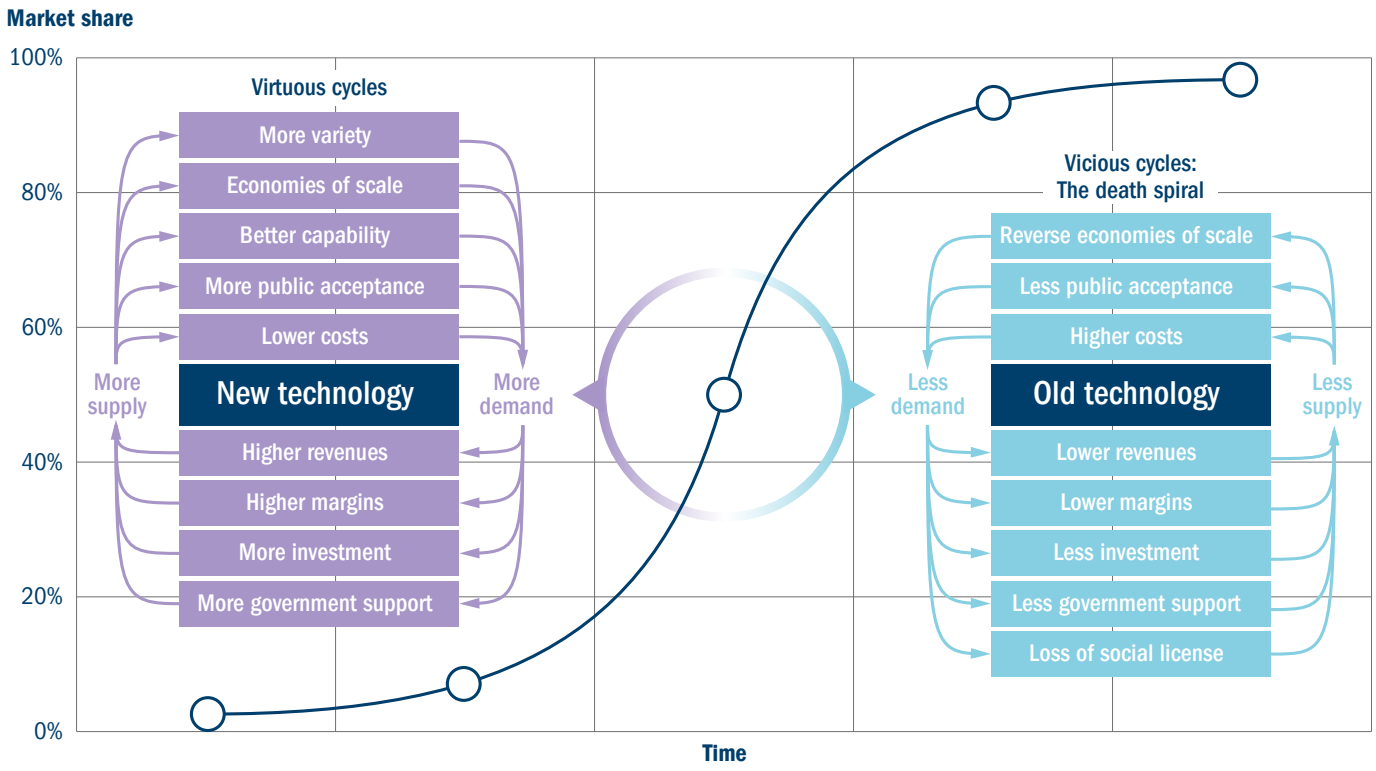
As a guide, Figure 7 serves as a high-level framework to consider new technology and whether it can achieve exponential status.

Figure 6: Global energy mix forecast using Wright's Law to predict renewable energy cost declines



Source: Farmer and Lafond, 2016. The graph shows how the average price decreases as the total number of units produced increases. Both axis use a log scale.

Figure 7: Virtuous and vicious cycles



Source: Rethink Disruption 2022

In summary

The behavioural biases discussed in this article go some way to explaining why industry and analyst predictions of the cost and capacity required for decarbonising the global economy have been regularly beaten by real-life progress. When the Paris Agreement was signed in 2015, the IEA thought the cost of solar would still be higher than fossil electricity in 2040, and it anticipated a total installed capacity of 360GW of solar by 2020. Both of these predictions have been blown out of the water: by 2020 90% of new electricity generation was cheaper from renewables than from fossil fuels, and 710GW of solar had been deployed – almost double the 2015 estimate[10].

Using the research of Dr Ives, Lafond, Farmer and others it is possible to start to look at more disruptive models and scenarios which, in our opinion, will be essential as the world moves along its bumpy road to net zero emissions.

> That's the thing about exponential growth, it doesn't do much for a long time and then it comes and smacks you in the face.
>
> *Dr Matthew Ives, 2022*

1 The Economist, Cutting the cord, October 1999
2 Microsoft Today in Technology, The day the horse lost its job, Brad Smith and Carol Ann Browne, as at August 2022
3 Microsoft Today in Technology, The day the horse lost its job, Brad Smith and Carol Ann Browne, as at August 2022
4 Daimler, Q2 quarterly report, 2021 and Mercedes, Q2 quarterly report, 2021
5 BNEF, 2021
6 Bloomberg NEF, May 2021
7 Wikipedia, Experience curve effects, as at August 2022
8 ScienceDirect, How predictable is technological progress?, J.Doyne Farmer and Francois Lafond, April 2016
9 Carbon Tracker, 2020
10 BNEF, Carbon Tracker, IEA, 2021

Energy transition engagement: Green hydrogen

Company

centrica

Sector and country

Energy, UK

Why we engaged

The company is in the process of updating its climate transition plan, with the aim to get to net zero by 2045, and for its customers to be net zero by 2050. This will include improving the number of smart meter customers, increases in the installation of EV charge points and heat pumps, and investing £100 million in low carbon and transition assets each year. We were interested in the role of green hydrogen in this process.

How we engaged

The company hosted an investor webinar.

What we learnt

The meeting enabled us to ask questions on the role of hydrogen in the domestic heating sector. Many experts are becoming sceptical around hydrogen's role in this area. One reason being that heat pumps are about six times more efficient than green hydrogen. It was good to see that Centrica is balancing its efforts between heat pumps and green hydrogen, and the company believes the hydrogen value chain will evolve, with green hydrogen initially used in industry but expanding into domestic use. The UK is likely to be a test case for domestic hydrogen heating due to the development of hydrogen hubs and an abundance of very inefficient housing stock that could be better suited to hydrogen than heat pumps.

Outcome

We will continue to monitor developments at the company and within this field. Centrica's leadership on energy transition and its role in the UK energy system provide a significant learning opportunity for us and the market more generally.

03 Food & Materials Transition

> **Biodiversity**
> Plastics circularity
> Alternative proteins
> Food security

Nature and biodiversity loss: how is it relevant to portfolios?

Olivia Watson
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Definitions:

Biodiversity is the "variability of life on earth"

- Genetic diversity (within species)
- Species diversity (across species)
- Ecosystem diversity

"Nature" includes biodiversity as well as the physical world and biogeochemical cycles, upon which biodiversity depends

Source: Convention on Biological Diversity

Nature, and the resources and services it provides, underpins the economy and sustains life on earth. Yet indicators on the health of ecosystems are heading in the wrong direction, according to the Intergovernmental Panel on Biodiversity and Ecosystem Services (see box).

As awareness of the repercussions of these trends grows, stakeholders are coalescing around a global goal to halt and reverse nature loss by 2030, and to regenerate it in the longer term. This is shaping the direction of regulation.

As this theme evolves we see four mechanisms by which it can translate to risks and opportunities for investors:

1. Companies causing negative impacts on nature will face increased risks and costs
2. Companies' operations and supply chains are at increasing risk of disruption
3. Increased systemic and sovereign risks
4. Shifting financial flows and new investment opportunities

We will assess each of these to identify impacts for companies and portfolios.

Nature is in decline globally

75% of earth's land area has been significantly degraded

85% of wetland areas have been lost

25% of assessed species are threatened

50% of coral reefs have died or been destroyed

20% decline in abundance of native species

Source: IPBES Assessment, 2019

1. Companies causing negative impacts on nature

Pressure is increasing to reduce and reverse damage to nature through tighter regulations of harmful practices, increased oversight of supply chains, taxes on polluting activities, and increased litigation. Examples of this can be seen in the EU Farm to Fork strategy[1] cutting use of harmful pesticides and fertilizers by 2030; negotiations on a global treaty on plastic pollution; and expanded due diligence requirements for products linked to deforestation.

Failure to manage these risks could result in increased operating costs, lower revenues, loss of access to markets, and increased costs of capital. Companies that have traceable supply chains, use resources more efficiently, and innovate to provide lower-impact products, however, could see greater opportunities.

Using the five drivers of nature loss identified by Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), which can each be linked to a range of company activities and impacts, provides a framework to identify material risks among businesses and in portfolios (Figure 1).

Company disclosures across many of these issues are mixed, but external initiatives provide valuable inputs – for instance, deforestation data from Forests 500 and CDP Forests; plastics data from the Ellen MacArthur Foundation; chemicals data from ChemSec; wastewater quality data from regulatory agencies and CDP Water; and a range of data from the World Benchmarking Alliance.

2. Disruption to companies' operations and supply chains

Risks will arise not only where companies impact nature, but also where they depend upon it. The resources and services that nature provides, such as water availability, healthy soils or pollination, will become increasingly disrupted If current trends continue. This could result in price volatility, operational and supply disruption, and stranded assets. However, companies that are evaluating risks in their supply chain and seeking to improve resilience of the resources on which they depend may be less vulnerable.

The ENCORE tool (Exploring Natural Capital Opportunities, Risks and Exposure) developed by the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) provides an evidence-based assessment of the vulnerability of economic activities to disruption (Figure 2).

In addition, the use of mapping data on the degradation of ecosystem services can further highlight possible hotspots of higher risk related to these activities.

3. Increased systemic and sovereign risk

Nature-related risks will also flow through the wider economy via impacts on inflation, GDP, disruption to trade and social unrest. The World Economic Forum estimates that 55% of global GDP is dependent on high-functioning biodiversity and ecosystem services[2], highlighting the scale of the issue, while the UK Treasury's Dasgupta Review in 2021 argued that the entire economy is "embedded within" nature.[3]

Financial institutions will face risks. Studies from the Dutch and French central banks estimate that between 36% and 42% of their financial institutions' portfolios are comprised of assets that are highly dependent on nature.[4] Similarly, a World Bank study of Brazilian banks found that 20% of credit portfolios were highly dependent on nature.[5]

The potential for negative feedback loops between nature and climate change is another concern. Forests, soil and the ocean all store carbon, but climate change may reduce their ability to do so, increasing net emissions and limiting the potential of nature-based solutions. Climate change can also reduce the resilience of ecosystems, for example by changing the suitability of habitat, reducing water availability or changing weather patterns. Severe tail-risk events such as reduced rainfall in the Amazon, which would have major consequences for regional economies and food systems, might also become more likely.

Economies which appear to be at potentially higher risk due to the nature-dependence of their GDP and negative indicators of ecosystem health include South Africa, India, Turkey, Mexico, Brazil and Argentina.[6]

Figure 1: Company contributions to nature loss

5 Drivers of nature loss, and their impacts:

	Drivers	Sector relevance	Potential risks	Investment opportunities
Ecosystem change	Harm to protected areas or resources directly or through suppliers (e.g., impacts from farming)	Food & beverage, agriculture oil & gas, mining, utilities, renewables, transports, construction, real estate, financials	Supply disruption, operational disruption, increased cost of capital, stranded assets, reputational and litigation risk	Alternative proteins, precision agriculture, synthetic biology, sustainable/alternative textiles, lower impact mining
Invasive species	Introduction of invasive species via transport	Transport/shipping, tourism	Supply disruption, operational disruption	Water filtration, DNA monitoring technology
Pollution	Pesticides, nitrogen fertilizer, plastics and microplastics, wastewater, air emissions	Food & beverage, agriculture, chemicals, water utilities, manufacturing, heavy industry, packaging, financials	Increased taxes or restrictions on sales of chemicals, pesticides or fertilizers, Fines, taxes and/or capex to mitigate pollution	Bio-based chemicals, chemical clean up, synthetic biology, recycling technologies, alternative fertilizers and pesticides, wastewater treatment, air pollution reduction technologies
Climate change	Greenhouse gas emissions	Emissions intensive sectors and those with product and supply chain emissions	Supply chain disruption, operational disruption, physical asset risk, human capital & health care costs	Renewable energy providers and their supply chain, electric vehicles, building technology and energy efficiency providers
Exploitation of resources	Over-fishing, timber-mismanagement, degradation of land and soils, overuse of water	Food & beverage, agriculture, apparel, forestry, technology, financials	Increased costs for resource use/access, changes to subsidy and incentive structures, demand shifts for products	Blockchain and related technologies for supply chain transparency

Source: Columbia Threadneedle Investments 2022

4. Financial flows and investment opportunities

As all of these factors evolve we expect to see lower willingness to invest in companies linked to harmful activities; increased investment in real assets and new types of assets such as forestry, sustainable agriculture, nature-based solutions and blue bonds; and new investment opportunities in technologies that can help reduce impacts on nature.

Avoiding harm and finding new opportunities

Europe's 2021 Sustainable Finance Disclosure Regulations (SFDR) are already leading to greater scrutiny of companies' track records and involvement in nature-related impacts and controversies. Increasing numbers of investors are also adopting exclusions related to nature – for instance at COP26 global investors pledged to eliminate deforestation from portfolios by 2030. This trend is likely to continue.

The next phase of the EU Taxonomy may steer investment towards companies that positively impact biodiversity. However, we think the draft criteria are narrowly defined, potentially leading to only a sliver of companies being able to evidence eligibility. More positively, we believe the development of this theme will support long-term investment opportunities in technologies that can increase productivity in the use of resources (Figure 1).

Figure 2: The disruption of products and services

Products and services	Economic processes 'highly' or 'extremely' vulnerable to disruption
Water quality and availability	■ Alcoholic fermentation and distilling ■ Tobacco production ■ Water treatment and distribution ■ Agriculture and forestry ■ Cotton, paper, natural fibre production ■ Construction materials production
Soil quality **Pollination** **Forests** **Fibres**	■ Agriculture and forestry ■ Livestock (leather) ■ Construction materials production ■ Tobacco production
Coastal protection **Erosion control** **Local climate regulation**	■ Power transmission and distribution ■ Transport networks ■ Oil and gas and renewables

Source: ENCORE/UNEP FI/UNEP WCMC/Global Canopy

Conclusion

Nature and biodiversity loss is a complex and fast-evolving theme. Economic conditions in 2022 may prove a hiccup in efforts to reduce nature loss, but over time the scale of the risks will increase pressure to reduce impacts and to remedy damage. Milestones such as the UN's COP15 negotiations on a global biodiversity agreement, related regulatory proposals and initiatives such as the Taskforce for Nature-related Financial Disclosures will give an indication of the pace of evolution, and will remain a focus in our research and engagement.

Food & Materials transition engagement: Biodiversity and deforestation

Company

Sector and country

Retail, USA

Why we engaged

We wanted to better understand Home Depot's sourcing commitments and encourage their further development.

How we engaged

Video call with VP of Sustainability and several portfolio managers.

What we learnt

The company's disclosure is lacking in detail, but it does have granular information on the origin and certification status of its wood products, which it will disclose. The company has also committed to respond to the CDP Forests questionnaire. Home Depot's wood sourcing policy will be expanded to a wider range of at-risk forest regions – including those where it does not source - to avoid ambiguity. Sourcing of slower growing timber used in building materials, such as spruce and hard pine, poses a barrier to Home Depot adopting more comprehensive commitments on deforestation and forest degradation.

Outcome

Management heard our views on the need for continuous improvement in policies and disclosure on wood sourcing. We will review its progress and updated disclosures next year. Its policies on deforestation will rightfully remain a focus, given growing biodiversity and climate risks. The discussion highlighted the need to balance progress on company commitments with ensuring they are meaningful, achievable and avoid unintended consequences.

1 European Commission, Farm to fork strategy, as at August 2022
2 Today's Environmentalist, A fifth of countries worldwide at risk from ecosystem collapse, as at August 2022
3 Gov.uk, Final Report - The Economics of Biodiversity: The Dasgupta Review, HM Treasury, August 2021
4 Banque De France, Eco Notepad, Post n°248 Biodiversity loss and financial stability, Mathilde Salin et al, May 2022
5 Open knowledge repository, Nature-Related Financial Risks in Brazil, Pietro Calice, Frederico Diaz Kalan, Faruk Miguel, August 2018
6 Swiss Re Institute, 2020

Food & Materials transition engagement: Biodiversity impacts and risk management

Company

Sector and country

Financials, France

Why we engaged

Biodiversity is an emerging area where impacts and risk can be difficult to quantify. We wanted to understand the approach taken by AXA, one of the more proactive insurers on this theme.

How we engaged

Video call with Group Chief Corporate Responsibility Officer.

What we learnt

At group level, biodiversity is being integrated as an extension of AXA's climate approach and strategy; it sees biodiversity as an eventual part of its regulatory framework, as with climate risk. There is some integration of biodiversity issues to products – for instance innovation in parametric insurance, and inclusion of provisions in environmental liability insurance to prevent biodiversity risk. Within asset management AXA is working with Iceberg Data Labs to measure biodiversity impacts and is focused on reducing impacts to forests and the ocean, via engagement and exclusions.

Outcome

While early stage, AXA appears to be taking a holistic approach to biodiversity, identifying both risks and opportunities and linking biodiversity to wider themes including climate change and health, across different parts of the business. This provides reassurance on biodiversity risk management and is a useful comparison for other insurers.

Food & Materials transition engagement: Biodiversity and deforestation

Company

RICHEMONT

Sector and country

Consumer discretionary, Switzerland

Why we engaged

Richemont has an increasing proportion of revenue derived from leather goods following the acquisition of the Delvaux business. We wanted to understand the company's approach to leather-related deforestation risk, considering pending EU regulation.

How we engaged

Video call with Group Corporate Communications and IR Director.

What we learnt

Biodiversity- and nature-related risks are among the priorities of the company's newly appointed Chief Sustainability Officer, with a strategy and roadmap due in 2023. On leather sourcing, at present 60% of animal hides are derived from Europe, and 71% from tanneries certified by the Leather Working Group. The company is transferring the remainder of sourcing to Europe by 2024 for Group businesses ex-Delvaux. This is for several reasons, including deforestation, improving traceability for animal welfare standards, and as part of the efforts to reduce the GHG footprint as part of the net zero goal. The approach for Delvaux has not yet been outlined but is a focus area.

Outcome

We were reassured by the company's evolving approach to sustainability, particularly the appointment of the CSO and the evidence of the thoughtful and well-integrated approach, including on leather sourcing. We will follow up with the company on the establishment of their biodiversity roadmap and sourcing for Delvaux.

Stewardship in action

Our stewardship activities are integral to our investment process, helping us to detect inflection points and long-term trends, and influence companies' standards around ESG risk management and sustainable outcomes. A key focus our investment research so that we can make informed capital allocation decisions as active investors.

The ultimate goal of our stewardship approach is to enhance our understanding of risks and opportunities, strengthening our ability to deliver sustainable long-term value for clients. In approaching these responsibilities we are mindful of market trends; company, local market and industry-specific issues; and relevant best-practice standards – but we will ultimately be guided by what we consider is in the best long-term economic interests of our clients.

The research and analysis emerging from this, and the ongoing engagement with companies, is disseminated globally throughout the firm as part of our culture of research intensity and helps us identify potential issues at an early stage.

In prioritising our engagement work, we focus our efforts on the more financially material or contentious issues and themes, and the issuers in which we have large holdings. There are many companies with which we have ongoing engagements, as well as a number that we speak to on a more ad hoc basis, as concerns or issues arise. We vote actively at company meetings.

We view this as one of the most effective ways to signal approval (or otherwise) of a company's governance, management, board and strategy, or standards of operating practice. While analysing meeting agendas and is making voting decisions, we use a range of research sources and consider various ESG issues, including companies' risk management practices and evidence of any controversies.

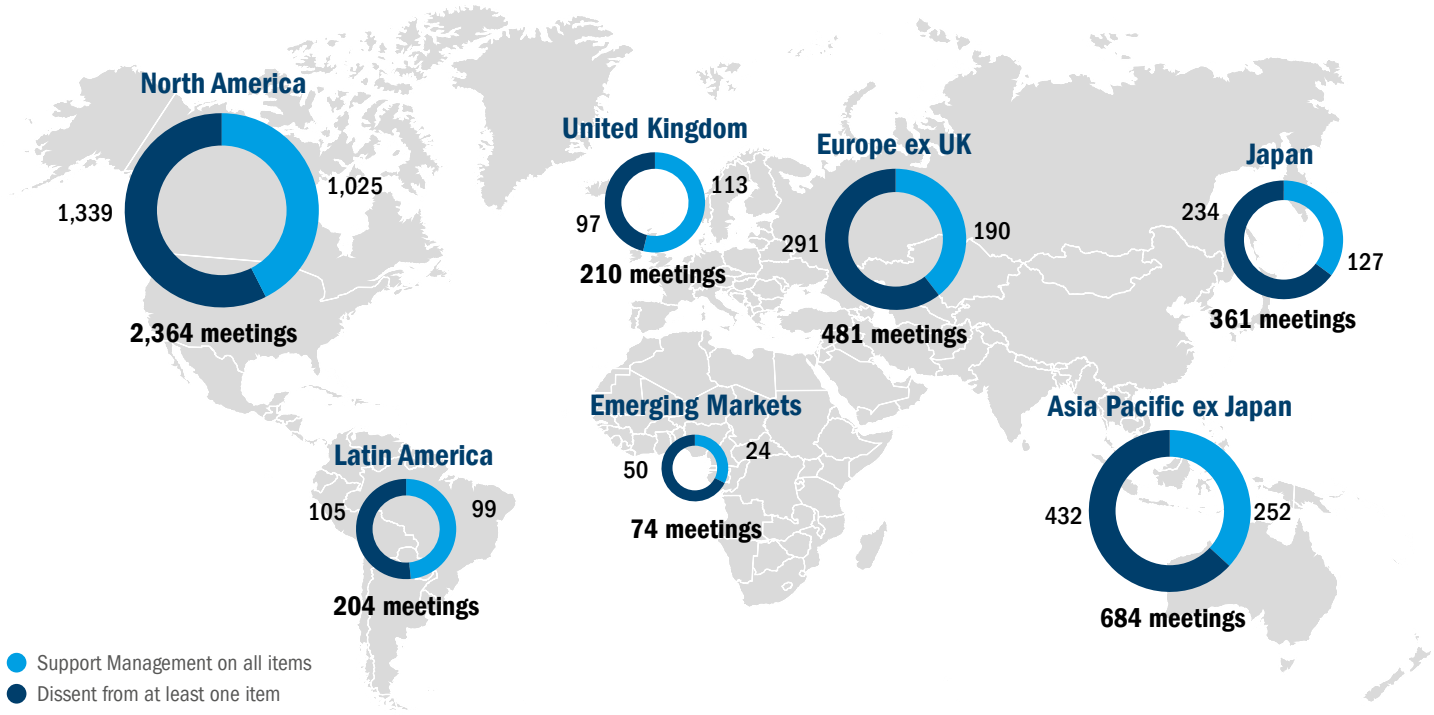
Our final voting decisions take account of research issued by proxy advisory organisations such as ISS, IVIS and Glass Lewis, as well as MSCI ESG Research. Although we subscribe to proxy advisors' research, votes are determined under our own custom voting policy. Within this, material or controversial proposals receive enhanced due diligence and are voted on by the investment team, with support from the RI team. Votes are cast identically across all mandates for which we have voting authority. All our voting decisions are available for inspection on our website seven days after each company meeting in EMEA/APAC, and are updated annually in September in the US.

Voting Q2

Between April and June 2022, we voted at 4,378 meetings across 60 global markets. This compares to 585 meetings voted across 43 global markets in the last quarter. Of the 4,378 meetings, 3,909 were annual general meetings, 270 special, 171 combined annual/special, 14 proxy contest meetings, 11 court, 2 bondholder and 1 written consent. We cast at least one dissenting vote in 2,548 meetings (58%).

We voted in 60 separate markets in the second quarter. Most meetings were voted in the United States (2,256), followed by Japan (361), United Kingdom (190) and Brazil (131). The majority of the voting items that we did not support throughout the quarter continue to be related to directors (63%), remuneration (15%) and capitalisation (9%), followed by other business-related proposals (4%).

Figure 1: Meetings voted by region



Source: Columbia Threadneedle Investments, ISS ProxyExchange, 30 June 2022.

Engagement highlights

Between April and June 2022 we conducted ESG-focused engagements with 40 issuers, some on multiple occasions. Meetings with a sustainability focus concern the impact of a company's products and services, while meetings with an ESG focus concern how well companies manage their internal non-financial risks.

Environmental

JBS SA
Aviva plc
Bayer
Chevron Corporation
Dow Inc.
Hershey
KBR inc.
Valero Energy Corporation

ESG

Centene Corporation
Hotel Chocolat Group plc
Marathon Petroleum Corporation
Rio Tinto plc

Governance

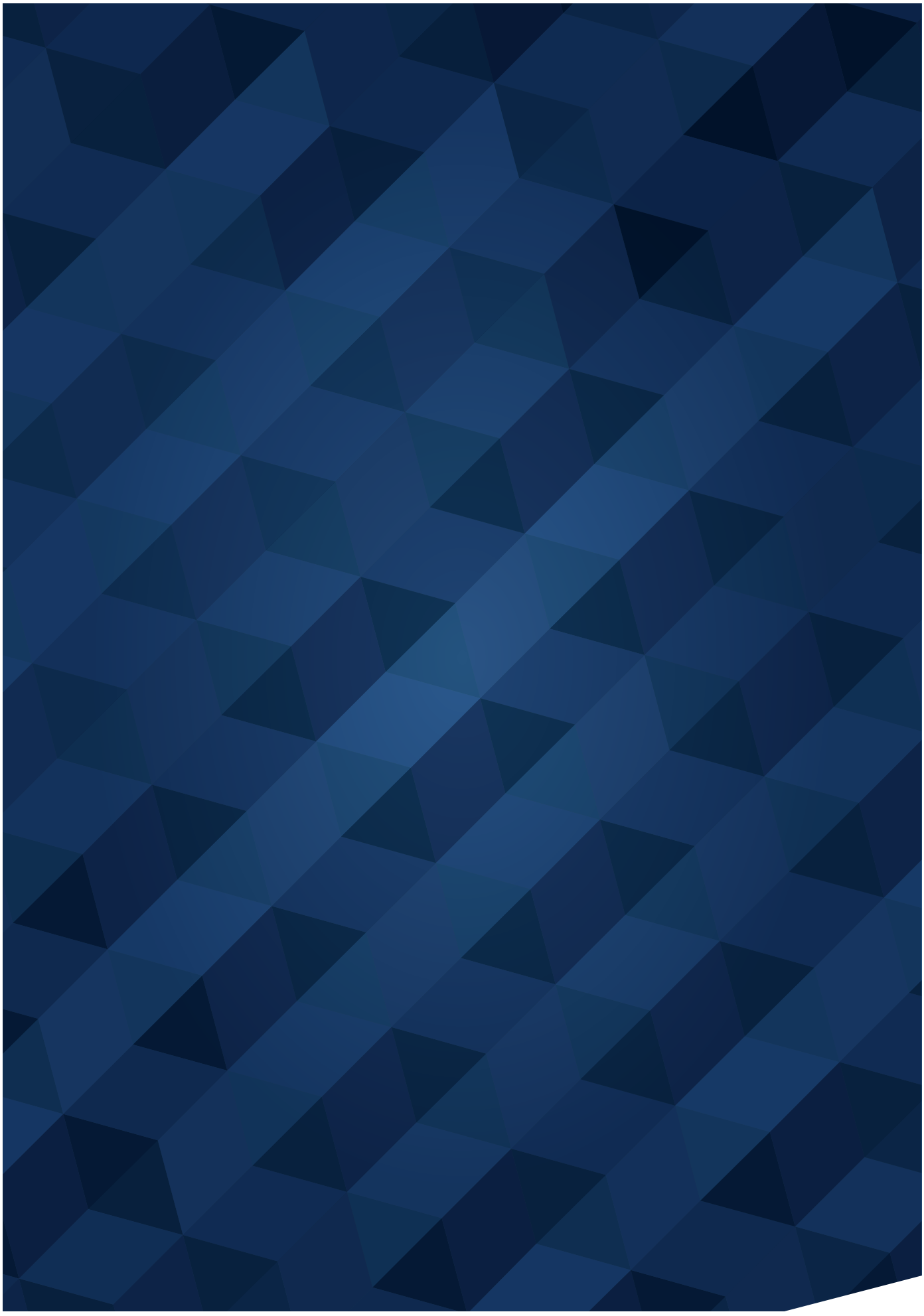
Chevron Corporation
Comcast Corp
JD Wetherspoon plc
Johnson Matthey plc
Kingspan Group plc
Rank Group plc
RS Group plc
The AES Corporation
Valero Energy Corporation
Victrex plc

Social

Adidas
BAE Systems plc
Comcast Corp
JD Wetherspoon plc
Li-Ning

Sustainability

Bodycote plc
BP plc
Breedon Group plc
Britvic plc
BT Group plc
Centrica plc
Ceres Power Holdings plc
Compass Group plc
Croda International plc
Deutsche Bahn
Lindt & Sprungli
MatsukiyoCocokara
Restaurant Group plc
Rolls-Royce Holdings plc
RS Group plc
Shin-Etsu Chemicals
SSP Group plc
Volution Group plc



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