CLIMATE CHANGE RISK MANAGEMENT

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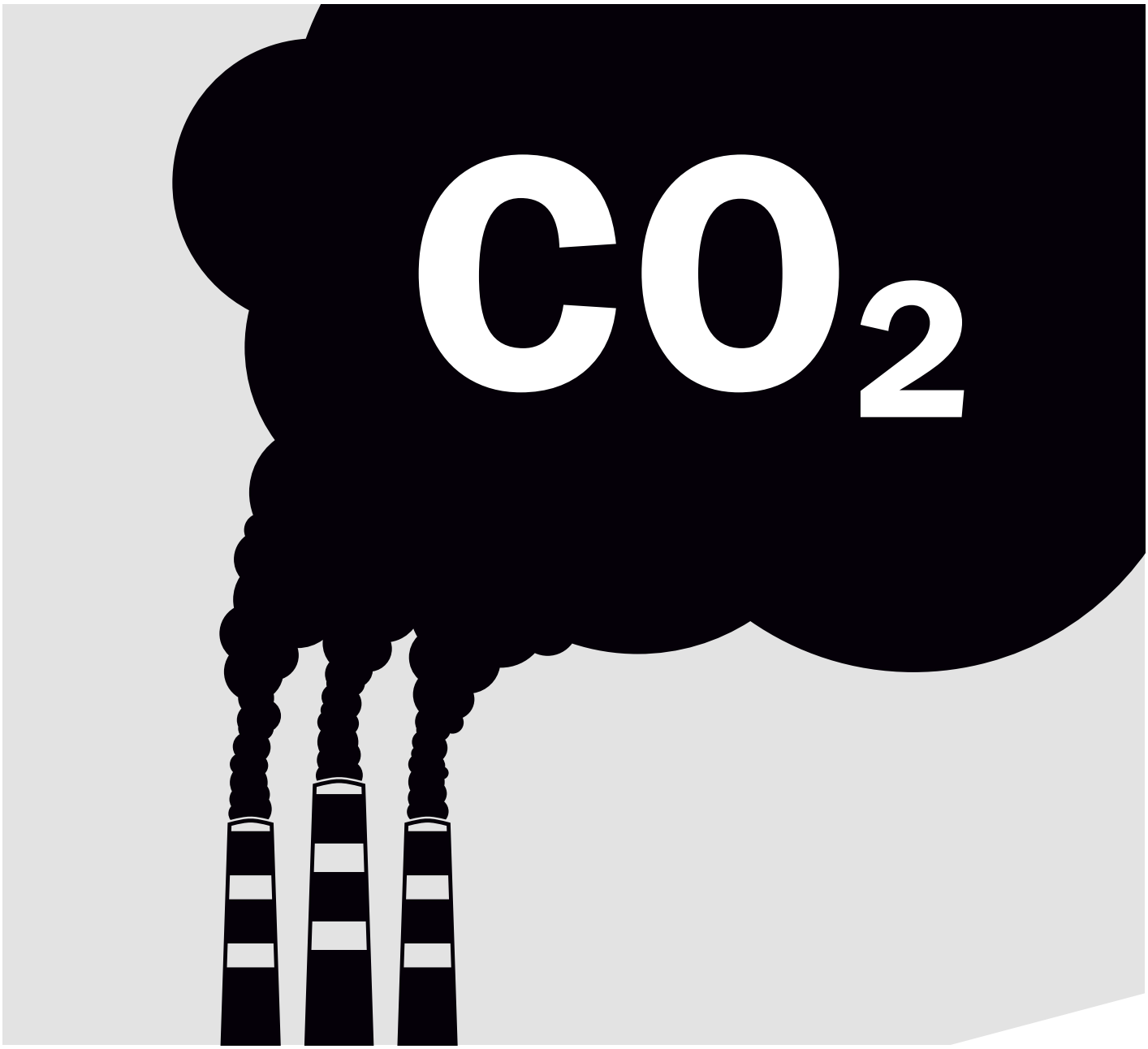
THERE IS NO PLANET B:

Why climate change risk management is the world's hottest topic and how asset owners and asset managers should be responding

Chris Wagstaff, Head of Pensions and Investment Education, Columbia Threadneedle Investments and Senior Visiting Fellow, Finance Faculty, Cass Business School, London



THERE IS NO PLANET B:
WHY CLIMATE CHANGE RISK MANAGEMENT IS THE WORLD'S HOTTEST TOPIC AND HOW ASSET OWNERS AND ASSET MANAGERS SHOULD BE RESPONDING

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EXECUTIVE SUMMARY

There is mounting evidence that rising levels of greenhouse gas (GHG) emissions are moving the world perilously close to a calamitous destination point. If left unchecked, the consequent rise in global temperatures above pre-industrial levels, which are already fast approaching a tipping point, will lead to ever more severe environmental damage, extreme weather events, natural disasters, crop failures, and a potentially catastrophic loss of biodiversity. However, despite powerful media coverage and imagery having planted climate change firmly in the popular consciousness, there have been limited interventions to date by policymakers and, to a degree, by regulators in stemming the myriad sources of GHG emissions, the financing of carbon emitting technologies and in seeking to change industry, company and individual behaviours. Of course, such interventions, from a policymaker perspective, are politically unpalatable given that economic growth, carbon emissions, property rights and personal freedoms have been strongly interlinked since the industrial revolution.

However, a failure to act more decisively could result in a deeply impaired economic and financial system. This would, in turn, severely inhibit the ability of asset managers to generate and asset owners to derive sustainable investment returns and expose asset owners to unacceptably high and largely unmanageable risks. Therefore, now is the time for both asset managers and asset owners to take mitigating actions and, indeed, take the lead in addressing one of humanity's greatest ever challenges. After all, asset managers and institutional asset owners have a significant, potentially game changing, influence in transitioning the world to a low carbon future, by collectively engaging with policymakers and regulators and in exercising responsible stewardship over companies. In fact, to say that asset managers and asset owners are not only very well positioned to be the catalyst for major transformative change, but that they have the potential to lead the world in addressing humanity's greatest systemic challenge to date, is no exaggeration. Therefore, this paper looks at how asset owners and asset managers, whether independently of or in line with policymaker or regulatory initiatives, should be and have been responding to, and indeed pre-empting, the potentially gargantuan, game changing systemic risks posed by climate change.

Ultimately, however, against the backdrop of clear gaps in behaviour, disclosure, accountability, regulation and financial and behavioural incentives that are collectively frustrating the move to a low GHG emissions economy, this paper calls for *six* specific actions to advance the themes identified:

1. Make the language, chronology, facts and figures pertaining to and the systemic risks posed by climate change more accessible and transparent.
2. Employ policy measures to remove the behavioural barriers to asset owner engagement with and management of climate risk factors. Combining the clearer framing and explaining of why and how to manage climate risk factors, with positive socialisation and measures to make the future more salient today, should result in more widespread adoption of coherent climate policies and responsible investment frameworks.
3. Encourage governments to act swiftly in a coordinated fashion to ultimately secure an accelerated but orderly and just transition to a low carbon emissions world. This should, in turn, encourage governments to enact policy changes to increase the supply of, and therefore help satisfy the demand for, climate-friendly assets with a risk/return trade-off that appeals to asset managers and asset owners.
4. Enact regulation that results in better and more standardised climate and carbon emissions data and universally applied climate related financial disclosures by listed companies.
5. Require regulators to adopt a more collaborative approach in setting climate change risk regulation, which more closely aligns with the targeted outcomes of the Paris Agreement and better recognises the differences between a disparate range of financial institutions, markets and asset owners.
6. Adopt globally coordinated actions with universal applicability, such as setting carbon taxes, which genuinely achieve a fair and just transition to a low carbon emissions world.

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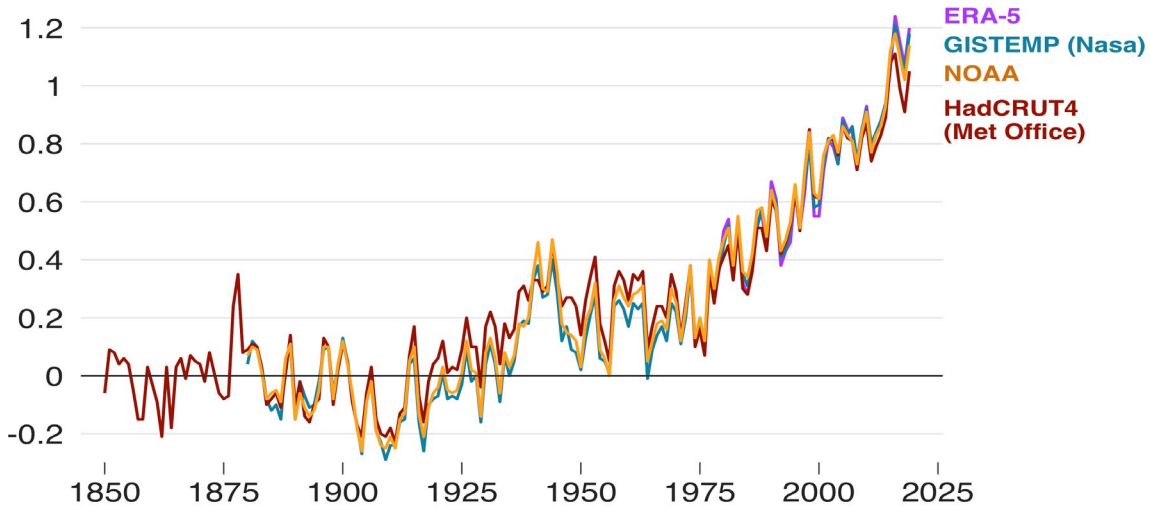
INTRODUCTION

"Hello babies. Welcome to Earth. It's hot in the summer and cold in the winter. It's round and wet and crowded."

Kurt Vonnegut: God Bless You, Mr Rosewater (1965)

Kurt Vonnegut was certainly right about the weather in the 1960s – and the 1970s and 1980s for that matter – at least for most of the northern hemisphere. The summers were certainly hot and the winters were cold, often very cold. It also rained a lot. Indeed, until relatively recently, this seemed to be the way of the world north of the equator. However, for the past couple of decades it's been getting considerably hotter and dryer almost everywhere regardless of the season. Indeed, according to NASA, each successive decade since the 1960s has been warmer than the last.[1] This is evident from *Figure 1*. This abrupt change in the weather, according to NASA, the National Oceanic and Atmospheric Administration (NOAA) and the UK Met Office, made the 10 years to the end of 2019 the warmest decade on record, with 2019 being the second warmest year globally since 1850.[2]

Figure 1: 2019 – Global mean temperature rise since 1850 (°C)



Source: MetOffice, January 2020.

However, this warming has been punctuated with periodic spells of cold and windy weather and heavy rainfall – the latter which has, on occasion, proved to be particularly destructive. Indeed, according to the World Meteorological Organisation (WMO), more than 90% of natural disasters are related to the weather. Storms, tropical cyclones and flooding have led to the highest economic losses, while heat waves and drought have led to the highest human losses.[3] Then, of course, there have been the wildfires – the massive forest fires in Canada and Sweden, widespread fires in the non-renewable tropical rain forests in Southern Asia and the Amazon, unprecedented wildfires in the Arctic region and, earlier this year, the bushfires in Australia. In fact, the latter were so big that they were generating their own weather, in the form of giant thunderstorms that initially started more fires but then extinguished large swaths of the deadly wildfires which had engulfed more than 27m acres of forest and bush. Proof, if any was needed, that the weather is a complex adaptive system.

[1] NASA, NOAA Analyses Reveal 2019 Second Warmest Year on Record. NASA. 15 January 2020.
[2] Climate change: Last decade confirmed as warmest on record. BBC Online. 15 January 2020. Moreover, in the UK, 2010-2019 was only second to 2000-2009 as the warmest and wettest decade on record over the past century, with 2019 being exceptional in that both UK summer and winter high temperature records were recorded in the same calendar year – a pattern repeated in many other northern hemisphere countries.
[3] Global Climate in 2015-2019: Climate change accelerates. World Meteorological Organisation. 22 September 2019. Additionally, the World Bank states that 90% of natural disasters are water related. Source: Water. World Bank. 1 July, 2019.

As the WMO identifies, this extreme weather, combined with rising sea levels and accelerated ice loss, encapsulates "the tell-tale signs and impacts of climate change."[4] Another is the fact that greenhouse gas (GHG) concentrations, which lock in warming for years to come, have increased to record levels, with global carbon dioxide (CO_2) growth rates nearly 20% higher in 2014-2019 than in the previous five years. Crucially, the WMO notes that as a consequence, "the global average temperature has increased by 1.1°C since the pre-industrial period, and by 0.2°C compared to 2011-2015."[5] This is perilously close to the agreement, made by world leaders in Paris at the end of 2015,[6] of keeping the global temperature rise this century well below 2°C above pre-industrial levels with an aspiration to limit this to 1.5°C. The resolve, of the so-called COP21 (the 21st session of the Conference of Parties), was reinforced, in October 2018, by the UN Intergovernmental Panel on Climate Change (IPCC), set up in 1988 to provide policymakers with regular assessments of climate change, by stating that there are "only a dozen years for global warming to be kept to a maximum of 1.5°C – beyond which even half a degree will significantly worsen the risks of drought, floods, extreme heat and poverty for hundreds of millions of people."[7]

THE LEXICON AND IMPACT OF CLIMATE CHANGE

Climate change is when greenhouse gases (GHG), such as carbon dioxide (CO_2) methane and nitrous oxide, are released into the air, enter the atmosphere and amplify the Earth's natural greenhouse effect, trapping more heat within the atmosphere. This results in global warming, whose effects include rising temperatures, more frequent extremes of weather and rising sea levels.

Ocean acidification. Around 25% of the CO_2 emitted by human activity is eventually dissolved in the oceans. Although this process helps to alleviate additional warming, it also forms carbonic acid and decreases the pH of the surface water, endangering the ocean's ecosystem and its food chain.

Biodiversity loss. A decline in the number and variety of living species damages the integrity of and risks irreversible change to ecosystems, so undermining their capacity to sustain life.

Air pollution and weather patterns. When micro-particles, of smoke, dust and pollutant gases, interact with water vapour in the air, they affect cloud formation and, in large volumes, can significantly alter regional rainfall patterns, including shifting the timing and location of monsoon rains in tropical regions.

Water stress. Water is essential for life and is widely used by agriculture, industry, and households. Excessive withdrawals of water can impair lakes, rivers and aquifers, damage ecosystems, and alter the hydrological cycle and climate. With unprecedented pressure on water resources, water stress, the shortfall between forecast demand and available supply of water, is estimated by the World Bank to affect two thirds of the world population by 2025 and one quarter of the world's economic output.[8]

Source: Doughnut Economics. Kate Raworth. Penguin Random House. 2017. Modified extracts from pp.297/8.

[4] WMO (September 2019). op.cit. Over the five-year period May 2014 to May 2019, the rate of global mean sea-level rise has amounted to 5mm per year, versus the average rate since 1993 of 3.2 mm/year. This is directly related to the amount of ice lost annually from the Antarctic ice sheet, which increased more than six-fold, from 40 gigatons (Gt) per year in 1979-1990 to 252 Gt per year in 2009-2017. Moreover, given that the ocean absorbs around 25% of the annual anthropogenic emissions of CO_2, thereby helping to alleviate additional warming, and more than 90% of the excess heat caused by climate change is stored in the oceans, it is notable that 2018 had the largest ocean heat content values on record measured over the upper 700 metres, with 2017 ranking second and 2015 third. This is further compounded by the overall increase in the acidity of the oceans by 26% since the beginning of the industrial revolution – given that absorbed CO_2 reacts with seawater and changes the acidity of the ocean.

[5] WMO (September 2019). op.cit. Global warming is defined by the WMO, MetOffice and IPCC as an increase in combined surface air and sea surface temperatures expressed relative to the period 1850–1900.

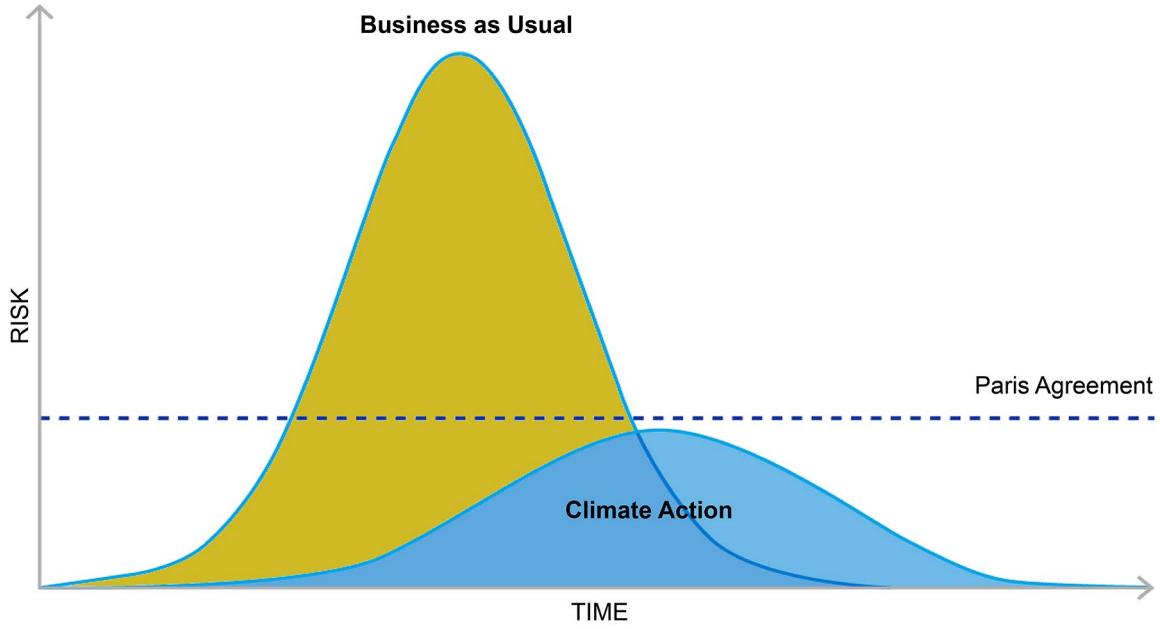
[6] COP21 – The Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) at its 21st Session in Paris, France (30 November to 11 December 2015).

[7] IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. *An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.*

[8] Water resources management. World Bank. 20 September 2017.

However, the enormity of the challenge ahead which must largely focus on reducing CO_2 emissions from myriad human-driven activities, such as energy production, industry, transport and even food production, principally in the G20 countries, cannot be underestimated. Indeed, according to the WMO, "to stop a global temperature increase of more than 2°C above pre-industrial levels, the level of ambition needs to be tripled. And to limit the increase to 1.5°C, it needs to be multiplied by five."[9] Indeed, the IPCC warns that carbon emissions need to be almost halved by 2030 if the world isn't to tip over to an even more calamitous path. To contextualise this challenge, Mark Carney, outgoing Governor of the Bank of England and incoming United Nations Special Envoy for Climate Action and Finance, maintains that, "if you add up the policies of all companies out there, they are consistent with warming of 3.7-3.8°C"[10] – a concern raised in 2013 by Lord Nicholas Stern, author of the authoritative 2006 *The Economics of Climate Change report*.[11] *Figure 2* presents a stylisation of the challenge.

Figure 2: Time to flatten the curve

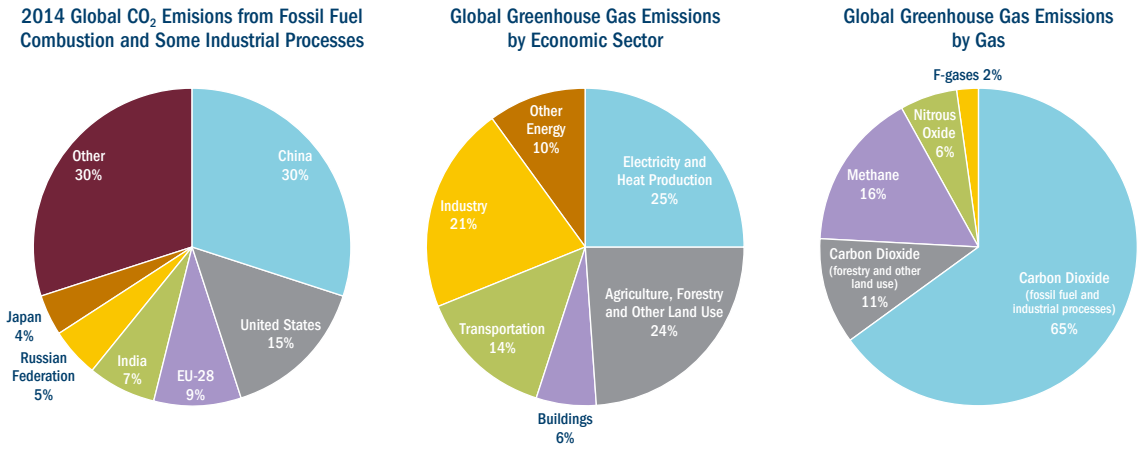


Source: Circular Sustainability.

[9] WMO (September 2019). op.cit.
[10] Bank of England chief Mark Carney issues climate change warning. BBC News. 30 December 2019.
[11] https://www.theguardian.com/environment/2013/jan/27/nicholas-stern-climate-change-davos. The Stern Report is covered later in the paper.

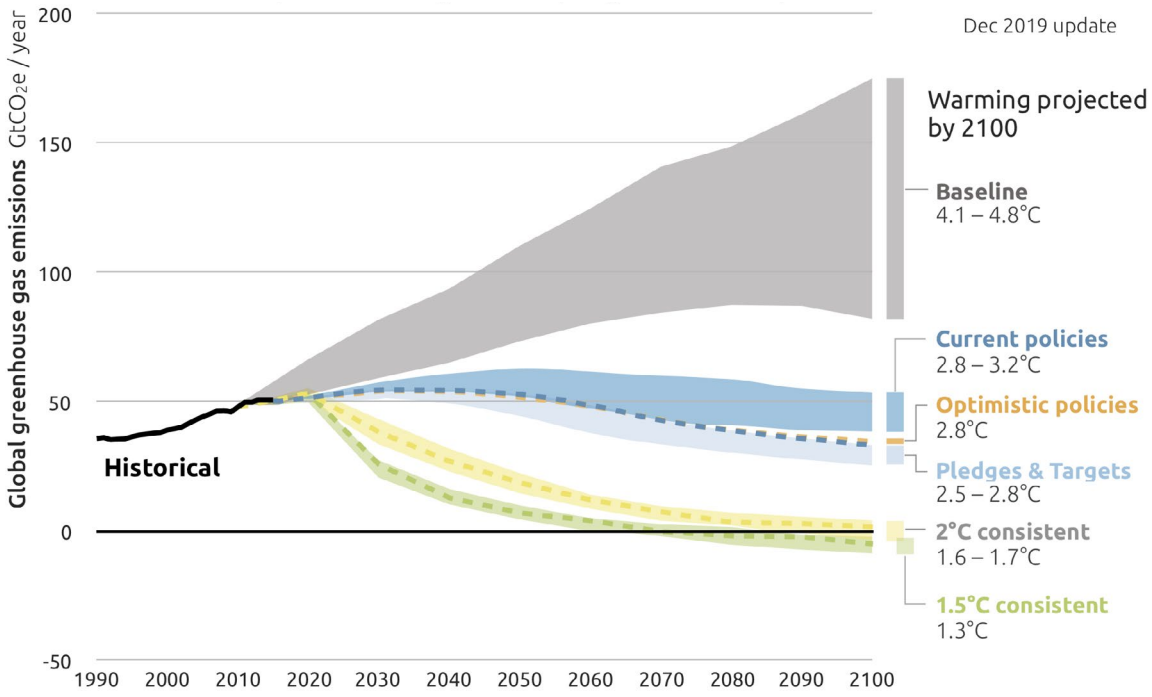
Figure 3 sets out the IPCC's breakdown of GHG emissions by country, economic sector and by gas, as at 2010 – disappointingly the most recent data available, while *Figure 4* illustrates future global carbon emission paths given various global warming trajectories.

Figure 3: Global greenhouse gas emissions by country, economic sector and by gas



Source: IPCC (2014) based on global emissions in 2010. Contributions of Working Group III to the fifth assessment report of the IPCC.

Figure 4: Future global carbon emissions paths from global warming trajectories: current policies fail to get close to the Paris Agreement's ambition of well-below 2°C by 2100



Source: Climate Action Tracker (December 2019).

THE PARIS AGREEMENT

At the 21st Convention of Parties (COP 21) in Paris, on 12 December 2015, the 197 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. Coming into force in November 2016, following ratification by 146 countries, the Paris Agreement's central aim, in replacing the Kyoto Protocol of 1990, has been to strengthen the global response to the threat of climate change by keeping a global temperature rise this century *well below* 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C by 2100. To achieve this temperature goal, the Parties must aim to reach global peaking of greenhouse gas emissions (GHGs) as soon as possible. The Parties also agreed to a long-term goal to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHGs development.

Nationally determined contributions (NDCs), or national climate plans, are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs reflect each country's ambition for reducing national emissions and adapting to the impacts of climate change, taking into account their respective domestic circumstances and capabilities. Each Party is required to prepare, communicate and maintain successive NDCs and regularly report on their emissions and on their implementation efforts. There is also a global stock take every five years to assess the collective progress towards achieving the Agreement's objectives, with each successive NDC required to represent a progression beyond the previous one.

Some Parties to the Agreement also have supplementary reporting requirements enshrined in national law. For instance, the UK Government, which in 2019 became the first major economy in the world to legislate for net zero GHGs by 2050, is required, under the 2008 Climate Change Act, to publish a climate change risk assessment (CCRA) every five years. The assessment sets out the risks facing and opportunities arising in the UK from climate change. The UK Government's third CCRA (CCRA3) due to be published next summer, will, as per the first two risk assessments, be prepared by The Adaptation Committee of the Committee on Climate Change, itself represented by over 200 people from more than 65 organisations. This report will provide the UK government with independent advice on building a low-carbon economy and preparing for climate change. Similarly, in March 2018, the European Commission published its EC Action Plan, within which it identified a €180bn funding gap towards supporting the transition towards a low carbon economy.[12] [13]

[12] The EC Action Plan is revisited later in the paper when discussing the forthcoming amendments to the existing European financial services legislation that regulates asset managers and which gives effect to the Paris Agreement. See: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0097&from=

[13] There are other European action plans with less of a finance focus, e.g. see: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

CLIMATE CHANGE RISK

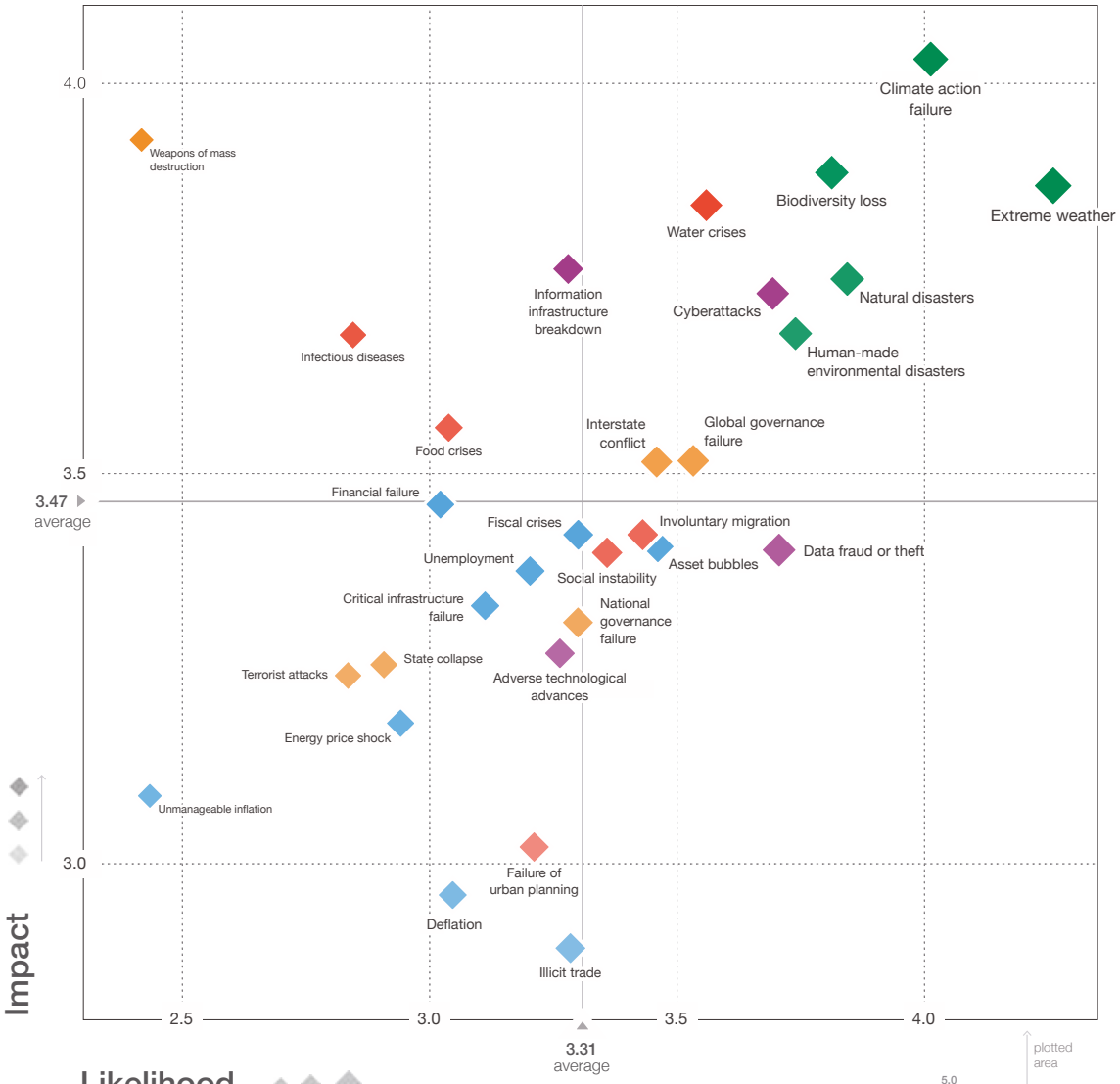
"If humanity fails to prevent irreversible global warming, the consequences are not yet fully modelled but they already look terrifying to unacceptable. To a large extent, the consequences are threefold: freak weather events and events linked to weather changes, a rise of the ocean water level and threats to food security. They will cause huge numbers of deaths, from babies and the retired dying from heat, to the victims of country-wide wildfires, storms and flooding."

Peter Kraneveld, International Pensions Adviser, February 2020[14]

Although climate change risk is a known unknown, most commentators agree that if left unchecked, its effects, as a global systemic risk,[15] could be seismic. Indeed, without global coordinated action, the world could conceivably be 2-3°C warmer by the time today's millennials retire, potentially making entire swaths of the planet uninhabitable. To sum up the sentiments of one economic commentator, "100 years ago we as a species couldn't have smashed the planet up even if we tried. 50 years ago we could have done so only if we did something incredibly stupid like push the nuclear button. Today it's our inaction, our failure to change anything that will smash the planet up."[16] Given this and that which has been discussed so far, it's little wonder that environmental risks, climate action failure in particular, from both a likelihood and impact perspective, dominated this year's annual World Economic Forum (WEF) Global Risks Report, for first time in its 15 year history. This is illustrated by the data points in the top right hand corner of *Figure 5*.

[14] Fiduciary duty and global warming. Guest viewpoint. IPE. 3 February 2020.
[15] Systemic risks are those which impact all economic agents, albeit some more than others.
[16] Professor Mike Berners-Lee, WTW sustainability summit. December 2019.

Figure 5: Environmental risks dominate the World Economic Forum's Global Risks Report 2020



Top 10 risks in terms of **Likelihood**

1. Extreme weather
2. Climate action failure
3. Natural disasters
4. Biodiversity loss
5. Human-made environmental disasters
6. Data fraud or theft
7. Cyberattacks
8. Water crises
9. Global governance failure
10. Asset bubbles

Top 10 risks in terms of **Impact**

1. Climate action failure
2. Weapons of mass destruction
3. Biodiversity loss
4. Extreme weather
5. Water crises
6. Information infrastructure breakdown
7. Natural disasters
8. Cyberattacks
9. Human-made environmental disasters
10. Infectious diseases

Categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

Source: Visual Capitalist, 17 January 2020.

CATALYSING THE WORLD INTO ACTION

Yet, despite the evidence and the contention that action on climate change is the greatest challenge for public policy of our time, with a few notable exceptions the world largely carries on as if climate change and its consequences are inevitable and unstoppable. Thankfully, not everyone adopts a deterministic view that we're inevitably heading towards a predestined and ultimately calamitous destination point. Notable among those not suffering from wilful blindness,[17] and who have made the world sit up and listen are Greta Thunberg, the young, vocal and inspirational Swedish climate activist, and 94 year old natural historian Sir David Attenborough. Indeed Greta Thunberg, in her book, *No one is too small to make a difference*, which is written with a remarkable level of maturity and eloquence, suggests that "…the climate crisis has already been solved. We already have all the facts and solutions. All we have to do is to wake up and change."[18] Integral to waking up to the new reality and the urgent need to radically change our ways, she suggests that "every time we make a decision… we should no longer ask: "Have we got enough money to go through with this?" but also: "Have we got enough of the carbon budget to spare to go through with this?" That must become the centre of our new currency."[19] Moreover, in denouncing world leaders for their lack of leadership, sense of urgency and somewhat misleading zero emissions targets at the UN Climate Change Conference COP25 in Madrid in December 2019, Greta Thunberg pointed to the fact that just 100 companies are responsible for 71% of global carbon emissions, while "the G20 countries account for almost 80% of total emissions, with the richest 10% of the world's population producing half of our CO_2 emissions."[20]

It's remarkable to think that it's taken a teenager and a nonagenarian to put addressing, what is widely acknowledged to be, a climate change emergency firmly on the world stage.

WHAT EXACTLY IS CLIMATE CHANGE RISK? TIME FOR SOME DEFINITIONS

As we know, the sources of climate change are largely man-made. Moreover, with the world's population having more than tripled since 1950,[21] the current daily routine activities of planet earth's 7.8bn human inhabitants is an incremental force of unprecedented and currently unknowable consequences on ecologies and economies. Principal among them is the burning of fossil fuels – oil, gas and coal. Indeed, in 2016, 86% of the world's primary energy was generated from carbon-intensive and non-renewable fossil fuels.[22] Additionally, process emissions from activities such as manufacturing, agriculture and waste management contribute significantly to the world's atmospheric GHG concentration. Even the internet and its infrastructure generates as much CO_2 as the entire airline industry.[23] Combined, these continue to increase global temperatures, raise sea levels, cause glaciers to shrink and ice to melt, perpetuate extreme weather, such as floods, hurricanes and droughts, destroy habitats, and impair livelihoods, health and economic activity. These are the highly visible risks which, if left unchecked, will, over time, make the world a far less hospitable place in which to live and work, while posing major risks to human societies and natural systems.

[17] See: Wilful blindness. Margaret Heffernan. Simon and Schuster. 2019.
[18] No one is too small to make a difference. Greta Thunberg. Penguin, Random House UK, 2019. p.11.
[19] Thunberg (2019). op.cit. pp.64-65.
[20] https://www.express.co.uk/news/science/1216452/Greta-Thunberg-UN-speech-full-COP25-Greta-Thunberg-speech-transcript-climate-change
[21] World population growth. Max Roser, Hannah Ritchie and Esteban Ortiz-Ospina. Our World in Data. May 2019. https://ourworldindata.org/world-population-growth
[22] The Future of Carbon Pricing in the UK. Report prepared for the Committee on Climate Change by Vivid Economics. Final Report. August 2019.
[23] Our climate has a new enemy: the internet. Six. Robeco. May 2020.

Regulatory and reputational risk

However, while these visible risks are potentially tempered to varying degrees when policymakers, NGOs, regulators, pressure groups and fiduciaries, such as asset managers and asset owners, intervene, whether directly or indirectly to effect change, such actions introduce financial and economic risks, principally to those organisations that have been slow to adapt to the changing landscape or have resisted change. These risks include *regulatory risk*, the risk of failing to anticipate regulatory change and subsequently being unable to comply with ever stringent environmental regulations, and *reputational risk*, the risk of being named and shamed and consequently sidelined for failing to keep up with current thinking and developments. Of course, regulatory and reputational risk equally applies to those asset managers and asset owners who fail to move with the times, update their beliefs, adapt their behaviours or align with their parent's or sponsor's climate policy. Moreover, given the transparency afforded to published climate policies, the reputational risk of not acting in line with a stated policy is also very real.

Transition and physical risk

However, climate change risk, in an asset manager and asset owner context, additionally comprises the failure to sidestep and/or to capitalise upon the *transition risk* and *physical risk* (each of which is covered below) of allocations to the various asset classes, industries, individual securities and real assets across the globe. Additionally, for many asset owners this also extends to the transition and physical risks applying to their sponsoring organisation, especially to those asset owners heavily dependent on a strong sponsor covenant.

However, the regulatory initiatives applying to asset managers and asset owners approach climate change as a financial, rather than as an environmental, risk. That is, how climate change might impact the value of an investment, rather than requiring these institutional investors to set environmental targets to achieve positive environmental outcomes – targeting defined portfolio GHGs for example. Although this dichotomy is often conflated, this distinction is important particularly for asset owners, who need to think about whether and, if so, how to approach climate change on two different planes. Indeed, for many asset owners this conflation may fall within their fiduciary duty, whereas for others it may take them beyond what their fiduciary duty dictates and necessitate a normative judgement – a point that's explored later in the paper.[24]

Turning to the risks themselves – let's firstly consider transition risk. The Bank of England's Prudential Regulation Authority (PRA) defines transition risk as those risks "arising from the process of adjustment towards a low-carbon economy" noting that, "a range of factors influence this adjustment, including: climate-related developments in policy and regulation, the emergence of disruptive technology or business models, shifting sentiment and societal preferences, or evolving evidence, frameworks and legal interpretations."[25] Indeed, transitioning to a low carbon and ultimately a net zero emissions economy, like any disruptive force, will invariably result in winners and losers. While some economic sectors will disappear, or experience higher costs of doing business, others with the foresight *and* the ability to reinvent themselves by transitioning to new low carbon technologies and/or offsetting their carbon emissions through carbon-capture technologies (which in its simplest form comprises planting trees), stand to prosper, alongside those new entrants who emerge to tap into new areas of demand. Indeed, achieving a Paris Agreement-aligned energy transition, for example, requires an unparalleled infrastructure spend on renewable energy, quite possibly on nuclear energy,[26] energy efficiency and storage, and cleaner modes of transport.[27] Not that transition risks are confined to the energy and transport sectors. Even the consumer staples sector, that which comprises those non-cyclical companies which produce and sell those items typically considered essential for everyday use – food, beverages, household goods and hygiene products – faces considerable transition risks.

[24] It's evident there is a collective action problem here. Most/all investors need to act to prevent environmental damage, which if not addressed will have systemic financial consequences. However, it may not be in their individual interests, or within their fiduciary duty, to seek to limit their environmental impacts. Hence there is a role for regulators to encourage/require collective action and that is what we're starting to see.
[25] The PRA Supervisory Statement: Enhancing banks' and insurers' approaches to managing the financial risks from climate change (SS3/19).
[26] See: The Important Challenge. John Belgrove. Aon Consulting. February 2020. https://aon.com/unitedkingdom/the-important-challenge.aspx
[27] There is considerable debate on whether electrical or hydrogen cell technology will be the dominant power source behind cleaner, more efficient transport. Detractors of electric vehicles point out that their lifetime emissions are unacceptably high, noting that mining lithium, making car batteries, shipping cars and most electricity generation isn't clean.

Then there's the potentially monumental declines in the physical asset values of those companies that fail to anticipate and adapt to regulatory, reputational and, particularly, transition risks in the move to a net zero emissions economy, or those unable to reinvent themselves. In extremis, many assets will be rendered uneconomic and, in popular parlance, become stranded. For instance, if government policies were to align with limiting the post-industrial increase in global temperatures to 1.5°C, then a whopping 84% of remaining fossil fuels would need to be left in the ground, resulting in an estimated US$900bn of coal, oil and gas assets becoming stranded, equivalent to one-third of the January 2020 market value of big oil and gas companies.[28] While a +2°C scenario would be less punitive, in that 71% of the world's oil and 92% of gas reserves could be burnt, less than a quarter of coal reserves could be combusted – coal by weight containing 150% as much carbon as crude oil and twice that of natural gas. While these points have not been lost on capital markets, it would appear that markets have yet to reassess the value of existing oil and gas reserves and the risk of asset write downs by the world's oil and gas companies, despite having done so in reassessing the value of coal stocks.

Secondly, there's the physical risks of climate change – those risks to life and property resulting directly from the effects of global warming already discussed. According to the PRA the "physical risks from climate change arise from a number of factors, and relate to specific weather events, such as heatwaves, floods, wildfires and storms and longer-term shifts in the climate, such as changes in precipitation, extreme weather variability, sea level rise, and rising mean temperatures."[29] The physical risks of climate change are likely to be greater in emerging economies than more mature economies given the potentially higher economic losses of the former.

Of course, many organisations and their insurers will potentially be subject to liability risks, arising from compensation claims for losses suffered as a result of undisclosed or unconsidered transition or physical risks due to climate-related events. Indeed, climate change impacts insurers on three levels. Firstly, those insurers who offer indemnity policies that pay liability claims where legal action is successfully brought against policyholders, e.g. for losses suffered as a result of undisclosed or unconsidered transition or physical risks due to climate-related events.[30] Secondly, making payments to policyholders for the physical risks associated with climate change, notably from the rise in extreme weather events considered earlier, heavy storms and floods in particular, needs to be factored into insurers' liability claims forecast modelling. Thirdly, as asset owners, insurers are subject to the risk of assets, used to cover future liability claims, becoming stranded, either as a result of physical or transitional risks. This needs to be factored into their investment management strategies. Consequently, insurers are now required to develop climate change risk management practices and to introduce a climate change risk management policy.[31]

Later in the paper we look at how transition and physical risks can be analysed across the asset classes and what mitigating actions can be taken to address them – notably whether the response should be to engage, embed, effect or exclude. Not that each of these responses is necessarily mutually exclusive.

[28] Lex in depth: The $900bn cost of 'stranded energy assets'. Alan Livsey. Financial Times. 4 February 2020.
[29] PRA (SS3/19). op.cit.
[30] This is what the PRA meant by its term "liability risks" in its seminal 2015 paper https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/publication/impact-of-climate-change-on-the-uk-insurance-sector.pdf
[31] PRA (SS3/19) requires insurers to address the financial risks from climate change through their existing risk management frameworks, while recognising that the nature of the risks requires a strategic approach; to conduct scenario analysis to determine the impact of the financial risks from climate change on their overall risk profile; and to consider whether further disclosures are necessary to enhance transparency on their approach to managing the financial risks from climate change.

CASE STUDY: UK RENEWABLES NOW GENERATE MORE ELECTRICITY THAN FOSSIL FUELS

According to *CarbonBrief*,[32] in Q319, for the first time since 1882 when fossil fuel power stations were introduced to the UK, UK renewable energy generated more electricity than gas and coal-fired power stations. In a crucial tipping point in Britain's energy transition, renewable energy, comprising windfarms, solar panels and renewable biomass plants, took a 40% share of power generation, while nuclear power, another zero carbon emitting power source, contributed just under 20%. By contrast, carbon emitting power sources took a 39% share of electricity generation, with gas assuming a 38% share and coal less than 1%. Indeed, coal-fired power stations are to be banned from the UK in 2025.

Moreover, against the backdrop of the cost of new offshore wind infrastructure having fallen to an all-time low, making onshore and offshore wind the UK's lowest-cost large scale power source, and the next generation of offshore wind farms being expected to generate power at a lower cost than the average market price for electricity on the wholesale energy markets, *Renewable UK* expects the size of the UK's offshore wind sector to treble by 2030, at which point it would generate more than a third of the UK's electricity.[33]

That said, John Belgrove eloquently argues that nuclear also has a prominent role to play in decarbonising electricity generation in the UK by 2050. Pointing out that no one electricity source can do it alone, he states that "there is an emerging 'energy gap' between the power [the UK] will need by 2050 and the current low-carbon electricity supply [the UK is] building. This means [the UK is] heading towards a serious shortfall that can only be filled by nuclear energy…. If [the UK] only invests in renewables without also investing in a firm baseload of zero-carbon generation, [it] will have to continue to use polluting fossil fuels to meet electricity demand."[34] Of course, energy efficiency measures to reduce the demand for electricity can also play an important role in minimising this shortfall, while fossil fuels with carbon capture and storage might be an alternative to nuclear.

[32] CarbonBrief is a UK research house, funded by the European Climate Foundation, covering the latest developments in climate science, climate and energy policy. See: https://www.carbonbrief.org/analysis-uk-renewables-generate-more-electricity-than-fossil-fuels-for-first-time?utm_content=buffer92635&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

[33] Given the relative paucity of climate-friendly assets in which to invest, such as renewable energy infrastructure and carbon capture technologies, with a risk/return trade-off that appeals to asset managers and asset owners, later in the paper it is suggested that governments should be required to enact policy changes to increase the supply of, and therefore help satisfy the demand for, such assets.

[34] See: The Important Challenge. John Belgrove. Aon Consulting. February 2020. https://aon.com/unitedkingdom/the-important-challenge.aspx

COMPANIES TAKING ACTION TO MANAGE TRANSITION AND PHYSICAL RISK

To date, although many companies have adopted measures to limit their impact on climate change, most have yet to set out comprehensive measures to achieve net zero carbon emissions in line with the Paris Agreement, with some still *greenwashing*. However, notable high profile exceptions include National Grid, Microsoft, Heathrow Airport, BP and Repsol.

In November 2019, National Grid, which has responsibility for transmitting gas and electricity to homes and businesses throughout the UK and New York, Rhode Island and Massachusetts in the US, committed to achieving a 45% reduction in GHG emissions, against a 1990 baseline, by 2020 and an 80% reduction by 2050. The first target has already been achieved. This it is doing by modernising its infrastructure networks, introducing innovative ways to reduce carbon across its operational assets, managing energy in its office buildings, and finding better ways of conserving resources and protecting natural habitats and green spaces across the UK and US. In the UK, pre-empting the energy companies regulator, OFGEM's, 9-point climate plan,[35] National Grid has additionally pledged by 2020 to implement carbon pricing (internalise the social costs of GHG emissions) on all major investment decisions, reduce the capital carbon[36] of its major construction projects by 50% and increase energy efficiency of its UK property portfolio by 10%. Additionally in the US, it is targeting increasing the energy efficiency of its ten largest US property sites by 20% by 2020.

In January 2020, Microsoft, the American multinational technology giant, vowed to be carbon *negative* by 2030 and remove all historic emissions, dating back to 1975, by 2050. Principal amongst its initiatives, Microsoft intends to start a $1bn fund to invest in carbon reduction, capture and removal, begin counting its "scope 3" emissions[37] and halve them by 2030 by applying an internal carbon tax to them. Implicit within this emissions target are the carbon emissions generated by its customers. It has also pledged to shift its energy supply to 100% renewables by 2025 and to electrify vehicles at its headquarters by 2030.[38]

Following a commitment from the UK aviation industry to achieve net-zero carbon emissions by 2050, through an international approach, in February 2020 Heathrow Airport became the world's first airport to declare an intention to become net carbon neutral by the mid-2030s. Although Heathrow has reduced carbon emissions from airport buildings and infrastructure by 93% compared to 1990, the remaining 7% of airport infrastructure emissions will be offset in the interim through tree planting projects, in Indonesia and Mexico, certified through the Verified Carbon Standard, while Heathrow works towards becoming a zero carbon airport, through improvements to sustainable transport links and ensuring it meets its target to transition all of Heathrow's cars and small vans to electric and plug-in hybrid. Heathrow, in recognising that it can't create this saving alone though, will use its position to encourage others within the UK aviation industry to invest in similar initiatives.[39]

[35] Ofgem's nine-point climate plan, comprises:
- Make price controls more adaptable to help firms invest in clean energy.
- Set up a regulatory fund to help invest in climate-change solutions.
- Explore ways to create a "lowest cost" offshore grid to support wind power.
- Work with government and industry to decarbonise heating.
- Make UK energy systems fit for a net-zero future.
- Create a more flexible electricity system to help move towards net zero.
- Develop a regulatory strategy to help get 10m electric cars on the road by 2030.
- Support energy firms to create low-carbon products and services for consumers.
- Change its regulatory approach and take "big decisions" on decarbonisation faster.

[36] Capital carbon comprises greenhouse gas emissions arising from the creation, refurbishment, and end of life treatment of assets such as buildings and infrastructure.
[37] See the *Scope 1, 2 and 3 emissions defined* box below.
[38] Microsoft vows to be 'carbon negative' in 10 years and remove all historic emissions by 2050. James Titcomb. The Guardian. 16 January 2020.
[39] Heathrow set target for zero carbon. https://www.heathrow.com/latest-news/heathrow-targets-zero-carbon-airport-by-mid-2030s. 21 February 2020.

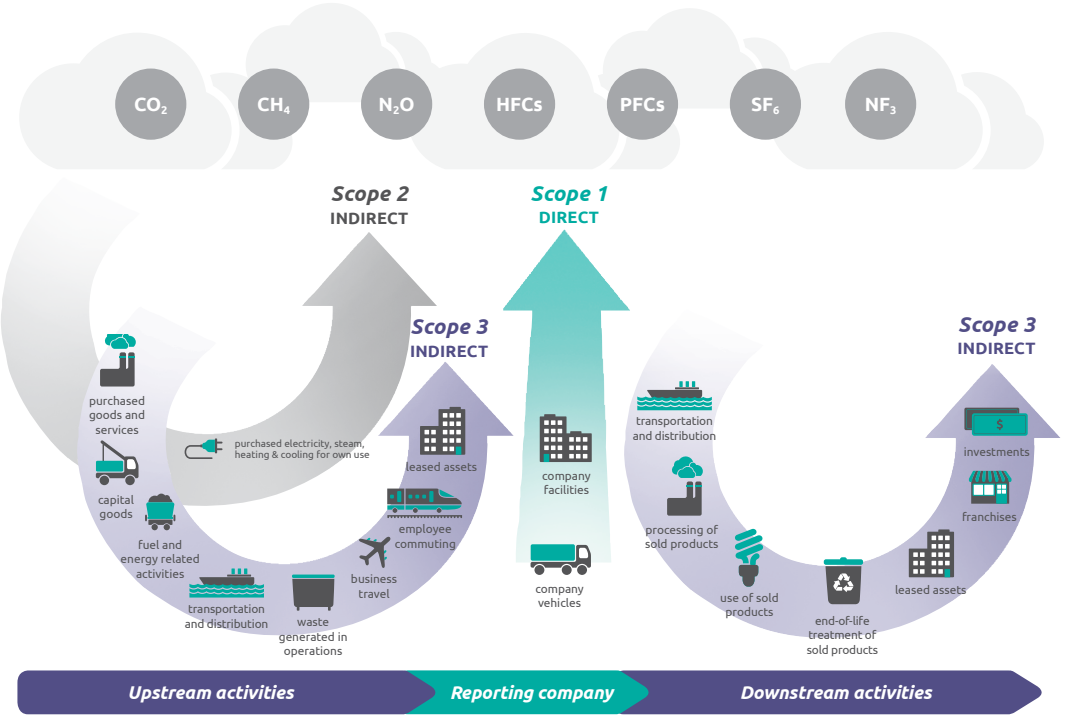
Likewise, in February 2020, BP became the first oil major to target being a net zero carbon emitter by 2050, by endorsing a rapid transition to cleaner energy by "reimagining energy", although it is yet to reveal details of how this transition will be achieved.[40] BP's ambition in the oil and gas sector is only matched by Repsol, the smaller Spanish oil and gas producer who, in December 2019, announced an overhaul of its business strategy – from re-evaluating long-term energy prices to ensuring "all of its activities and investments" are in line with the Paris climate goals. As a marker of its intent, Repsol will take a €4.8bn impairment charge on its exploration and production assets and anticipates that one quarter of its capital expenditure in 2020-2025 will be dedicated to low-carbon projects. To put this into context, oil companies currently devote less than 1% of capital expenditure to investment in renewable energy.[41] Additionally, at least 40% of the long-term pay of Repsol's top managers, representing 6% of its workforce, will be aligned to achieving the 2050 target. Markers to achieving Repsol's 2050 target have been set for 2025, 2030 and 2040 while, like Microsoft, Repsol will take responsibility for the emissions of *both* its businesses and of its customers in line with the International Energy Agency's most ambitious "sustainable development" model scenario.[42]

Consequently, other resources giants, such as the world's mining giants, are beginning to feel the heat, having to date failed to outline their plans to reduce their carbon footprint in a meaningful manner. Increasingly, these and other companies that have skirted around the climate issues pertaining to their business are recognising that *they* need to earn their social licence to operate from consumers, investors and wider stakeholders, by demonstrating that their contribution is moving the world to a better place.

[40] New boss Bernard Looney pledges net zero carbon emissions by 2050. Angli Raval. FT. 12 February 2020.
[41] FT Lex (4 February 2020). op.cit.
[42] Repsol sets net zero CO_2 emissions target for 2050. Angli Raval. Financial Times. 2 December 2019.

SCOPE 1, 2 AND 3 EMISSIONS DEFINED

Figure 6: Scope 1, 2 and 3 emissions defined



Source: GHG Protocol, Compare Your Footprint.

An organisation's emissions are categorised into three groups, or scopes, by the Greenhouse Gas (GHG) Protocol, the most widely-used international accounting tool, in order to better understand the source and to address emission hotspots. Scope 1 and 2 emissions are those within the organisation's control, while scope 3 are not.

Scope 1 – All Direct Emissions from the activities of an organisation under its control.

Scope 2 – Indirect Emissions from the production of the energy purchased and used by the organisation.

Scope 3 – All Other Indirect Emissions that occur in a company's value chain but outside their own operations. Scope 3 emissions usually comprise the greatest share of an organisation's carbon footprint. Covering emissions associated with purchased goods and services, business travel, procurement, waste and water, often the environmental impact of a company's supply chain is many times that of its own operations.

WILL ECONOMIC GROWTH BE COMPROMISED BY MEASURES TO ALLEVIATE CLIMATE CHANGE?

"We should no longer measure our wealth and success in the graph that shows economic growth, but in the curve that shows the emissions of greenhouse gases… We should no longer ask: "Have we got enough money to go through with this?" but also: "Have we got enough of the carbon budget to spare to go through with this?" That must become the centre of our new currency."

Greta Thunberg, 2019[43]

Economic growth is the periodic increase in an economy's measurable output, income or expenditure, known as its gross domestic product (GDP) or, if taking a more international perspective – gross national product (GNP). Expressed in real, or inflation-adjusted, monetary terms over the course of a calendar quarter or calendar year, economic, or GDP, growth is the principal barometer of a nation's economic health.

Although inadequate in many respects, in that economic growth doesn't capture myriad factors that determine whether the economic prosperity *and* social wellbeing, or welfare, of a nation, or its distribution across the population, has improved or deteriorated from one year to the next, no one has yet come up with a workable viable alternative – or at least one that doesn't revolve around the assumed need for growth. After all, given that consumers are assumed to prefer more to less, the working assumption, certainly for the past 90 years, is that human welfare is principally based upon the ability to continually grow income, expenditure and output – exactly what GDP growth seeks to measure.

Notable amongst these inadequacies is the fact that economic growth doesn't capture, so-called, externalities, those observable factors which typically detract from social welfare but are not captured in market pricing, or GDP – GHG emissions, for example. Moreover, GDP also fails to capture carbon leakage – the extent to which emissions are exported to other countries. Hence the long standing contention that economists know the price of everything but the value of nothing.

Inadequacies aside, another matter of contention is whether sustainability and economic growth can co-exist or if growth will be compromised in transitioning to a net zero carbon economy. Much rests on history being a guide to the future. Indeed, since the UK industrial revolution of 1760-1840 and those that followed elsewhere in the world, a succession of innovations, disruptive technologies and a series of economic and demographic challenges, some regional others global, have done little to either *permanently* enhance or dent very consistent long-run rates of economic growth. After all, throughout history, economic progress in free market and mixed economies has been dependent on Schumpeterian creative destruction, where new, disruptive technologies, business models and ways of working continually usurp the old and outdated.[44] Moreover, in a world where sustainability might usurp economic growth as the dominant metric of prosperity and wellbeing, this would invariably lead to a different, more sustainable, model of capitalism – one with longer-term thinking and longer pay backs. Additionally, as Mark Carney recently

[43] Thunberg (2019). op.cit. pp.64-65.
[44] What Do We Learn From Schumpeterian Growth Theory? Philippe Aghion, Ufuk Akcigit, Peter Howitt. NBER Working Paper No. 18824. Issued in February 2013.

noted, "There is a need for [action] to achieve net zero emissions, but actually it comes at a time when there is a need for a big increase in investment globally to accelerate the pace of global growth, to help get global interest rates up, to get us out of this low-growth, low-interest-rate trap we are in."[45] In fact, tackling the climate crisis will require the world's largest ever peacetime investment. According to the UN, annual investment spending of $2.4tn to 2035 is required to keep global temperature rises to safe levels. Given that renewables' costs tend to be front-loaded and deliver savings over time, those that take advantage of the low-rate environment to lock in investment now are likely to be the ones that survive the energy transition and emerge dominant.[46] Moreover, a more widespread move into renewables will pave the way for cheaper, more secure and sustainable energy supplies which, in turn, would provide a fillip to global wealth and growth.

Perhaps unsurprisingly, there is an alternative view – one that paints a very different, indeed much bleaker, picture. This view rests on the extent to which and the short timeframe over which the carbon intensity of the global economy needs to decline if the world isn't to tip over onto a calamitous path from which there is no way back. As Simon Kuper notes, while the amount of carbon required to produce one dollar of GDP has been falling by about 0.4% per annum, this is more than offset by the 2% per annum growth in global GDP per head. Therefore, the Renewable Energy Policy Network for the 21st Century (REN21) think-tank suggests that to keep global temperature rises at safe levels, the world should be targeting a reduction in carbon emissions per unit of GDP, ten times as great as that achieved to date, not in 2050 but now. This would, of course, put an immediate brake on economic growth, perhaps even tipping the world economy into a long economic contraction, as money is diverted from consumption to rapidly accelerating the development of zero carbon emitting technologies and building energy efficient infrastructure. Indeed, although according to REN21, renewables already account for more than 10% of total global energy consumption, a much faster rate of energy transition is needed if the world isn't to tip over onto a yet more calamitous path. Of course, given that economic growth, carbon emissions, property rights and personal freedoms have been strongly interlinked ever since economies industrialised, such dramatic interventions would, at best, be politically inept as no electorate would vote for climate over growth if today's unsustainable lifestyles were to be radically compromised.[47] Moreover, the Paris Agreement doesn't envisage economic activity being halted abruptly. However, a failure to act more decisively on climate change could result in a deeply impaired economic and financial system.

Another potentially calamitous economic risk in transitioning to a net zero emissions world, is the structural, or involuntary, unemployment, within high carbon sectors, that would result from failing to support a fair and just transition.[48] Aside from the potentially devastating long-term impact on economic growth of failing to preserve aggregate levels of employment, financial stability might also be compromised – a risk recently highlighted by the Bank of England.[49]

However, academic economist, Kate Raworth, may well have the final word on this debate. Raworth suggests that we need to reframe the economy by promoting economic development without being tied to infinite growth and obsessing over growth at all costs. As Raworth puts it, "today we have economies that need to grow, whether or not they make us thrive: what we need are economies that make us thrive, whether or not they grow."[50]

[45] Firms ignoring climate crisis will go bankrupt, says Mark Carney. The Guardian. 13 October 2019.
[46] Low rates provide a historic opportunity to tackle climate change. Deirdre Cooper. Financial Times. 28 December 2019.
[47] The myth of green growth. Simon Kuper. Financial Times. 24 October 2019.
[48] A just transition is one that seeks to minimise to involuntary unemployment when an industry goes through seismic structural change and its workers do not have readily transferable skills.
[49] The 2021 biennial exploratory scenario on the financial risks from climate change. Discussion paper. Bank of England. 18 December 2019.
[50] Doughnut Economics. Kate Raworth. Penguin Random House UK. 2017. p.30.

THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW

"Hindsight is a wonderful thing but foresight is better"

William Blake

In 2005, Lord Nicholas Stern, then Head of the UK Government Economic Service, was commissioned by then, UK Chancellor of the Exchequer, Gordon Brown, to report on the medium to long-term economics and other implications of moving to a low-carbon global economy and through which policies and institutions this might be achieved. On 30 October 2006 Lord Stern published his landmark 700 page review of the impact of climate change, entitled, *The Economics of Climate Change: The Stern Review*.

His work was quickly recognised as the definitive account of the economic dangers posed to the planet by global warming but sadly wasn't acted upon, despite his warning that the cost of inaction would be far greater for future generations than the costs of actions taken at the time of the report's publication.

The report's main findings[51] included:

- a 75% chance that global temperatures would rise by between 2-3°C above the long-term average;
- there still being time to avoid the worst impacts of climate change, if strong action was taken immediately;
- climate change potentially having very serious impacts on growth and development;
- the costs of stabilising the climate being significant but manageable; delay being dangerous and much more costly;
- a range of options to cut emissions; with strong, deliberate policy action being required to motivate their take-up; and
- climate change demanding an international response, based on a shared understanding of long-term goals and agreement on frameworks for action.

Despite the report's stark warnings and urgency surrounding its recommendations, in 2013 Lord Stern, speaking at the World Economic Forum in Davos, admitted that he "underestimated the risks, and should have been more "blunt" about the threat posed to the economy by rising temperatures". He noted that, "[now being] on track for something like 4°C [above the long-term average] some of the effects are coming through more quickly than we thought then."[52] Despite these prescient warnings, the world has done little to stem or mitigate the effects of climate change.

[51] http://www.lse.ac.uk/GranthamInstitute/publication/the-economics-of-climate-change-the-stern-review/
[52] https://www.theguardian.com/environment/2013/jan/27/nicholas-stern-climate-change-davos

CARBON PRICING

Since economist Arthur Pigou wrote his seminal essay 100 years ago on the subject of taxing externalities, economists have argued that the well-being of society as a whole would increase if private consumption and production decisions were modified to take the social cost of externalities into account.[53] As noted earlier, externalities are those activities which, in generating pollution and/or congestion, detract from social welfare and/or explicitly increase the costs to, or impede, others going about their business. Indeed, a central barrier to reducing emissions arises from the fact that as individuals and firms do not face the full costs of their GHG emissions, they are not compelled to take them into account, or internalise them, in their decision making.

To address this, governments have, over the past three decades, variously implemented a range of carbon pricing policies to ensure that the external costs of the production and consumption of GHG emissions-intensive outputs are internalised into private costs. By treating these costs like other business costs, the idea is that low-emissions producers will gain market share over high-emissions producers as consumers substitute towards low-emissions products due to their cost advantage. Therefore, carbon pricing is a critical part of a policy suite for the decarbonisation of the economy. Indeed, carbon pricing works alongside other climate policies to reduce emissions by encouraging short run substitution and efficiency measures and changing longer run investment and consumption decisions.

Of course, carbon pricing isn't without its challenges. After all, putting a price on an externality to moderate the effects of the offending activity, while maintaining a nation's or domestic industry's international competitiveness, is easier said than done. After all, in the absence of an international agreement to prevent carbon leakage and a race to the bottom, there is always the temptation to apply a lower carbon price than that applied by a nation's trading partners. Indeed, while many European economies in recent decades have combined higher GDP with falling emissions, that's principally because these countries have offshored their emissions: much of that which was previously manufactured in the EU is now made in Asia. Moreover, aviation and shipping aren't counted against national carbon budgets. According to the Global Carbon Project, a network of scientists, once emissions embedded in imported goods are factored into the EU's carbon emissions, they are about 19% higher than official figures suggest.[54]

To date, over 50 carbon pricing initiatives have either been implemented or are scheduled for implementation, principally with a national, rather than an internationally-coordinated, focus. These are typically concentrated on one or a number of economic sectors, whether industry, power, transport, aviation, shipping, solid and/or liquid fossil fuels, buildings, agriculture or waste management. Power, industry and transport emissions are the most frequently covered, agriculture the least due to challenging emissions measurement. Collectively, this carbon pricing which, in 2019, raised $44bn in revenue for participating governments, covers around 20% of global annual GHG emissions, though there are significant variations in the national coverage of emissions. These range from less than 10% of GHG emissions generated in Spain and Poland to almost 50% in the EU, Mexico, Switzerland and Sweden to nearly 90% in California, with widely varying degrees of sectoral coverage. These variations in coverage are in part a function of the equally varied pricing applied to CO_2 emissions ranging from less than $1 per tonne of CO_2 emissions in Mexico, Poland and Ukraine to $127 per tonne in Sweden, with California at $16, Denmark at $23, the EU at $25 and France at $50. Finland, the first country to implement a carbon pricing regime in 1990, prices carbon emissions at between $59 and $70 per tonne.[55] The national and sectoral coverage is also a consequence of the mode of carbon pricing employed, which is considered shortly.

[53] Pigou, A. C. The Economics of Welfare. 1920. London: Macmillan.
[54] Financial Times (24 October 2019). op.cit.
[55] "State and Trends of Carbon Pricing 2019" State and Trends of Carbon Pricing (June), World Bank, Washington, DC.

Ultimately, the effectiveness of carbon pricing instruments is fundamentally determined by their impact on emissions reductions. However, most countries have found it politically difficult to set prices that are high enough to spur truly deep reductions in CO_2 emissions and facilitate the transition to low carbon technologies. Indeed, in France and Australia, efforts to increase carbon taxes were shelved after a backlash from voters angry about rising energy prices. Moreover, with around 50% of carbon pricing being less than $10 per tonne of CO_2 in 2019, rather disappointingly less than 5% of global GHG emissions are covered by carbon pricing initiatives consistent with achieving the Paris Agreement's goal of limiting climate change.[56] In fact, to meet the Agreement's objectives the Carbon Pricing Leadership Coalition suggests a price of $40-$80 in 2020 and $50-$100 by 2030.[57] Others suggest $140 to $870 per tonne by 2040.[58] Additionally, many sectors require very high carbon prices to achieve net zero emissions without further policy support. For example, unlocking *negative* emissions technology could require carbon prices of up to around $380 per tonne in the UK in 2050.[59] In summary, as the OECD notes in its latest assessment, carbon prices are far too low to reduce emissions and speed up innovation in renewable energy.

Against this disappointing backdrop, the World Bank, in a mildly upbeat fashion, notes that as jurisdictions take action to pursue the Paris Agreement's objectives, pricing regimes globally continue to expand. Indeed, 96 of the 185 Parties to the Paris Agreement, who have submitted NDCs and collectively represent 55% of global GHG emissions, are planning to use carbon pricing to meet their commitments under the Agreement.[60]

Carbon pricing is implemented via two main carbon pricing policy instruments – carbon taxes and emissions trading systems (ETSs).[61] Carbon taxes, which offer greater administrative simplicity than ETSs, set a *price* per unit of emissions and let the market determine the *volume* of emissions. By contrast, ETSs, or cap-and-trade schemes, set the *volume* of emissions and let the trading of emission allowances, or pollution permits, set a *market price*. Whereas some counties or regions solely employ a carbon tax, and others an ETS, many, such as the EU, use both. While each methodology has its pros and cons, carbon taxes arguably help firms better project their carbon costs and transition to decarbonisation investments with greater certainty. By contrast, the uncertain market-determined allowance prices of ETSs can inhibit longer run investment. Additionally, with all major ETSs having seen prices remain at low levels for extended periods, they have had only a minor impact on emissions. Despite these drawbacks, ETSs far outnumber carbon taxes.[62] Consequently, most ETSs have undergone major revisions since their launch which has seen allowance prices increase in most jurisdictions over the last few years. Although available data is limited, there is some evidence to suggest that carbon pricing instruments have reduced industry emissions intensity. Unsurprisingly, carbon taxes have the highest impact on emissions if set at a high level and sustained over time.

[56] "State and Trends of Carbon Pricing 2019". op.cit.
[57] CPLC, Report of the High-Level Commission on Carbon Prices. May 29, 2017.
[58] The daunting task of decarbonising portfolios. Amin Rajan. FTfm. 24 February 2020.
[59] Burke J, Byrnes R and Fankhauser S (2019). How to price carbon to reach net-zero emissions in the UK. London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science.
[60] "State and Trends of Carbon Pricing 2019". op.cit.
[61] For a fuller explanation of how these carbon pricing policy instruments work and their pros and cons, see: The future of carbon pricing in the UK: Report prepared for the Committee on Climate Change. Final report. Vivid Economics. August 2019.
[62] Among the most eloquent of all of the carbon pricing models to have emerged in recent years is the Dynamic Integrated model of Climate and the Economy (DICE) model developed since 1990 by, 2018 Nobel-prize winning economist, William D. Noudhaus. Viewing the economics of climate change from the perspective of acting to stop climate change costs money but ignoring the problem costs more, Noudhaus acknowledges that by devoting output to emissions reductions, economies reduce consumption today but in preventing economically harmful climate change, they increase consumption possibilities in the future. The DICE model comprises myriad variables (some of which when altered change the numbers more than others), while acknowledging the limitations of modelling climate change, itself a moving target. In pinpointing the most efficient tax regime for reducing GHG emissions, also viewed as a moving target, the DICE model gauges the impact on economic welfare, economic output and temperature change in the race to slow the trajectory of global warming. See: The Climate Casino: Risk, Uncertainty, and Economics for a Warming World. William D. Nordhaus. Yale University Press. October 2013.

THE UPS AND DOWNS OF CARBON PRICING

As noted above, the effectiveness of carbon pricing instruments can be judged by their impact on emissions reductions. Although most countries have found it politically challenging to set prices that are high enough to lead to significant cuts in CO_2 emissions and facilitate the transition to low carbon technologies, there are notable exceptions, Sweden and the UK being principal amongst them.

Sweden's punitive carbon tax of $127 per tonne of CO_2 applied to heating and transport has substantially reduced the country's emissions in those sectors. In the transport sector alone, the carbon tax is estimated to have reduced Sweden's emissions by 6% annually.[63] In the UK, the birthplace of the Industrial Revolution powered by coal, GHG emissions have plummeted after the introduction in 2013 of a carbon price floor, that in functioning as a carbon tax of around $25 per tonne, has prompted electric utilities to rapidly switch away from coal to natural gas.[64]

In 2019, Canada introduced one of the most ambitious carbon pricing programs in the world by enacting a nationwide tax on oil, coal and gas to reduce Canada's emissions 30% below 2005 levels by 2030. Having started at $15 per ton of CO_2 in 2019 and rising to $38 per ton by 2022, most of the revenue raised from the carbon tax will be refunded to Canadians through their tax bills to offset higher energy costs for about 70% of Canadians.[65]

In the US, with Congress gridlocked on climate policy, carbon pricing initiatives have been undertaken at the state level. In the Northeast, nine states participate in a cap-and-trade system which auctions a steadily dwindling supply of carbon pollution permits to power plants. As carbon prices under this system have been fairly modest, it is unclear how much these prices have driven emissions reductions in the region though states have used the money raised by the auctions to invest in efficiency and clean energy programs. California, meanwhile, has enacted its own cap-and-trade program that goes beyond power plants by also covering manufacturers, refineries, and other polluters. Likewise, carbon prices have remained modest, in part because the initial cap was set fairly high, and most of California's emissions cuts to date have come as a result of other climate policies, such as the state's efficiency standards for buildings, and aggressive renewable power targets.

But now the downs. The European cap-and-trade system, which sets an overall ceiling on emissions from key industries and allows companies to buy and sell carbon permits has, because of a glut of permits on the market, seen carbon prices in Europe remain consistently low with a commensurately muted effect on emissions. By contrast, the cap-and-trade program introduced by Australia in 2012, which set a price on carbon of $23 per tonne and saw emissions fall nationwide, was, as noted earlier, repealed in 2013 in the face of a fierce political backlash from industry groups and voters. Australia now has a far more lenient carbon pricing program in place, in which large industrial polluters that exceed a pollution baseline can buy carbon credits to compensate. Australia is currently on track to miss its overall goals for cutting emissions.

However, a ray of hope rests with China, the biggest contributor to GHG emissions on the planet. Since 2011, China has been piloting cap-and-trade programs in several cities, with a view to gradually rolling out a nationwide program, starting this year, before applying it to major CO_2 emitting sectors like electricity, steel and concrete. If enacted in full, China will have created the largest carbon-pricing program in the world. Moreover, in liaising with California and the European Union, China hopes to learn from their mixed experiences in designing cap-and-trade programs. Indeed, China may well set the tone of carbon pricing mechanisms from hereon.[66]

[63] VividEconomics (August 2019). op. cit.
[64] These countries have prices on carbon. Are they working? Brad Palmer and Nadjar Popovich. The New York Times. 2 April 2019.
[65] Palmer and Popovich (2 April 2019). op.cit.
[66] Nordhaus (2013). op. cit. concludes with a helpful description of what a fully functioning *international* carbon price regime might comprise.

THE PRINCIPLES FOR RESPONSIBLE INVESTMENT'S INEVITABLE POLICY RESPONSE: PREPARING FINANCIAL MARKETS FOR CLIMATE-RELATED POLICY, REGULATORY AND TRANSITION RISKS

"If we don't take care of our impact on the economy, society and the environment … we inhibit our ability to generate returns from these systems."

Lucy Thomas, Head of Investment Stewardship at the New South Wales Treasury Corporation, August 2019

Launched in 2006, The Principles for Responsible Investment (PRI) is the world's leading independent proponent of responsible investment. Supported by the UN Environment Programme Finance Initiative (UNEPFI) and UN Global Compact, the PRI works to understand the investment implications of environmental, social and governance (ESG) factors and to support its international network of 2,500 investor signatories, of whom almost 1,800 are asset managers and 450 are asset owners, in incorporating these factors into their investment and ownership decisions.

Acting in the long-term interests of its signatories, the financial markets, economies and the natural environment in which they operate, the PRI has two major concerns in relation to climate change. Firstly, as government action globally to tackle climate change to date been insufficient to achieve the commitments made under the Paris Agreement, financial markets have yet to price in a likely forceful near term policy response to climate change. By lacking a strong basis by which to price in climate transition risks and given the absence of a policy marker for markets to anchor to, means that investor portfolios are potentially exposed to significant risk from a disorderly and disruptive transition. Indeed, according to the PRI, only 2% of its signatories are "strategic" in their assessment and reporting of climate risk.[67]

These concerns are shared by a recent academic study, which postulates that the extent to which the climate policy sensitive asset exposures of investors, such as pension funds, will translate into shocks, depends on the ability of market participants to anticipate climate policy measures.[68] The study suggests that if climate policies are implemented early on and in a stable and credible framework, market participants with exposures to climate-policy-relevant sectors should be able to smoothly anticipate the effects, thereby minimising any systemic shock to asset prices. By contrast, in a scenario in which the implementation of climate policies is uncertain, delayed and sudden, market participants with exposures to climate-policy-relevant sectors would not be able to fully anticipate the impact of policies and be exposed to abrupt, systemic price adjustments.

Therefore, perhaps unsurprisingly, in the absence of concerted government action to tackle climate change, the market's default assumption appears to be that no further climate-related policies are imminent. However, as the realities of climate change become increasingly apparent, with pressure for policy action by electorates and businesses, the PRI believes it is perhaps inevitable that governments, in the not too distant future, will be forced to act more decisively than they have done to date. Principal among these catalysts is likely to be the Paris Agreement's *ratchet mechanism*

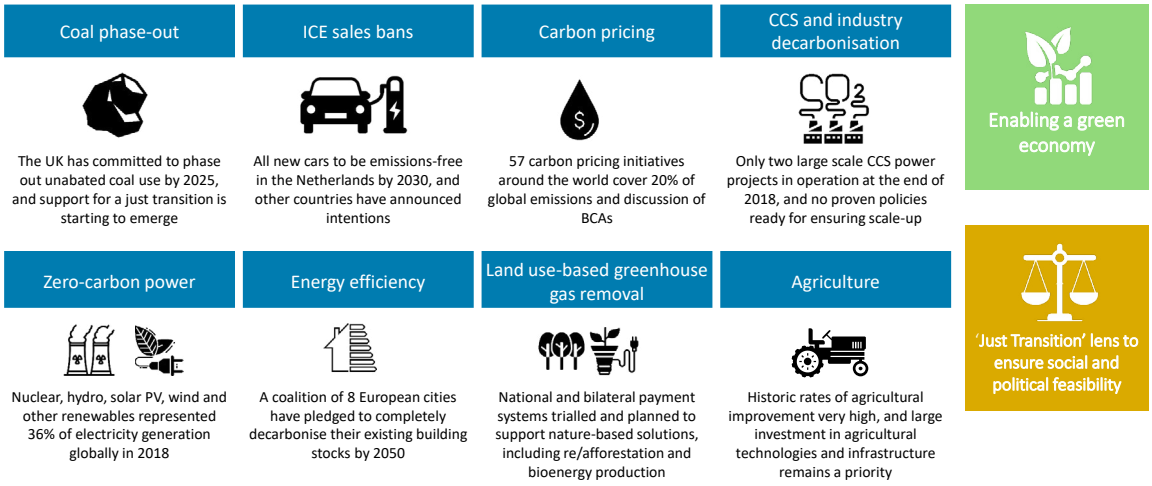
[67] Although the vast majority of asset managers are signatories to PRI, making it an effective lever for change with a good track record, some have argued it's time for the PRI to raise the bar i.e. no longer treat it as enough just to be a signatory. Indeed, while the PRI has been successful in driving desired behaviours, it is evident that not all signatories fully embed its principles into their processes. The PRI has also been accused by some of tending more towards capital serving a wider public interest, thereby putting climate priorities first and investment second.

[68] A climate stress-test of the financial system. Stefano Battiston, Antoine Mandel, Irene Monasterolo, Franziska Schütze and Gabriele Visentin. Nature of Climate Change. Vol 7. April 2017.

which, in 2023, provides for a global stock take on climate mitigation and, in 2025, when countries submit their third round of climate pledges, or NDCs.[69] Additionally, such a policy shift will, if *Moore's Law* is any guide,[70] be easier to engineer by the likely advances in and declining cost and improving performance of renewable, low carbon and carbon capture technologies.

In response to these concerns, the PRI has, through its Inevitable Policy Response (IPR) project,[71] sought to prepare investors for these climate transition risks by forecasting a central scenario of accelerated and disruptive policy actions occurring between 2023 and 2025 and quantifying the impact of this response on the real economy and financial markets. Integral to this IPR, is the PRI's Forecast Policy Scenario (FPS) – a robust real world analysis of climate-related policy and technological developments that are likely to emerge between now and 2050. Acknowledging that climate policy developments and innovations are highly dependent on local and regional initiatives, with a significant geographic disparity in adoption rates, the FPS identifies eight critical policy levers which, based on current trends, are expected to feed into the Paris Agreement process, and drive significant, albeit uncoordinated, actions by governments to ultimately secure an accelerated and just transition to a net zero carbon emissions world. The EU, China and the US are expected to set the tone on many policies, while the application of border carbon adjustments (BCAs), or border carbon taxes, to prevent emissions being exported (carbon leakage), will help facilitate the transmission of these policies across countries and regions. *Figure 7* depicts these eight key climate policy levers, while *Figure 8* sets out the eight key climate policies that are likely to result.

Figure 7: Forecast climate policy levers from current trends: The most likely policy levers to secure an accelerated and just transition are starting to emerge

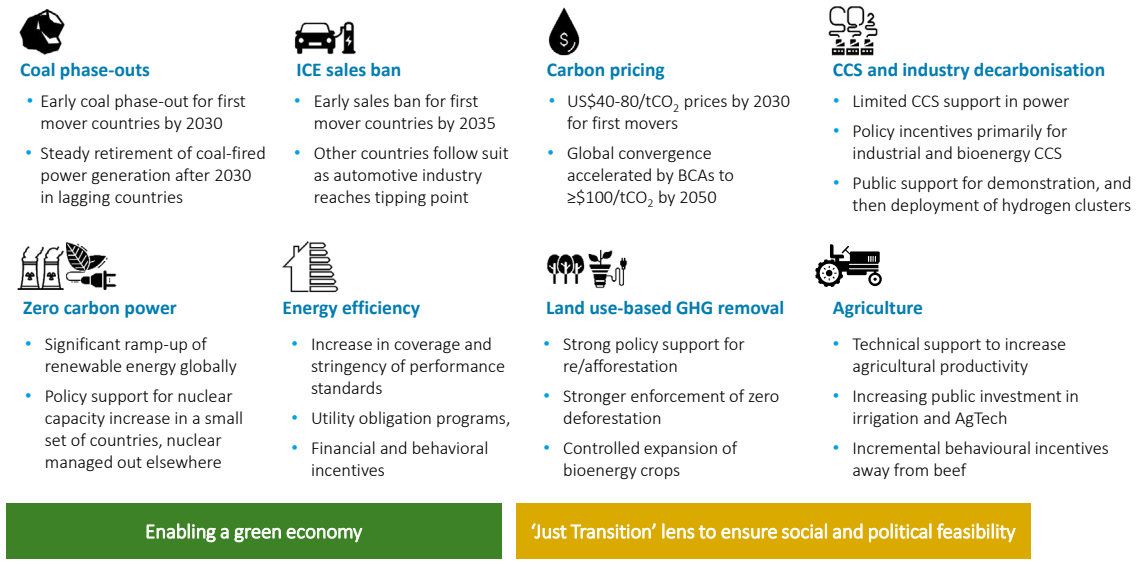


A Border Carbon Adjustment (BCA), or border carbon tax, is a unilaterally levied national or regional tax to prevent carbon-intensive production, subject to a domestic carbon tax, being transferred to countries with lower (or no) carbon taxes, i.e. to prevent carbon leakage.

Source: PRI, The Inevitable Policy Response, December 2019.

[69] See: The Paris Agreement box earlier in the paper.
[70] In 1965, Gordon Moore, co-founder of Intel, made a prediction from careful observation of an emerging trend, that computing would dramatically increase in power, and decrease in relative cost, at an exponential rate. Moore's Law, became the golden rule for the electronics industry, and a springboard for innovation and has since been adopted by other industries.
[71] https://www.unpri.org/inevitable-policy-response/what-is-the-inevitable-policy-response/4787.article

Figure 8: The PRI's The Inevitable Policy Response forecast policies could secure an accelerated and just transition to a net zero carbon emissions world



Carbon capture and storage (CCS) is the process of capturing waste carbon dioxide (CO_2) usually from large point sources, such as a cement factory or biomass power plant, transporting it to a storage site and depositing it where it will not enter the atmosphere.

Source: PRI, The Inevitable Policy Response, December 2019.

THE PRI'S RECOMMENDATIONS FOR ASSET OWNERS AND ASSET MANAGERS

The PRI isn't alone in cautioning against a disorderly and disruptive transition arising from a likely forceful near term policy response to climate change. Indeed, global investment consultant, Mercer, recently modelled the potential financial impacts of climate change under different scenarios and found that sudden sizeable return impacts are likely to dominate pension portfolios that fail to build in sustainability themes.[72]

Therefore, the message flowing from the PRI's analysis to asset owners and asset managers is quite simple: act now to protect and enhance value. Indeed, the PRI's analysis highlights the importance of a forward-looking climate risk assessment to better prepare for climate transition risks and mitigate financial losses associated with the IPR. According to the PRI, both asset owners and asset managers should prepare for the PRI FPS as a likely central business case. Perhaps unsurprisingly, the UN-supported body also suggests incorporating both IPR and FPS into strategic and dynamic asset allocation, sector allocation, manager selection and monitoring and proxy voting recommendations.

[72] Investing in a Time of Climate Change – The Sequel. Mercer LLC. 2019.

DEVELOPING MORE EFFECTIVE ASSESSMENT, DISCLOSURES, PRICING OF AND EXPOSURES TO CLIMATE RISKS

"There is one and only one social responsibility of business--to use its resources and engage in activities designed to increase its profits."

Milton Friedman. The Social Responsibility of Business is to Increase its Profits. The New York Times Magazine, 13 September, 1970

IS CARBON RISK EFFICIENTLY PRICED?

The view as to what constitutes corporate social responsibility has changed markedly over the past 50 years, even over the past five, with businesses increasingly being assessed on their environmental, social and governance (ESG) credentials. However, for many asset owners and even for some asset managers, the challenge remains demonstrating that a failure to incorporate ESG considerations into investment strategies could be materially detrimental to outcomes. After all, the view that financial markets do not reward sustainable behaviour, or for that matter penalise it, has long been held. This is principally a result of *market inefficiency* (a failure to internalise the costs of 'unsustainable' development in security pricing), which is principally a result of *market failure* (companies not disclosing adequate information on the sustainable development risks and opportunities of their activities). Crucially, the principal function of financial markets to allocate capital efficiently between competing investment opportunities is being compromised. While the challenge is no different for assessing whether carbon risk is efficiently priced in financial markets, this particular challenge is exacerbated by the paucity of empirical studies on the subject and no overall consensus.

According to one recent study on pricing carbon risk, by Bolton and Kacperczyk, US firms with higher CO_2 emissions earn institutional investors higher returns, suggesting that investors are demanding compensation, or a carbon premium, for their exposure to carbon risk.[73] This risk premium is *partly* explained by institutional investors divesting from, and thereby possibly under pricing, energy, utility and transport stocks with high scope 1 emissions. However, in failing to screen those industries with scope 2 and 3 emissions, notably those whose activities are linked to scope 1 emitters, this carbon premium appears to be narrowly concentrated.

One obvious question raised by this study is why isn't this carbon premium arbitraged away? This is partly addressed by another recent study, albeit one more widely focused on ESG issues more generally, rather than just the decarbonisation of portfolios. In this study, the researchers found that the ESG preferences of some institutional investors are so strong that even when undervalued, against conventional metrics, high scope 1 emitting stocks will never find their way into the portfolios of these investors, just as overvalued ESG stocks will rarely be sold. Additionally, the study postulates that in periods of low market liquidity, the leverage usually employed to capitalise on this type of anomaly may be in short supply.[74]

[73] Do investors care about carbon risk? Patrick Bolton and Marcin Kacperczyk. October 2019. These findings were made after controlling for size, book-to-market,momentum, and other factors that predict returns and are unexplained by differences in unexpected profitability or other known risk factors.
[74] ESG preference and market efficiency. Evidence from mispricing and institutional trading. Cao, Jie and Titman, Sheridan and Zhan, Xintong and Zhang, Weiming Elaine. November 2019.

However, yet another study, that sought to understand whether by reducing the carbon emissions of portfolio holdings, returns were compromised, found that they weren't. In fact, these portfolios earned superior returns, a reverse carbon premium if you will. This was particularly evident in Europe relative to the US. Moreover, perhaps unsurprisingly, these returns were given an added boost by positive institutional fund flows into decarbonisation strategies.[75]

Of course, in interpreting the conclusions of these studies, one must disentangle the decision to insulate a portfolio from declining commodities prices from those which focus on GHG emissions considerations, accepting that the two decisions aren't always entirely separate.

Finally, recent research undertaken by Columbia Threadneedle suggests that carbon risk premia are not a function of the carbon intensity of an industry or individual company, i.e. whether they are a high or low emitter, but rather whether that industry or individual company in question has the ability to transition to a low carbon world, via a chosen pathway, without being tripped up by myriad costly known unknowns along the way.[76] As Charles Darwin famously said, "it isn't the strongest… that survives, but the one most responsive to change."[77] This ability to sidestep, so-called, *carbon lock-in* is driven by the ability to negotiate a number of exogenous factors, such as current and prospective future regulation, legislation, carbon taxes, changes in consumer preferences and activist pressure, as well as when and how the capital expenditure (capex) budget is deployed and the substitutability of that capex. Indeed, long-lived capex recently deployed with low substitutability of use that is caught by these other endogenous factors is likely to limit the ability to avoid carbon lock-in.

Interestingly, energy companies, more so than any other sector over the past five years, have chosen transition pathways that not only continually manage to successfully sidestep carbon lock-in, evidenced by an adaptability improvement score that far surpasses that of any other industry, but also have reduced emissions by a greater quantum than any other.

The suggestion that carbon intensity exhibits no independent signal when viewed in isolation is a compelling one in that it would seem to explain why the evidence around the existence of a carbon risk premium is inconclusive. Indeed, the market may well be pricing a considerable number of industries and their constituents against the wrong carbon metric.

OBSTACLES TO ASSESSING THE CARBON AND GHG EMISSIONS EXPOSURE OF INSTITUTIONAL INVESTOR PORTFOLIOS

Not that any of the above should come as a surprise. After all, there are three main obstacles asset managers and asset owners face in establishing the carbon intensity of their portfolios – the paucity of quality GHG emissions data analytics, the inconsistency of ESG data, of which climate risk is a key "E" risk factor, and inadequate disclosures by companies of their GHG emissions. Obviously, the market failure of companies not disclosing adequate information on the sustainable development risks and opportunities of their activities severely compromises the accuracy of ESG data and of the GHG emissions data compiled by data vendors and analysed by asset managers.

Scope 1, 2 and 3 emissions data analytics

First the emissions data analytics. As noted earlier, an organisation's GHG emissions are broken down into three categories, or scopes, by the Greenhouse Gas Protocol in order to better understand their source and to address emission hotspots. Scope 1 captures an organisation's direct emissions under its control, Scope 2, its indirect emissions, again within its control, from the energy purchased and used by the organisation, and Scope 3, all other indirect emissions within its value, or supply, chain from sources it does not own or control. Covering emissions associated with

[75] Decarbonization factors. Alex Cheema-Fox, Bridget R. LaPerla, George Serafeim, David Turkington and Hui Wang. November 2019.
[76] Kyle J. Bergacker, CFA (2019). *Climate Risk Modelling*, Columbia Threadneedle Investments.
[77] Charles Darwin. On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. November 1859.

purchased goods and services, business travel, procurement, waste and water, Scope 3 emissions usually comprise the greatest share of an organisation's carbon footprint. Often, the environmental impact of a company's supply chain is many times that of its own operations. According to the Carbon Trust,[78] which provides supply chain emissions measurement services, organisations can by measuring their Scope 3 emissions:

- Assess where the emission hotspots are in their supply chain;
- Identify resource and energy risks in their supply chain;
- Identify which suppliers are leaders and which are laggards in terms of their sustainability performance;
- Identify energy efficiency and cost reduction opportunities in their supply chain;
- Engage suppliers and assist them to implement sustainability initiatives;
- Improve the energy efficiency of their products, and
- Positively engage with employees to reduce emissions from business travel and employee commuting.

However, measuring emissions is not an exact science with Scope 3 data, in particular, being poorly defined, largely estimated and subject to double counting. Indeed, there is significant disparity amongst data providers in capturing Scope 3 emissions, with each adopting different methodologies and taking a different view on the same factor, and considerable differences between estimated data for Scope 3 emissions from these providers as compared to the companies' own reporting of their Scope 3 emissions. A severe case of garbage in, garbage out (GIGO) you might think. However, despite these limitations, investors are using the available data, principally Scope 1 and 2, but also Scope 3 data, often after making judgmental adjustments, to formulate views on which companies are striving to boost their sustainability credentials and then using the data to track how these companies progress over time.

To demonstrate how precarious this process is, Alecta, the €90bn Swedish pension giant, obtained approximated Scope 3 data for its portfolio of investee companies, from a reputable third-party data vendor. Depending upon the carbon pricing scenarios used in its assumptions, the inclusion of Scope 3 data had a marked negative effect on Alecta's equity portfolio. Under the International Energy Agency scenario,[79] if only Scope 1 and 2 data are used, the portfolio falls by 5% but is magnified to 21% when Scope 3 data is also used. However, under the Intergovernmental Panel on Climate Change (IPCC) price scenario,[80] the fall is even bigger: from 9% to 29%.[81]

[78] https://www.carbontrust.com/resources/what-are-scope-3-emissions
[79] The IEA scenario envisages the price of carbon dioxide emissions per tonne to rise from $30 in 2019 to $140 in 2040 in Europe; and from $5 to $140 in the US over the same period.
[80] According to Rajan (24 February 2020) op. cit, under the IPCC scenario, the carbon price needs to rise from $30 in Europe and $5 in the US, to $230 per tonne in both by 2040.
[81] Rajan (24 February 2020). op.cit.

The frictional costs of decarbonising a portfolio

Of course, seeking to progressively decarbonise a portfolio as a result of this analysis comes with both short and longer-term frictional costs. Indeed, divesting from and replacing fossil fuel assets, can ultimately amount to hundreds of basis points. Further, as company policies and technologies evolve, the individual investments that comprise an appropriately divested portfolio will likely change. As a consequence, investors need to undertake ongoing research and management costs to maintain compliance with divestment goals. This introduces a costly element of active management.

Indeed, in combining estimates of transaction costs and ongoing compliance costs to US endowments, these frictional costs of divestment would variously result in up to 12% of value being lost over a 20-year period.[82] Moreover, these frictional costs are in addition to foregone diversification benefits and any reduction in investment returns that divestment might impose. All of these points are well illustrated within a recent annual review of the Bates College Endowment which reported, *"To guarantee divestment from 200 public companies, our investment advisers estimate that between a third and a half of the entire endowment would need to be liquidated and replaced with separately managed accounts. Were we to guarantee a fossil fuel free endowment more broadly than the 200 companies, greater than half of the endowment would need to be liquidated. In either scenario, the transition would result in significant transaction costs, a long-term decrease in the endowment's performance, an increase in the endowment's risk profile, and thus a loss in annual operating income for the college."*[83]

ESG data

According to PwC, many ESG data providers have inconsistent coverage, lack standardised methodologies provide subjective ESG assessments of companies and attempt to differentiate themselves by adopting proprietary metrics.[84] This makes it extremely difficult to measure ESG factors consistently and creates significant concentration risks if a single ESG data provider is used to inform investment decisions, monitoring and reporting.

In particular, PwC found there is only a moderate degree of correlation in Environmental coverage, i.e. including climate risk, metrics and data between providers while, geographically, ESG data coverage is weak across Asia and almost non-existent in the Middle East, Africa and South America.

However, when it comes to generating effective data analytics, all is not lost, given that there are some very significant and usable data sources currently available and those asset managers with strong stewardship and ESG credentials are working on class leading and differentiated solutions. Over time, this will enable them to provide asset owners with more accurate data to further inform their decision making.

[82] Bergacker (2019). op.cit.
[83] Throwing the baby out with the bathwater? A case study on Divestment. Kyle J. Bergacker, CFA (2019). Source: Arizona State University, University of Washington and Compass Lexecon: "Frictional Costs of Fossil Fuel Divestment", May, 2016.
[84] ESG update. PwC. March 2020.

Company disclosures of GHG emissions

However, this aspiration continues to be compromised by inconsistent company disclosures of GHG emissions. While there are a number of global reporting frameworks that help companies *voluntarily* measure and report sustainability information to a wide range of stakeholders, not all pull in the same direction. Although CDP[85] is the main vehicle for GHG emissions reporting, probably the two most prominent are the Task Force on Climate-related Financial Disclosures (TCFD) and the Sustainability Accounting Standards Board (SASB). Although TCFD and SASB are newer entrants than CDP, they have a much broader scope than the latter.

The TCFD

The TCFD was set up in December 2015, in the lead up to the Paris Agreement, by the Financial Stability Board (FSB), an international body that seeks to increase the stability of international financial markets. Established to provide a *voluntary* reporting framework within which *companies* can develop and provide effective climate related financial disclosures to investors and others across the investment chain, these disclosures, based on recommendations released by the TCFD in June 2017, cover four areas: governance, strategy, risk management and metrics and targets:

- *Governance*: Disclose the organisation's governance around climate-related risks and opportunities;
- *Strategy*: Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy and financial planning where such information is material;
- *Risk management*: Disclose how the organisation identifies, assesses, and manages climate-related risks, and
- *Metrics and targets*: Disclose the metrics and targets used to assess and manage relevant climate- related risks and opportunities where such information is material.

With institutional investors increasingly seeking to commit money to those companies that support the transition to a low-carbon economy, these disclosures *should* enable investors to gauge which businesses are most at risk and which are best prepared. Indeed, with greater disclosure and transparency comes the ability to better assess and price climate-related risks and opportunities pertaining to each business which, in turn, leads to more accurately priced securities, more price efficient financial markets and more efficient capital allocation. Moreover, the widespread adoption of TCFD-aligned assessment has the potential to enhance companies' own risk management, capital budgeting and capital allocation.

Over 1,000 organisations are now supporters of the TCFD, including the world's largest banks, asset managers and pension funds. However, the TCFD, in its *2019 Status Report*, which provides an overview of the extent to which companies in their 2018 reports included information aligned with the TCFD framework, found that:

- disclosure of climate-related financial information remains insufficient for investors;
- more clarity is needed on the potential financial impact of climate-related issues on companies, and
- the majority of companies using scenarios do not disclose information on the resilience of their strategies.

[85] CDP, formerly the Carbon Disclosure Project, is an international, not-for-profit organisation that works with over 6,000 companies and over 550 cities to disclose their impacts on the environment and natural resources so as to help them ensure that an effective carbon emissions reductions strategy is made integral to their operations.

On the back of these results, the FSB has asked the TCFD to deliver another status report to the FSB in September 2020. Meanwhile, the TCFD will look to actively promote and monitor adoption of its recommendations and perform additional work to develop process guidance around how to introduce and conduct climate-related scenario analysis, and identify business-relevant and accessible climate-related scenarios.

SASB

Additionally, SASB, an independent standards board based in the US, has, since 2011, developed 77 industry-specific standards, to help companies around the world report on the financially material sustainability topics that matter most to investors. Whether used alone, alongside other reporting frameworks, or as part of an integrated report, a company considering use of SASB standards self-determines which standard(s) is (are) relevant, which disclosure topics are financially material to its business, and which associated metrics to report. Working alongside and with multiple organisations seeking to advance reporting and corporate disclosure on sustainability issues, SASB complements global initiatives including the Global Reporting Initiative (GRI),[86] the International Integrated Reporting Committee (IIRC),[87] the CDP and the TCFD, amongst others.

Although compliant with TCFD guidelines, at the end of 2019, only around 120, mainly US, companies were using SASB standards in their ESG reporting with companies like GM, Merck and Nike being early adopters of the SASB guidelines. Moreover, of these, only 28% feature a full adoption of SASB's recommendations, with 72% making use of some, but not all, of the industry-specific recommendations. SASB, like the TCFD, continues to adapt and actively promotes its standards to companies, so that they can provide investors with the information they need to make informed decisions about the sustainability of the company's activities.

Finding solutions to the challenges

Of course, given how new the science of climate disclosure is, it is perhaps inevitable that these bodies are each grappling with what good looks like and which metrics best capture the climate-related risks of and opportunities offered by reporting entities operating in myriad sectors.[88] Indeed, one size does not fit all. Moreover, in making their disclosures, most companies, few of whom understand what *sustainability risk* means for their business, treat climate change separately from other ESG risk factors. Sustainability risk is defined as an ESG event, climate change being a subset of the "E" risk, which, if it occurs, negatively impacts the value of an investment. Then there's the frequent misalignment between companies and their stakeholders as to what constitutes sustainable economic activity and a sustainable outcome.

Once again, a recent intervention by the World Economic Forum (WEF) is helpful. In attempting to address the policy and industry discussions over which ESG metrics are material for company reporting, the WEF, in January 2020, published a consultation on 30 key metrics that drive sustainable value creation.[89] Within those 30, they recommend companies report the following on their climate exposures:

- GHG Protocol Scope 1 and 2 emissions in tonnes of carbon dioxide equivalent (tCO_2e) and estimates for GHG Protocol Scope 3 emissions where material, and
- TCFD-aligned reporting on material climate risks and opportunities, noting that if climate change is material in the short, medium or long-term, there should be disclosure on strategy, metrics and targets, including whether the company has committed to set a science based target in line with achieving net zero emissions by 2050.[90]

[86] GRI is an independent international organisation, based in the Netherlands, which, since 1997, has, through its GRI Sustainability Reporting Standards, or GRI Standards, helped businesses and governments worldwide understand and communicate their impact on critical sustainability issues such as climate change, human rights, governance and social well-being.
[87] The, UK-based, International Integrated Reporting Council (IIRC) is a global coalition of regulators, investors, companies, standard setters, the accounting profession, academia and NGOs. Its mission is to align capital allocation and corporate behaviour to the wider goals of financial stability and sustainable development through integrated reporting and thinking.
[88] This is, of course, a broader topic than establishing GHG emissions/carbon intensity.
[89] Toward Common Metrics and Consistent Reporting of Sustainable Value Creation. World Economic Forum. Prepared in collaboration with Deloitte, EY, KPMG and PwC. January 2020.
[90] World Economic Forum (January 2020). op.cit. p.8.

However, as noted earlier, company disclosures on the climate risk relating to their activities remains voluntary. Also, different providers often pull in different directions. This has to change. Indeed, only by companies fully disclosing the climate risks associated with their activities in a more standardised and consistent manner, ideally benchmarked to science-based targets aligned with the Paris targets, will asset managers and asset owners be able to back the winners – those with the technologies and competitive advantages to thrive in the transition to a net zero carbon emissions world. Delaying this transition through inadequate disclosures will simply heighten the risks of shocks to the financial system and a sudden collapse in asset prices. This latter point hasn't been lost on the UK's Financial Conduct Authority (FCA) which, in its latest consultation document, recognises "the significant and complex impact [of climate change] on most, if not all, listed companies'… assets and prospective profits."[91] Given this, the FCA proposes that all UK listed companies will be required to state whether they comply with TCFD disclosures and if not, to explain why. Additionally, all FCA-regulated firms, such as asset managers and life insurers, may be subject to enhanced climate-related disclosures.

[91] Proposals to enhance climate-related exposures by listed issuers and clarification of existing disclosure obligations. Consultation paper CP20/3. FCA. March 2020.

THE ROLE OF ASSET MANAGERS AND ASSET OWNERS IN SECURING A MORE SUSTAINABLE FUTURE

"A question for every company, every financial institution, every asset manager, pension fund or insurer: what is your plan?"

Mark Carney, 13 October 2019

The investment consultant, WTW, has for some time pondered the concept of the +1.5°C portfolio with the aim of identifying the likely key characteristics of an economy, and hence the future investment opportunity set, consistent with global warming of no more than +1.5°C above pre-industrial levels. While this defines a destination rather than necessarily telling us how we can get there, it is a destination that has been inadequately articulated so far.

As Tim Hodgson at WTW's Thinking Ahead Institute (TAI) suggests, "designing a +1.5°C asset portfolio to mobilise capital for a sustainable future requires some big thinking and intensive collaboration, not to mention transformational change that extends way beyond the borders of the investment industry."[92] Indeed, this will necessitate thinking about the implications for how the fiduciary role is defined, for stewardship and corporate governance responsibilities and for other aspects of the investment process.

Hodgson also points out that of the estimated $530tn stock of global productive assets, the investment industry manages about $90tn and asset owners, big and small, own a subset of that. So what role can and do asset managers and asset owners, both institutional and individuals, play in ensuring capital flows to those companies and those productive assets that prospectively secure a sustainable future?

To answer that question, one should look at how the various stakeholders interact with one another, as interactions really do matter. For instance, although individuals *individually* hold far less sway than government, companies, asset managers and institutional asset owners, *collectively* the consumption choices individuals make, how they invest their savings and mobilise themselves to resolve an issue, whether via social media or peaceful protest on the streets, isn't lost on the governments they elect, the companies from who they purchase goods and services, and the asset managers and institutional asset owners through whom they invest their savings. Indeed, as noted earlier, those companies that have skirted around the climate issues pertaining to their business are recognising that *they* need to earn their social licence to operate from consumers, investors and wider stakeholders, by demonstrating that their actions are genuinely moving the world to a more sustainable place.

Likewise, the significant influence that asset managers and institutional asset owners have in transitioning the world to a low carbon future, by *collectively* engaging with policymakers and regulators and exercising responsible stewardship over companies, is potentially game changing.[93] Indeed, the lack of meaningful policy progress globally means there is ever-increasing pressure on asset managers and asset owners to drive more ambition in this low carbon transition.[94]

[92] The +1.5°C asset portfolio. Tim Hodgson. Thinking Ahead Institute (TAI). Top1000Funds. 25 February 2020.
[93] The unilateral and collective action being taken by asset managers and asset owners, through initiatives such as Climate Action 100+, is considered later in the paper.
[94] Acknowledging this, Roger Urwin, of WTW's Thinking Ahead Institute, in 2018, coined the label *Universal Owners*, defining these as investors who own the externalities associated with their portfolio companies. Urwin identifies three avenues by which Universal Owners can manage the risks associated with such externalities: active ownership, seeking to influence public policy and using an investment strategy influenced by ESG considerations. See: Universal Owners: The Idea Reshaping Asset Management. Dan Mikulskis. March 2019.

Mark Carney, amongst others, has laid responsibility for climate change action firmly at the doors of corporations, financial institutions and asset owners,[95] albeit accepting the role that government must play in providing incentives and imposing rules and prohibitions to curtail the most damaging activities in the transition to a net zero carbon emissions world. This shouldn't come as any great surprise given the pivotal role asset managers and asset owners play in the financial system, owing to their often vast asset portfolios, their interactions with corporate leaders and long timeframes.

That said, there is no hiding from the fact that the scale of the problem of decarbonising the world economy is immense. Indeed, given that the remaining global carbon budget before +1.5°C is contravened is estimated at 350 gigatonnes of carbon dioxide ($GtCO_2$), the 850 $GtCO_2$ that is likely to be released by the world's existing energy infrastructure and that either planned or already under construction will, on its own, breach this pivotal tipping point.[96]

And therein lies the challenge. Most institutional investors with their long-dated obligations and the need to deliver inflation-beating returns, typically allocate the majority of their capital to public and private equity, real estate and infrastructure assets. Increasingly, such allocations are managed with Environmental, Social and Governance (ESG) overlays,[97] with some aligning their investment strategy with the UN's Sustainable Development Goals (SDGs).[98] However, little of the world's infrastructure with high associated GHG emissions is *directly* owned by asset managers and asset owners. Indeed, most institutional investor exposure to these assets is indirect. Moreover, many institutional investors are focused on their primary financial objectives as equity shareholders and therefore do not approach their stewardship activities with a focus on holding companies to account for their capital budgeting decisions based on sustainability tests against carbon intensity metrics.[99] Stewardship is typically delegated to asset managers, and a clear understanding of the objectives of engagement policies between an investment focus and a focus on wider public policy priorities often remains elusive. The difference between a focus on assessing and managing potential risk exposures, compared to a focus on campaigning for change, can be significant.

Moreover, although it is becoming clear how much policymakers expect to place responsibility for leadership towards funding transitioning to a low carbon economy on asset managers and institutional asset owners, some have yet to formalise an ESG risk management, or responsible investment, policy with fewer still having formally articulated how they manage the risks that may arise from the transition and physical risks of climate change.[100] Nowhere is this more evident than in the US,[101] which stands in stark contrast to countries like France, the Netherlands, the UK, Sweden and Canada where government is variously leading the charge on climate change and regulators require pension fiduciaries, in particular, to integrate material ESG considerations, including climate change risk management, into their portfolios as well as report transparently on these policies.

[95] Firms ignoring climate change will go bankrupt. The Guardian. 13 October 2019.
[96] Hodgson (February 2020). op.cit.
[97] ESG integration (covered later in the paper under *Potential mitigating actions to climate change risk available to asset managers and asset owners*) being a common and increasingly preferred approach.
[98] The United Nations' 17 Sustainable Development Goals (SDGs), introduced in 2015 and agreed by 193 member countries, set out to achieve by 2030 defined sustainability goals for all (on everything from eradicating poverty and hunger to building liveable cities) regardless of income and wealth. Those SDGs that most closely align to achieving a just transition to a net zero carbon economy are: 3. Good Health and Wellbeing; 6. Clean Water and Sanitation; 7. Affordable and Clean Energy; 9. Industry, Innovation and Infrastructure; 11. Sustainable Cities and Communities; 12. Responsible Consumption and Production; 13. Climate Action; 14. Life Below Water, and 15. Life on Land.
[99] It is acknowledged that this is a narrow test of sustainability. As well as being focused on the GHG dimension, it is also backward-looking. Forward-looking assessment is important here.
[100] Investment consultant LCP, found that, despite the increased percentage of asset managers with board level accountability for ESG, up from 50% to 70% in 2 years, only 52% of asset managers gave a reasonably detailed description of their approach on climate change, despite the widespread pressure on institutions to respond to growing demands for a faster transition to a net zero carbon economy. LCP found that the action most commonly undertaken is engagement with companies, with climate change regarded as a key engagement topic in 49% of cases.
[101] See: US public pension funds lag on climate. Scott Kalb. New America. Top1000Funds. February 28, 2020. According to the New America Responsible Asset Allocator Initiative (RAAI), which analysed 74 of the largest public pension plans and sovereign wealth funds in the US, only 16 or 22% of the US public plans analysed mentioned "ESG" or "responsible investing" in their annual reports, public documents and on their websites. This compares with 78% of the 123 global public plan peers rated by RAAI who issued a public statement on their responsible investing policy. However, although the US punches below its weight, with 80% of the 74 rated US public plans finishing in the third and fourth quartiles, it placed second among nations with the most plans in the top quartile of responsible investors, given the RI credentials of notable heavyweight US institutional asset owners such as CalPERS, CalSTRS, UC Regents Investment Funds, Colorado Public Employees Retirement Association, New York State Common Retirement Fund and Washington State Investment Board. However, the RAAI also rated US public plans on having dedicated staff for responsible investing (14% of US public plans scored versus 50% for global peers), providing guidelines for external managers on ESG priorities (15% vs 63%), joining partner organisations on responsible investing, such as the PRI or Ceres (22% vs 80%), integrating ESG factors into the decision making process (15% vs 60%), and publishing a downloadable report on responsible investing/ESG programmes (12% vs 36%). RAAI researchers also examined US public pension plan actions on the United Nations' Sustainable Development Goals (SDGs). They found only 3% of US public pension plans reference SDGs in their investment strategy, versus 25% of global peers.

REGULATORY AND POLICY MOMENTUM

With increasing recognition of the role that asset managers and asset owners can play in transitioning the world to a low carbon future, so policymakers and regulators are upping the pressure on both to make ESG, climate change risk management in particular, central to their decision making and wider processes. Indeed, both are having to navigate an increasingly ambitious, complex, evolving and far reaching regulatory landscape, with a number of new regulatory requirements beginning to emerge in the UK and Europe driving the agenda. Notable among these are draft European rules, which are expected to be finalised in the coming few months, requiring asset managers to integrate sustainability risk into all aspects of their operations.[102]

However, it is evident that regulators are still getting to grips with the issues, not least in having to grapple with new, unique datasets and benchmarks, with little history to guide them, in determining how to bring about meaningful change, whether by stick or carrot, and in aligning these edicts and incentives with the objectives of the Paris Agreement. Additionally, there's the sheer breadth of regulation, most of which has been drafted without reference to other regulation which seeks to achieve similar though subtly different objectives and some of which, rather ambitiously, attempts to apply its provisions universally to a disparate range of financial institutions, markets and asset owners.

In short, a more collaborative approach by regulators which aligns with the targeted outcomes of the Paris Agreement needs to be adopted.[103] However, regulatory change is now beginning to emerge at, what looks like being, the start of a broader reform program.

FIDUCIARY DUTY – A CONSTRAINT OR A FACILITATOR TO MORE CLIMATE-FRIENDLY PORTFOLIOS?

It was noted earlier that from a regulatory perspective, asset managers and asset owners should approach climate change as a financial, rather than as an environmental, risk. That is, to understand how climate change might impact the value of an investment, rather than require the setting of definitive environmental targets to achieve positive environmental outcomes. Again, as already noted, this dichotomy is often conflated. However, this distinction is important particularly for asset owners, with a defined fiduciary duty, who need to think about whether and, if so, how to approach climate change on two different levels. Indeed, for many asset owners this conflation may fall within their fiduciary duty, whereas for others it may take them beyond what their fiduciary duty dictates and necessitate a value judgement. Again, as noted above, for many the fiduciary role for stewardship and corporate governance responsibilities and for other aspects of the investment process may need to be redefined. That said, the scope of fiduciary duty, especially within the UK and many European countries continues to evolve and widen.[104]

Behavioural factors also have a role to play in accelerating asset owner engagement with climate change risk factors, by virtue of how prudently fiduciary duty is often framed. Indeed, as a consequence, some asset owners tend to be loss averse, driven by the fear of being burned by those risks that their peers have successfully navigated. We'll return to behavioural factors later in the paper.

[102] These include ESMA Technical Advice on integrating sustainability risks and factors in the UCITS Directive, AIFMD, MiFID II and the delegated acts under Solvency II and IDD, which variously necessitates: integrating sustainability risks and factors in developing engagement strategies, with a view to reducing the principal adverse impact of sustainability factors on investee companies; the inclusion of sustainability risks when establishing, implementing and maintaining an adequate and documented risk management policy; taking into account sustainability risks when assessing the security, quality, liquidity, and profitability of a portfolio as a whole and the potential long-term impact of investment strategy and decisions on sustainability factors. There have also been a number of developments in Europe introducing very comprehensive changes for assets managers, notably the EC Action Plan on Sustainable Finance; Sustainable Finance Disclosure Regulation; and The EU Technical Expert Group Final Report on Taxonomy. Additionally, as noted earlier, within the UK, the PRA Supervisory Statement: Enhancing banks' and insurers' approaches to managing the financial risks from climate change (SS3/19), the provisions of which capture particular asset management products, require firms: to address the financial risks from climate change through their existing risk management frameworks, while recognising that the nature of the risks requires a strategic approach; to conduct scenario analysis to determine the impact of the financial risks from climate change on their overall risk profile; to consider whether further disclosures are necessary to enhance transparency on their approach to managing the financial risks from climate change.

[103] See: https://www.ngfs.net/en and https://www.bankofengland.co.uk/climate-change/climate-financial-risk-forum

[104] In the UK, after over 30 years of debate and a continued lack of clarity, the 2017 Law Commission Report effectively established that there was no legal reason why UK pension schemes could not adopt ESG investment policies. This was followed by a letter from the UK government's Environment Audit Committee to the UK's 25 largest pension schemes requesting details of their Responsible Investment Policy and the subsequent adoption of climate risks into UK pension fund guidance from The Pensions Regulator. The PRI has commissioned work on this in several jurisdictions.

Finally, anecdotal evidence suggests that some sponsors of institutional asset owner portfolios, particularly those sponsors with strong climate credentials and, indeed, those seeking to meaningfully address the reputational, regulatory, transition and physical risk challenges to their operations, are prepared to underwrite any potential short-term hits to investment return from encouraging the asset owner to pursue a more climate-friendly investment strategy.

So, in answer to the question of whether fiduciary duty is a constraint or a facilitator to more climate-friendly portfolios, the answer would seem to be moving firmly in the direction of the latter.

TRANSITION AND PHYSICAL RISK ANALYSIS AND REPORTING

Transitions risk analysis and reporting

Earlier in the paper we considered the shortcomings of emissions data analytics, ESG data more generally and company GHG disclosures and the nature of transition risk and physical risk. We now turn to how transition and physical risks are being analysed by asset managers, how they are reported to asset owners, who in turn, are increasingly analysing these risks themselves and reporting the carbon-intensity of their portfolios, against appropriate benchmarks, to their beneficiaries. We will then consider what mitigating actions can be taken to address these risks, in the context of *engaging*, *embedding*, *effecting* and/or *excluding*, and what these solutions might look like in practice and how effective they may be.

As noted previously, transition risk analysis focuses on the risks to specific industries and companies from the transition to a low carbon economy. Contemporary thinking by Columbia Threadneedle suggests that 24 of out 70 identified economic sectors have a material exposure to climate-related risks. Portfolio exposures to these risks are typically reported through carbon footprinting, with the TCFD recommending that *asset owners* report the weighted average carbon intensity of their portfolios (per individual security weightings), based on scope 1 and 2 emissions (those within an organisation's control) and expressed in terms of tonnes of CO_2 equivalent (tonnes CO_2e)/$m sales).[105] However, many asset managers in their reporting to asset owners, especially for equity portfolios, provide additional metrics such as carbon emissions (tonnes CO_2e/$m invested) and total carbon emissions (tonnes CO_2e).

However the TCFD acknowledges the limitations of current carbon footprint metrics given limited data availability on company GHG emissions and in using this information to make informed decisions around excluding or tilting a portfolio away from particular industries or stocks. That said, a number of research providers have developed proprietary tools for this purpose. Indeed, new tools and methodologies are continuously evolving to assess the carbon exposure embedded in portfolios.[106] Although these tools are largely developed for listed equities, they can also be applied to those corporate bonds issued by the same entities.

Perhaps the most obvious limitation of carbon footprinting is that it doesn't capture the costs associated with *reducing* a company's carbon footprint. Indeed, two companies in different industries, or any two industries, may share the same carbon exposure but one may find it much easier and less costly to reduce its carbon footprint than the other. Therefore, as we noted when considering whether carbon risk is efficiently priced, separately analysing the net economic cost or benefit likely to arise over a defined timeframe from the transition risk applying to a particular industry, can help asset managers and asset owners determine the full extent of a portfolio's climate exposure and engender a greater focus on those industries and companies that are likely to be most impacted whether in terms of risk or opportunity. Indeed, as noted earlier, conducting

[105] As a next step, in the UK, against the backdrop of regulations that require occupational pension schemes to disclose and report on their climate policies, the UK Government has made clear its aim that schemes should start to actively manage their exposure to climate-related risks. Given this, in March 2020 the UK government-appointed Pensions Climate Risk Industry Group (PCRIG) published draft guidance for occupational pension schemes on assessing, managing and reporting climate-related risks, entitled *Aligning your pension scheme with the TCFD Recommendations: A guide for trustees on integrating climate-related risk assessment into decision making and reporting*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/871772/aligning-your-pension-scheme-with-the-TCFD-recommendations-consultation-guidance.pdf

[106] For instance, MSCI ESG Research collects GHG emissions data where relevant for a universe of about 8,600+ companies. Data is collected once per year from most recent corporate sources, including Annual Reports, Corporate Social Responsibility Reports and/or websites. In addition, MSCI ESG Research uses the GHG data reported through the Carbon Disclosure Project or government databases when reported data is not available through direct corporate disclosures.

a forward looking analysis of companies' adaptation capability, one that focuses on the risk of carbon lock-in, is particularly helpful. For instance, a company with a high risk of carbon lock-in and therefore little incentive to transition to a low carbon economy, would be one that faces high capital costs for new energy efficient infrastructure, no viable alternative uses for its existing infrastructure and a workforce without the required transferable skills.

Additionally, so as to better understand how effective companies are at furthering the global transition to a low carbon economy, there's the Transition Pathway Initiative (TPI). Launched in 2017, in collaboration with FTSE Russell, the PRI, and the London School of Economics' Grantham Research Institute on Climate Change and the Environment, the TPI offers an ESG-focussed tool that enables, within 14 economic sectors, the assessment of constituent companies' carbon management and carbon performance. It also provides for an emissions trajectory analysis, or carbon performance projection, to understand how effective, when benchmarked against the Paris Agreement targets, companies are at furthering the global transition to a lower carbon economy. In turn, this enables better-informed investment processes and decisions, and can shape too engagement activities and proxy voting decisions.[107]

Physical risk analysis and reporting

The physical risks of climate change, as you'll recall, are those risks to life and property resulting directly from the effects of global warming, specific weather events in particular. At the portfolio level, physical risk analysis can be approached from several different angles. For instance, where a portfolio's assets are "geo-locatable", it is possible to measure exposure to physical risks associated with climate change directly using catastrophe risk modelling tools, analysing the portfolio's physical risks by perils, such as floods, earthquakes and wildfires. This, in turn, can trigger more detailed analysis as to how such a risk exposure is managed or insured.

Additionally, a portfolio's exposure to, for example, water stress or water intensity can be identified by using interactive mapping tools and a geo-spatial mapping of those locations subject to extreme water stress. It can then be measured and benchmarked against increasingly established data sets provided by benchmark providers, such as MSCI's carbon and water related exposure data. For instance, a portfolio's exposure to geographic water risk can be ascertained by taking the weighted average of invested company assets in those business lines that have a high level of water intensity or key facilities located in water basins where water stress levels are high. Likewise, a portfolio's absolute and relative water withdrawal intensity can be established by measuring how efficient a portfolio is in terms of water usage per dollar of output and benchmarking this against an appropriate peer group or aspiration.

Climate Value at Risk (VaR) profiling

Increasingly asset managers and asset owners are seeking to add to their climate risk management by developing Value-at-Risk (VaR) measures of their portfolio climate exposures, known as climate VaR. A traditional VaR analysis quantifies the probable size of loss on a portfolio of assets over a given time horizon, at a given probability, or confidence level, with the resultant VaR quantifying the absolute or percentage impact of an event expected to occur once in 20 years (a VaR_{95} event with a 5% probability) or once in 100 years (a VaR_{99} event with a 1% probability). Therefore, a climate VaR is a measure of the potential for portfolio asset price corrections due to climate change. Of course, as quantifying the probability of climate scenarios is challenging and lacks robustness, climate VaRs instead look at the expected loss under a given climate scenario.

[107] As at July 2019, the tool ranked the carbon management quality of 274 companies in 14 sectors, accounting for c.41% of CO_2 emissions from public companies worldwide. The ambition is for it to eventually cover c.75% of emissions.

While for most, this is very much a work in progress, a notional climate VaR analysis appears to be best performed by combining a top down macro analysis, modelled on baseline warming scenarios, which quantify the climate risk to the world's total stock of financial assets,[108] with a portfolio-specific bottom up industry and individual company exposure analysis, that employs a forward looking analysis of companies' adaptation capability, noted earlier. The resulting weighted average portfolio climate VaR can, in addition to stimulating thinking around whether the level of climate VaR is an acceptable risk to run, be compared against an appropriate industry, peer group or aspirational benchmark.

Of course, this analysis is somewhat compromised by three limiting factors identified earlier – the paucity of empirical research on climate change risk, and the inconsistency and sporadic nature of company GHG disclosures and emissions data. However, that's not to say that a relatively informative measure of climate change risk can't be constructed. It can. Indeed, Dietz et al. in 2016, by combining a set of well established methodologies and drawing on widely accepted assumptions, estimated from their analysis of climate change risk on a typical institutional investor's portfolio, a climate VaR ranging from 1.8% with a 50% probability, to 16.9% (Climate VaR_{99}) with a 1% probability for a business-as-usual emissions path of +2.5°C warming by 2100. The substantial write-down of financial assets at the VaR_{99} point on the distribution of probable outcomes illustrates how much risk is in the left tail of this distribution. However, assuming a cut in emissions to limit warming to no more than +2°C reduces the climate VaR with a 50% probability to 1.2% and the tail risk associated with a climate VaR_{99} to 9.2%.[109]

POTENTIAL MITIGATING ACTIONS TO CLIMATE CHANGE RISK AVAILABLE TO ASSET MANAGERS AND ASSET OWNERS

When first defining transition and physical risks, we noted that in analysing these risks across the asset classes, asset managers and asset owners can adopt a number of non-mutually exclusive mitigating actions to address them, by choosing to engage, embed, effect and/or exclude, as appropriate. Of course, who exerts this influence is principally determined by whether a mandate is segregated or pooled. Within a segregated mandate the asset owner is in the driving seat whereas in a pooled, it is the asset manager.

In considering these potential mitigating actions, *Figure 9*, below, separates the asset classes held within most institutional investor portfolios into three broad categories – listed and private equity, investment grade and alternative credit, and real assets, comprising real estate and infrastructure. It then analyses the potential engage, embed, effect and/or exclude responses to the climate change risk posed by each asset class.

[108] See: Dietz, S., Bowen, A., Dixon, C. and Gradwell, P. 'Climate value at risk' of global financial assets. London School of Economics. April 2016.
[109] Dietz et al. (2016). op.cit.

Figure 9: Asset class response matrix to transition and physical risks

Asset class/ Potential responses	Listed and Private Equity	Credit (Investment grade and alternative)	Real assets (Real estate and infrastructure)
Engage	**Engage on climate change with policymakers and corporates, either directly, collaboratively with other investors or with collaborative groups who collectively carry out engagement activities.**		
	■ Carry out and lead independent climate engagements ■ Setup and enforce bespoke (and more aggressive) voting policy on climate (e.g. via moving to segregated mandates) ■ Hire specialist stewardship provider to focus on climate[110]	■ Add credit exposure to listed equities to add volume and scale to engagements ■ Negotiate more stringent conditions (e.g. additional covenants) linked to issuer strategy and disclosure around climate change and alignment to Paris Agreement	■ Encourage and monitor manager involvement to achieve better energy efficiency and green standards (e.g. through green retro-fitting) ■ Encourage manager engagement with local communities and industry on climate impact
Embed	**Adjust existing portfolios to reduce the exposure to climate-related risks.**		
	■ Set carbon footprint target (relative or absolute) ■ Climate tilted strategies according to specific climate or carbon metrics (e.g. tilts based on carbon emissions or reserves) ■ ESG integrated strategies of which climate is one factor ■ Develop bespoke strategy ■ Adopt a low carbon index (passive equity)	■ Integrate sustainability concerns into the selection criteria for bonds, particularly within buy and maintain portfolios ■ Set carbon footprint target (relative or absolute) ■ Climate tilted strategies according to specific climate or carbon metrics (e.g. tilts based on carbon emissions or reserves), and ESG integrated strategies	■ Set climate related metrics and targets for real asset holdings (e.g. minimum carbon efficiency targets) ■ Incorporate climate related metrics and targets into the asset selection process through mandate design
Effect	**Investors allocate capital to investment strategies specifically designed to perform well in a low-carbon economy, such as companies involved in energy efficiency, renewable energy, carbon capture and clean technology, to capture the upside potential of climate change. Examples of strategies include renewable infrastructure strategies and green bonds linked to specific projects which have environmental benefits.**		
	■ Positively tilted climate strategies towards companies with a higher proportion of climate-friendly revenues/sustainable outcomes aligned with the United Nations' Sustainable Development Goals (SDGs) ■ Private equity opportunistic investments in climate or environmental solutions ■ Thematic fund allocation addressing climate (e.g. renewable energy, energy efficiency, carbon capture, clean technology, water and waste management)[111]	■ Integrate sustainability concerns into the selection criteria for bonds, particularly within buy and maintain portfolios ■ Set carbon footprint target (relative or absolute) ■ Climate tilted strategies according to specific climate or carbon metrics (e.g. tilts based on carbon emissions or reserves), and ESG integrated strategies	■ Sustainable infrastructure linked to climate adaptation and resilience ■ Low carbon/green real estate ■ Impact investment mandates around transportation, cleaner electricity generation, energy efficiency, and sustainable agriculture or forestry (amongst others)
Exclude	**Exclude fossil fuels or high carbon emitters from the portfolio. A divestment strategy requires definitions and thresholds for which exclusion should occur to be established. Examples include: divest from all thermal coal companies or divest from companies which derive more than X% of revenues or as a % of market capitalisation from fossil fuel related activities. Consideration should be given to the impact on the investible universe as a result of divestment.**		
	■ Bespoke exclusions policy (e.g. according to revenue or reserves thresholds, or ability/ willingness to transition) ■ Move to a screened index (e.g. ex-fossil fuels)	■ Bespoke exclusions policy (e.g. according to revenue or reserves thresholds, or ability/ willingness to transition) ■ Move to a screened index (e.g. ex-fossil fuels)	■ Bespoke exclusions policy (e.g. all assets that do not meet minimum green credential or energy efficiency requirements)

Caution should be exercised given that some of the approaches outlined above may impact the risk and return characteristics of a portfolio. In addition, while some may result in more appealing exposure disclosures, they may not make any contribution to climate change mitigation.

Source: WTW 2019 (modified extract).

[110] There is a key difference between active and passive equity mandates when it comes to engagement. Passive equity managers have to exercise stewardship more widely than active, as they are compelled to hold those companies that populate the index being tracked, whereas active equity managers can make a more reasoned assessment of a company before deciding on whether to invest. Indeed, while engagement is becoming a key selection factor in passive equity mandates, there's a bigger a debate around the role of passive managers and whether they should engage or not – a point of difference contested by two of the asset management industry's biggest indexers.

[111] The institutional market is increasingly populated with low carbon global equity passive funds that can reduce the carbon intensity of an equity index by c.80% while prospectively offering the same investment return as the non-tilted index +/- c.30bps tracking error.

Summary of actions available to asset managers and asset owners

Figure 10, comprising the Asset Class RAG scoring table below, quantifies the climate change risk exposure of some of the main asset classes both *before* any asset owner actions are taken and after some of the more common asset owner actions are taken. Accepting the subjective nature of this analysis, those asset classes classified as red are at particular risk of negative outcomes arising from climate change whilst those classified as green are either unexposed or even potentially positioned to take advantage of efforts to combat climate change. As noted earlier, given the relative paucity of climate-friendly assets in which to invest, such as renewable energy infrastructure and carbon capture technologies, with a risk/return trade-off that appeals to asset managers and asset owners, governments should be required to enact policy changes to increase the supply of, and therefore help satisfy the demand for, such assets.

Figure 10: Asset Class pre- and post-actions RAG scoring

Asset class	Pre- action	Common actions	Post-action	Comments
Listed global equities		Employing climate-tilted passive equity Employing active management with a climate change focus		While climate-tilted passive equity reduces the exposure of the asset class, it is not a material enough change to remove the climate change risk associated with equity investment. There are also active managers with a climate change focus, employed either in part or as the main theme of a fund, which may reduce, by varying degrees, the climate exposure for investors with a long-term equity allocation.
Private equity		Managing the types of Private Equity opportunity invested in		Private Equity is a highly exposed asset class but with a potentially high degree of upside on offer if the "right" investments are made. As an asset class, any drag on the economy caused by climate change is likely to prove very negative for returns. However, impactful venture capital investments could potentially capture some of the upside from actions to combat climate change and mitigate its effects.
Investment grade credit (buy and maintain)		Putting mandates in place to screen issuers for climate change risk and other threats to sustainability		With credit assets, the main consideration is whether or not the issuer will be able to repay capital. Risk analysis for climate change and other threats to sustainability should be incorporated into the mandate design and the selection of managers. As visibility of the ability to repay deteriorates with longer time horizons, this should include rules on the term of assets purchased in certain sectors, credit and ESG rating bands.
Alternative credit		Careful mandate design and sub asset class selection		Alternative Credit is a large and diverse asset class with some sectors potentially more exposed to climate change than others. The principles of good mandate design from investment grade credit still hold but extend to selecting appropriate areas of the alternative credit universe. Some strategies, such as infrastructure debt financing renewable energy projects or mortgage debt that finances green housing, could be considered as climate change positive. Likewise, green bonds, linked to specific projects which have environmental benefits, sustainability bonds with an intentional mix of environmental and social benefits and sustainability goal-based bonds structured to reward issuers for having and adhering to defined sustainable business model metrics, which may be linked to UN Sustainable Development Goals (SDGs), can also mitigate risks associated with climate change.[112]
Real assets		Seek to make impactful real investments Manage physical and transition risks of currently held real assets		Real Assets is another asset class that allows the potential capture of positive return effects, largely through investment in infrastructure (for example, renewable energy). Many of these assets can also supplement a cash flow matching portfolio by offering secure cash flows at a higher yield than government bonds. Additionally, while generic real estate and infrastructure investments may be exposed to climate change risk, there is scope to manage these risks, through physical risk analysis and encouraging real estate managers to meet efficiency standards.

Source: WTW 2019 (modified extract).

[112] The International Capital Market Association (ICMA) Green Bond Principles provide voluntary process guidelines to issuers on the key components needed to issue a green bond. Green bond issuers are required to build a Green Bond Framework, which should align to four components as specified under the Green Bond Principles. For sustainability bonds, the ICMA provides separate a separate set Sustainability Bond Guidelines. See: https://www.icmagroup.org/green-social-and-sustainability-bonds/green-bond-principles-gbp/

Unilateral and collective action being taken by asset managers and asset owners

Not every asset manager and asset owner needs a regulatory stick or nudge to change behaviours. Indeed, many asset managers and asset owners are adopting a number of the mitigating actions just covered to address the transition and physical risks of climate change. However, additionally, some of the better resourced are unilaterally taking ambitious steps to align with and move the low carbon transition agenda forward, while voluntarily signing up to an increasing number of collaborative initiatives with their peers to achieve the same objective. These initiatives include the TPI, the Climate Action 100+ initiative, and The Institutional Investors Group on Climate Change (IIGCC).[113]

Two prominent asset owner exemplars, both UK pension funds, that have set themselves ambitious goals on how they should invest, decarbonise and engage, which they are steadily realising, are The Environment Agency Pension Fund (EAPF) and The National Employment Savings Trust (NEST). Moreover, the stated beliefs, actions and timetables that both funds are working to are steadily gaining traction with and raising the bar for many of their peers, especially those with already well developed environmental, social and governance (ESG) policies and Responsible Investment frameworks.[114]

UK Defined Benefit (DB) pension fund case study: The Environment Agency Pension Fund (EAPF)[115]

The EAPF, part of the Brunel Pensions Partnership pool of the UK Local Government Pension Scheme (LGPS), with c.£4bn of assets and over 39,000 members, has long been at the forefront of recognising the importance of incorporating ESG risk factors into funding and investment strategies and applying long-term thinking to deliver long-term sustainable returns.

The Fund is also recognised for its collaborative engagement with other pension funds, asset managers, advisers, industry bodies and associated organisations, such as the UNPRI, IIGCC, Pensions and Lifetime Savings Association (PLSA) and UK Sustainable Investment Forum (UKSIF). This it does to share ideas and promote best practice to achieve wider and more valuable Responsible Investment (RI) and ESG outcomes, while acting collectively with other asset owners to increase the effectiveness of the Fund's engagement with companies to act more responsibly.

Cognisant of the financial risks and opportunities posed by climate change and those that may flow from the impact on the real economy and financial markets, from regulation, policy, and increased competition from technological alternatives and innovation, the Fund, in 2015, set itself a Climate Change Policy to address the impacts of climate change. This Policy comprises a set of dedicated beliefs and very specific 2020 goals on how the Fund should invest, decarbonise and engage. The Fund's climate change beliefs are outlined below:

[113] The Climate Action 100+ (CA100+) initiative comprises a group of 370 asset managers controlling some $35tn of assets, who actively engage with the world's 100 biggest CO_2 emitters, notably US and emerging market companies, in seeking to curb emissions and improve the governance of climate-related issues. CA100+ seems to have got the most critical mass behind it and notched up a few tangible "wins". The Institutional Investors Group on Climate Change (IIGCC) is the European membership body for investor collaboration on climate change with more than 230 members, mainly pension funds and asset managers, across 15 countries, with over €30tn in assets under management.

[114] In the US, the Harvard Management Company (HMC), the first endowment to sign up to the PRI, is re-positioning its $40bn portfolio to invest in line with net-zero greenhouse gas emissions by 2050. In so doing, it is moving from internal to external fund management and already expects its external managers to report regularly on ESG integration, shareholder engagement, proxy voting activity and outcomes. A key focus will be to develop tools that monitor the carbon footprint of its investment managers. However, acknowledging that it can't achieve its objective in isolation, the HMC also intends to work closely with those of its peers, which have made or are making similar commitments. See: Harvard endowment goes net zero by 2050. Amanda White. top1000funds. 7 May 2020.

[115] Modified extract taken from: EAPF Annual Report and Financial Statements for the year ended 31 March 2019. Chair's Statement pp.1-2 and Annex 5 – Responsible Investment policy pp.157-161.

- Climate change presents a **systemic risk** to the ecological, societal and financial stability of every economy and country on the planet, with the potential to impact our members, employers and all our holdings in the portfolio.
- Climate change is a **long-term material financial risk** for the Fund, and therefore will impact our members, employers and all our holdings in the portfolio.
- Considering the impacts of climate change is both our **legal duty** and is entirely consistent with **securing the long-term returns** of the Fund and is therefore acting in the best long-term interests of our members. **Selective risk-based disinvestment** is appropriate but **engagement for change** is an essential component in order to move to a low carbon economy.

Building on these beliefs, and by integrating climate change into the Fund's risk management process, using carbon footprinting, assessing fossil fuel exposure and challenging asset managers on physical risks, the Fund seeks to reduce unrewarded climate and carbon risk. The Fund's 2020 climate change goals to invest, decarbonise and engage are stated as follows:

- Invest 15% of the EAPF in low carbon, energy efficient and other climate mitigation opportunities. This will contribute to our wider target to invest at least 25% of the EAPF in clean and sustainable companies and funds, across all asset classes.
- Decarbonise the equity portfolio, reducing our exposure to "future emissions" by 90% for coal and 50% for oil and gas by 2020 compared to the exposure in our underlying benchmark as at 31 March 2015. 'Future emissions' is the amount of greenhouse gases that would be emitted should these reserves be extracted and ultimately burnt, expressed in tonnes of carbon dioxide equivalent.
- Support progress towards an orderly transition to a low carbon economy through actively working with asset owners, fund managers, companies, academia, policy makers and others in investment industry.

In addition, the Fund's wider definition of sustainable investments includes:

- Social investments and those with significant revenues (in excess of 20%) involved in energy efficiency, alternative energy, water and waste treatment, public transport.
- Property, infrastructure, agriculture or forestry investments with a low carbon or strong sustainability criteria.

The Fund has made exceptional progress in striving towards achieving its 2020 goals. As at 31 December 2018, 39% of the Fund's investments were in clean technology and other sustainable opportunities, while 11% of the Fund was invested in low carbon, energy efficient and other climate mitigation opportunities.

The EAPF, with its strongly worded responsible investment principles, actions and timescales has raised the bar and set the agenda for other DB schemes to follow.

UK Defined Contribution (DC) case study: The National Employment Savings Trust (NEST)[116]

NEST is the UK's largest master trust, or multi-employer DC scheme, set up by the UK government in 2012 especially for the auto enrolment of low to middle income employees. NEST manages assets exceeding £10bn billion on behalf of over 8 million members, most of whom, being aged under 40, have a long investment horizon. Given this, NEST has long put ESG considerations front and centre of its investment decision making, with a steadily increasing emphasis on managing climate change risk as it becomes a more salient and material financial risk. Indeed, responsible investment campaign group, ShareAction, in ranking the climate policies of the 16 largest master trust schemes, found that NEST were the only master trust that had implemented a climate tilt in its default funds.[117]

Within its default funds, NEST runs a £1bn Climate Aware Fund (CAF), which invests on the basis of a forward looking +2°C global warming glidepath, but with stress testing using a +1.5°C scenario. The CAF has begun to tilt its exposures more aggressively away from companies generating large carbon emissions and towards those that are at the forefront of the climate transition or who have very low carbon emissions. It also allocates money to companies that focus solely on supplying renewable energy equipment, machinery or technology to renewable energy generation companies. In its 2019 Responsible Investment Report, NEST notes that during the past three years, the CAF has had a -2.4% average annual growth rate of CO_2 emissions in comparison to the FTSE Developed Index's average annual growth rate of +1.6%. The former is equivalent to taking over 44,000 cars off UK roads each year.

This, allied to NEST's responsible investment journey relative to its peers, meant that it was the only master trust ranked in ShareAction's "leading" category.[118] It is also one of the few to focus on a just transition – one that seeks to transition the economy to low-carbon while ensuring the transition is fair to those, such as workers in high-carbon sectors, who potentially stand to lose out.

Additionally, as NEST takes the lead, within UK DC, in moving into those real assets, not least renewables, with extensive time horizons, so it has placed an even greater level of scrutiny and oversight on its managers to ensure that these assets will be well governed, run sustainably, and protected from the impacts of climate change.

NEST is also very strong on engagement. Indeed, given its research finding that high standards of corporate governance doesn't necessarily translate into effective management of climate risk, it actively engages with the weakest performing businesses from a climate change perspective. This it does based on a proprietary eight factor scorecard formulated from the recommendations of The Taskforce on Climate-Related Financial Disclosures (TCFD). NEST is also a member of Climate Action 100+.

[116] Modified extract taken from: Paving the way. Our responsible Investment activities over 2019. NEST. December 2019.
[117] Is UK regulation enough?: A review of UK master trusts' ESG policies. ShareAction. December 2019.
[118] ShareAction (December 2019). op.cit. ShareAction found that master trusts in general show low levels of engagement with policy makers on the transition to a low-carbon economy and recommends that they report under the Task Force on Climate-related Financial Disclosures (TCFD) and encourage their asset managers to do the same.

Socialising asset owner engagement with and overcoming myopia and groupthink on climate risk management

We should never underestimate the extent to which well documented behavioural biases can hinder our decision-making, dampen our thinking and limit our effectiveness. Indeed, in many cases, asset owner engagement with climate risk, prospectively the most material and systemic ESG risk of all, is being compromised by those cognitive biases that enter into individual and group decision making. Left unchecked, the result is sub optimal decisions. With this in mind, we consider how, by tapping into two notable biases, socialisation and myopia, greater asset owner engagement with climate transition and physical risks should result.[119]

Socialisation

It is often said that most asset owners are notable for two particular traits: (1) not wanting to be the first mover into a new asset class or investment strategy,[120] and (2) keeping a beady eye on what their peers are doing.

When it comes to being the first mover, invariably it's the largest asset owners, with the greatest resources and most advanced governance, and who have access to the very best advice and due diligence expertise (especially the ability to price, absorb and diversify risk), who are the early adopters of new thinking. Indeed, many of the very biggest asset owners, albeit prompted by regulators and policymakers, have been frontrunners in adopting and publicising coherent climate risk management policies and investment frameworks. Therefore, it probably comes as no surprise that as greater numbers of larger asset owners adopt climate-friendly investment principles and the accompanying risk management framework as standard procedure, their smaller peers have started to take note.[121]

This process, of asset owners comparing and benchmarking themselves to others, engendering a momentum shift in replicating what these others are doing, is known as socialisation. Socialisation, which is used extensively in the public policy world, can, through publicising positive social group behaviour, also be used to accelerate the widespread adoption of desirable behaviours by others in that cohort. Indeed, as social animals our actions are largely driven by the actions and opinions of others, especially those perceived as experts. However, if the actions of the first movers are to filter down in a wholesale fashion, one must correctly frame the desired behaviours so as to create a positive social norm. Only by clearly explaining why and how to manage climate change risk factors effectively and the methodologies that others have successfully adopted, will socialisation have the desired effect of creating a collective change in behaviours. After all, there are myriad examples where, because of poor messaging, or framing, socialisation has had the opposite effect.

Moreover, with the right group decision making structures in place, the resulting momentum shift should allow those asset owners, who have hitherto been wary of being climate risk management flag bearers, to ensure core climate risk factors are treated as an integral component of their risk management.

Overcoming myopia

Another common behavioural factor that impedes asset owner engagement with climate risk factors and their management is myopia, or present bias – a predisposition to ignore the distant future in favour of more immediate imperatives. Indeed, in most aspects of life, anything more than two years out tends to fall off the radar. This is particularly true of climate change, the full impacts of which have failed to register with most and probably won't do so until its effects are more readily observable.

[119] It should also not be forgotten that asset owners' cognitive abilities are often stretched given that they are effectively being asked to be strategists, asset allocators, fund selectors, risk managers and now climate risk assessors.
[120] This is especially true of those asset classes and strategies with little supporting data, limited capacity and high fees.
[121] Smaller funds also tend to use pooled funds which, as noted earlier, are much more reliant on the practices of the asset manager.

This, of course, leaves many asset owners exposed to risks that may have a material asset and, in the case of defined benefit pension schemes, a covenant and/or liability impact – risks that should be identified, evaluated and managed far in advance of their impact materialising. On the asset side of asset owners' balance sheets, there is a very real risk of financial assets with either prominent underlying climate risks or strong climate-friendly credentials being materially repriced far in advance of company balance sheets, physical assets and the real economy being impacted. Therefore, as we move from an environment of climate stability to instability, there is a potential first mover advantage of overcoming myopia if these asset repricing risks, which might otherwise compromise the ability to generate long-run sustainable returns, are to be properly managed.

However, if myopia is to be overcome, then the future needs to be made more salient. That is, the future needs to be moved from back to front of mind. In other words, asset owners need to able to better identify with the distant future and understand how those potential risks might impact their scheme and what mitigating actions need to be taken ahead of the curve. Indeed, just as public policy measures are used to engender socialisation to collectively change behaviours, so behavioural measures to make the distant future more salient are used by policymakers to overcome myopia. Additionally, investment consultants and asset managers also have a pivotal role to play in using these behavioural interventions to improve asset owner engagement with climate risk factors and transform short-term mindsets. In fact, as many investment consultants and asset managers have fallen victim to the same behavioural biases as many asset owners, the contention remains that most don't challenge the latter enough to reach outside of their comfort zone.

Indeed, because climate change risk takes us into new and uncharted territory, and will invariably impact almost everything that we consider today to be "normal", there needs to be much more informed independent thinking around the topic and potential mitigating actions. After all, herding in uncharted territory is not a wise strategy if standing on a steep cliff and the view ahead is foggy.

Overcoming groupthink

While not immediately apparent, it is evident that there are some very human behavioural factors that impede asset owner engagement with climate risk factors and their management. Many also stem from those group decision making dynamics which result in groupthink – the reaching of an unchallenged consensus. The good news is that group decision making isn't always destined to be sub optimal in that very few of these surreptitious cognitive barriers to better group decision making are insurmountable.[122]

Indeed, groupthink, the bias which poses one of the biggest risks to the adoption of integrating climate risk factors to investment decision making, and those biases that lead to groupthink, such as social loafing, diffusion of responsibility and social proof, can typically be avoided by moving from a large and homogeneous group of decision makers to one that is smaller and more cognitively diverse. That is, one that welcomes different viewpoints, genuine challenge and debate. Indeed, when it comes to group decision making, being different is just as important as being smart, if not more so.

An equally powerful antidote to this most destructive of biases is to seek individuals' climate beliefs in a decentralised, rather than centralised, fashion to ensure that all viewpoints are captured. After all, it's the minority viewpoints, those that are often ignored, which hold the key to better decision making as it forces the majority to more rigorously interrogate their own positions. However, protecting dissenters and independent viewpoints demands strong and unbiased leadership from the group chair.

[122] See: Wiser: Getting Beyond Groupthink to Make Groups Smarter. Cass R. Sunstein and Reid Hastie. Harvard Business Review Press. 2015.

Time to remove the behavioural barriers to managing climate risk factors

Of course, improving asset owner engagement with and management of climate risk factors not only comes down to managing group decision making biases. Crucially, clearer framing and explaining of why and how to manage climate risk factors, engineering positive socialisation and taking measures to make the future more salient today, will also invariably see more widespread adoption of coherent climate policies and responsible investment frameworks. It will culminate in climate risk management becoming an integral component of asset owners' risk management toolboxes. All of which can only be a good thing for member outcomes, especially those with a long investment horizon.

CLOSING COMMENTS AND CONCLUSION

The aims of this paper are manifold. Firstly, despite being firmly planted in the popular consciousness, the subject of climate change, and its associated risks, is not particularly well understood. Nor is the fact that as a multi-faceted problem, it demands an equally multi-faceted solution. Therefore, the intention of this paper has been to make the language, chronology, facts, figures and projections posed by climate change and its potentially gargantuan, game changing systemic risks, more accessible.

Although the subject of climate change has been eclipsed by the Covid-19 pandemic,[123] one positive to have resulted from the impact of the latter has been to demonstrate that humanity, globally, *can* adapt to a low carbon future, when forced to radically change deeply engrained behaviours. It has also catalysed the debate around the need to invest more in researching extreme risks, devising mitigations and improving preparedness for when they do strike. During the lockdown, teleworking replaced business travel and physical meetings, while elements of conspicuous and carbon-intense discretionary spending took a backseat. Indeed, the stylised curve depicting the various transition trajectories to a low carbon future has already been flattened. Although opposing views abound as to whether the transition to a low carbon economy will have been given a permanent boost by stakeholders adopting a more sustainable approach to living and working and being more mindful of their carbon footprint, McKinsey successfully argues, in a particularly thoughtful piece, how, once daily life normalises, we should, "build upon the mindset and behavioural shifts that are likely to persist after the crisis… to reduce the demands we place on our environment, or… to shift towards sustainable resources."[124]

With this in mind, the paper's second aim has been to outline the genuine challenges faced by humanity's many stakeholders in ensuring the world reaches a desired destination point before a continued failure to act more decisively results in a deeply impaired economic and financial system. As many informed commentators have suggested, failing to avoid such a cataclysmic outcome would, in turn, severely inhibit the ability of asset managers to generate and asset owners to derive sustainable investment returns and expose asset owners to unacceptably high and largely unmanageable risks.

The third aim, given the significant influence that asset managers and institutional asset owners have in transitioning the world to a low carbon future, has been to consider the many and various mitigating actions that can be taken by each. Again, these potential responses are not without their challenges. Whether through the engagement, embedding, effecting or excluding of positions across the asset classes, these responses variously seek to sidestep regulatory, reputational, transition and physical risks and take advantage of opportunities in combating climate change. However, as we noted, these responses are somewhat compromised by three limiting factors – the paucity of empirical research on climate change risk, and the inconsistency and sporadic nature of company GHG disclosures and emissions data.

This inconsistency and lack of global coordination is also evident in policymaker and, to a lesser degree, in regulatory initiatives, to ensure a fair and just transition to a zero carbon emissions world. Of course, there's always a balancing act to strike between knowing how much stick to apply and carrot to dangle. However, a globally coordinated approach to setting a, somewhat politically unpalatable, carbon tax with universal applicability and at a price point which stems GHG emissions, plugs carbon leakage and speeds up innovation in renewable energy and carbon capture and storage, is sorely needed, as are more effective and universally applied climate related

[123] Though see: https://www.theguardian.com/science/2020/apr/26/what-if-covid-19-isnt-our-biggest-threat
[124] Addressing climate change post-coronavirus. Dickon Pinner, Matt Rogers, Hamid Samandari. McKinsey. April 2020.

financial disclosures by listed companies to better enable investors to gauge which businesses are most at risk from and which are best prepared for a low carbon future. Indeed, with greater disclosure and transparency comes the ability to better assess and price climate-related risks and opportunities which, in turn, leads to more accurately priced securities, more price efficient financial markets and ultimately more efficient capital allocation. Likewise, a more collaborative approach by regulators that aligns with the targeted outcomes of the Paris Agreement and which better recognises the differences between a disparate range of financial institutions, markets and asset owners would also help in enabling each to better negotiate the transition and physical risks of climate change.

Of course, not every asset manager and asset owner needs a regulatory stick or nudge to change behaviours. Indeed, many asset managers and asset owners are not only adopting a number of the mitigating actions to address the transition and physical risks of climate change but are also either unilaterally taking steps to align with and, indeed, move the low carbon transition agenda forward, while voluntarily signing up to an increasing number of collaborative initiatives with their peers to achieve the same objective. More of the same is needed for the bar to continue to be raised.[125]

Indeed, given how much of the responsibility for leadership towards transitioning to a low carbon economy rests with asset managers and institutional asset owners, both must continue to respond to, and indeed pre-empt, the potentially gargantuan, game changing systemic risks posed by climate change, whether independently of or in line with policymaker or regulatory initiatives. However, more widespread engagement with climate risk factors and the adoption of coherent climate policies by asset owners will inevitably require the clearer framing and explaining of why and how to manage climate risk factors and a helping hand from behavioural interventions that both positively socialise what leading peers are doing and which make the future more salient today.

Notwithstanding this, to say what happens next is, in no small part, down to the actions of asset managers and institutional asset owners, is no exaggeration. Indeed, asset managers and asset owners are not only very well positioned to be the catalyst for major transformative change, they have the potential to lead the world in tackling humanity's greatest systemic challenge to date.

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[125] Additionally, as noted earlier, the PRI is well positioned to yet further strengthen its principles while, in the UK, the revised UK Stewardship Code sets a template and raises the bar for others to follow, given its requirement to "identify and respond to market-wide and systemic risks to promote a well-functioning financial system".

Notes

Notes

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