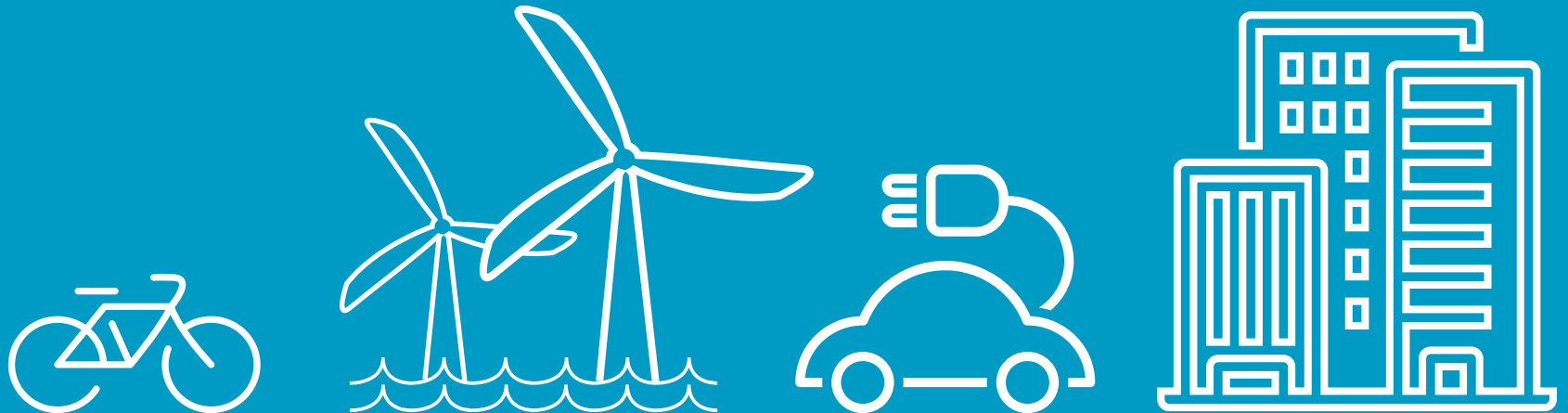
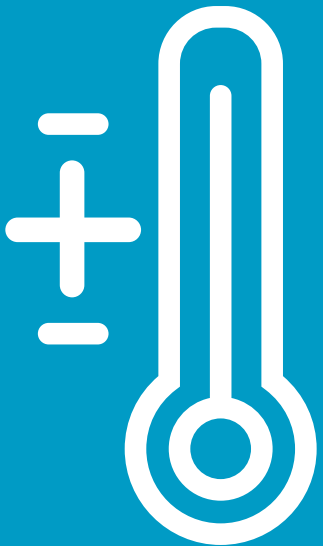


Climate change: A primer for investors

February 2021





Climate change and actions to prevent climate change – such as government policies and technological innovation – will continue to have fundamental impacts on the world and its economic prospects.

It is clear to us that these impacts will have material consequences for our clients, over both the shorter and longer term.

We have therefore written this guide for you, to ensure you have sufficient understanding of climate change to make informed investment decisions.

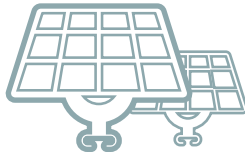
Contents

4



Introduction

6



Two types of climate impact: physical and transition

8



Physical impacts

10



Transition impacts

12



Policy commitments

13



Economic and financial implications

16



Climate change initiatives

18



Conclusion

As the pandemic has revealed, the interconnections between the real economy and the financial system run deep. And just like Covid-19, climate change is a far-reaching, system-wide risk that affects the whole economy, from which the financial system is not immune.

Sarah Breenen, Bank of England¹

This guide provides information on climate change and how it can affect investments, to help you form a view on its financial relevance. We focus on the types of impacts that might occur, rather than the practical actions that you might take. The appropriate course of action will depend on your circumstances, such as your investment time horizon and current investments. We'd be delighted to discuss possible actions and help you decide how to proceed.

1. Introduction

It is now widely accepted that the global climate is changing due to rising levels of greenhouse gases (GHG) in the atmosphere. This is being caused by human activities, principally the emission of carbon dioxide from burning fossil fuels. Almost all countries have committed to reduce GHG emissions in an attempt to limit the global rise in temperature and there is increasing support for these measures from businesses and investors.

Climate change: the basics

GHG include carbon dioxide (CO₂), methane, nitrous oxide and water vapour. GHG in the atmosphere trap heat from the sun and radiate it back to earth, thus acting as a thermal blanket and warming the earth. This thermal blanket is crucial for human survival; without it, our planet would not be habitable. However, GHG concentrations in our atmosphere are rising and this has led to average global surface temperatures increasing by roughly 1°C since pre-industrial times. This rise is mainly attributed to CO₂ released from fossil fuels used to generate electricity, heat our homes and power our transport, but also to GHG emitted by other sources such as agriculture and deforestation.

As temperatures rise, action will be needed to **adapt** to climate change such as improving flood defences and installing air conditioning.

Actions to limit, or **mitigate**, climate change focus on reducing GHG (or **carbon**) emissions, primarily by shifting to renewable sources of energy – such as solar and wind – and by using less energy and using it more efficiently. This shift is often referred to as the **low carbon transition**.

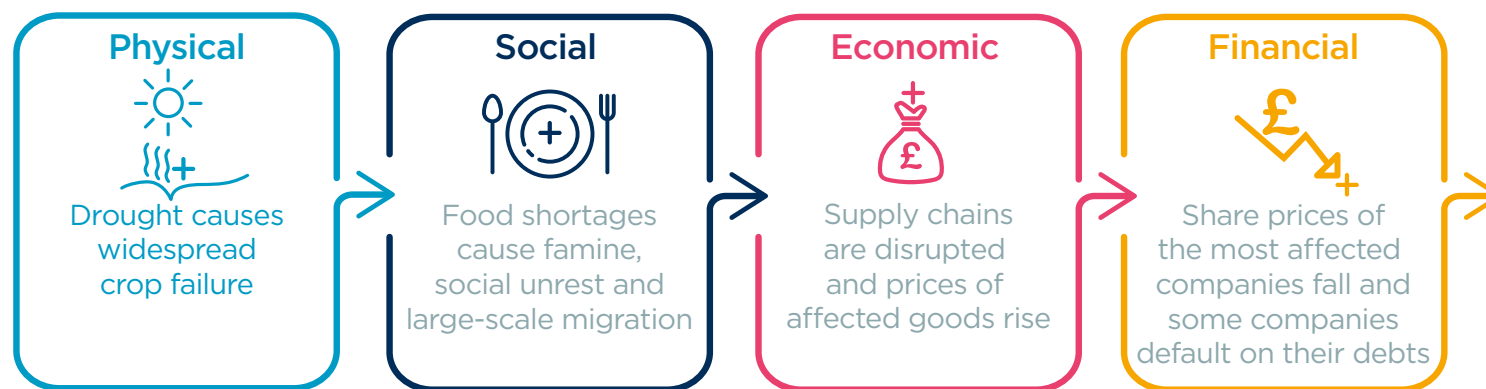
^[1] Speech given at London Climate Action Week on 1 July 2020

The future will be very different from the past, both due to physical changes in the climate itself and due to actions to reduce GHG emissions. What is much less clear is what that future will look like, and how the economy and financial markets will be affected. Whilst the full physical effects will play out over many decades, the social and economic changes from reducing GHG emissions are likely to occur more quickly and be significant over the next decade. Moreover, financial market impacts may be felt much sooner – and more suddenly – than real world impacts. Indeed, physical, social, economic and financial effects are already visible. They pose risks and opportunities for investors since they will inevitably affect investments.

In this guide, we provide background information on climate change to help you form a view on its financial relevance, focusing on the types of impacts that might occur and how these could affect your investments.

Figure 1: Illustrative example of the physical, social, economic and financial effects of climate change

Note: In practice, the effects would be more complex and there would be interactions between all four areas rather than a linear relationship.



2. Two types of climate impact: physical and transition

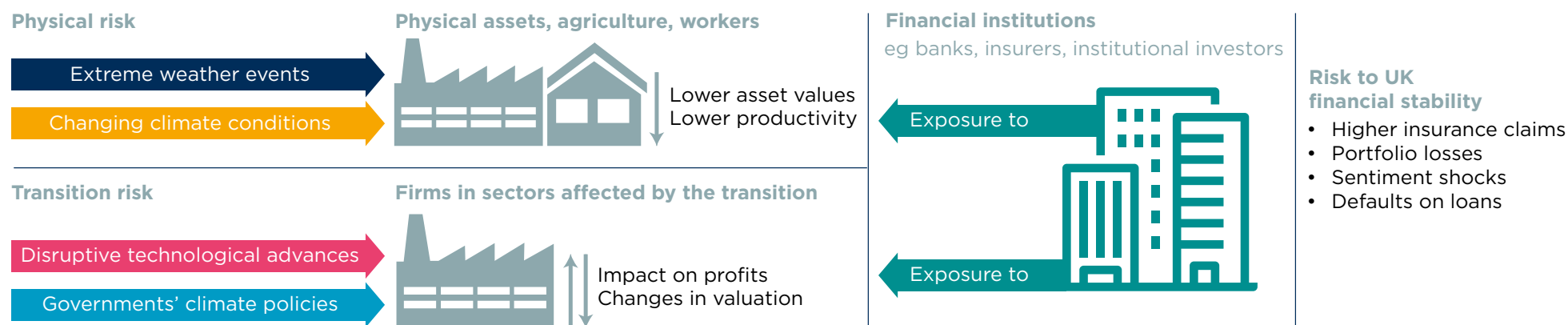
Climate-related impacts are not limited to the natural environment: they extend to individuals, communities, businesses and financial markets. There are two main types of impact, physical and transition:

- **Physical:** acute risks from physical changes such as more extreme storms and flooding can cause damage and disruption to homes, businesses and financial assets. Over the longer term, chronic risks from changing climate patterns may affect an organisation's financial and operational performance, both directly and indirectly through its supply chain.
- **Transition:** policy, legal, technology and market changes linked to the low carbon transition can affect organisational and consumer behaviour. Some governments are using economic incentives and regulatory mechanisms

to encourage the shift away from fossil fuels; rapid technological advances in renewable energy and electric vehicles are accelerating the shift; and businesses are responding to consumer demand and reputational risks. The transition brings opportunities for businesses, as well as risks, by opening up demand for new products and enabling more efficient use of resources.

The Bank of England has warned that climate-related impacts pose a threat to the stability of the financial system because of their significant, widespread nature, and the wide-ranging exposure of financial institutions (including asset owners): see figure 2.

Figure 2: Climate-related impacts are a risk to financial stability

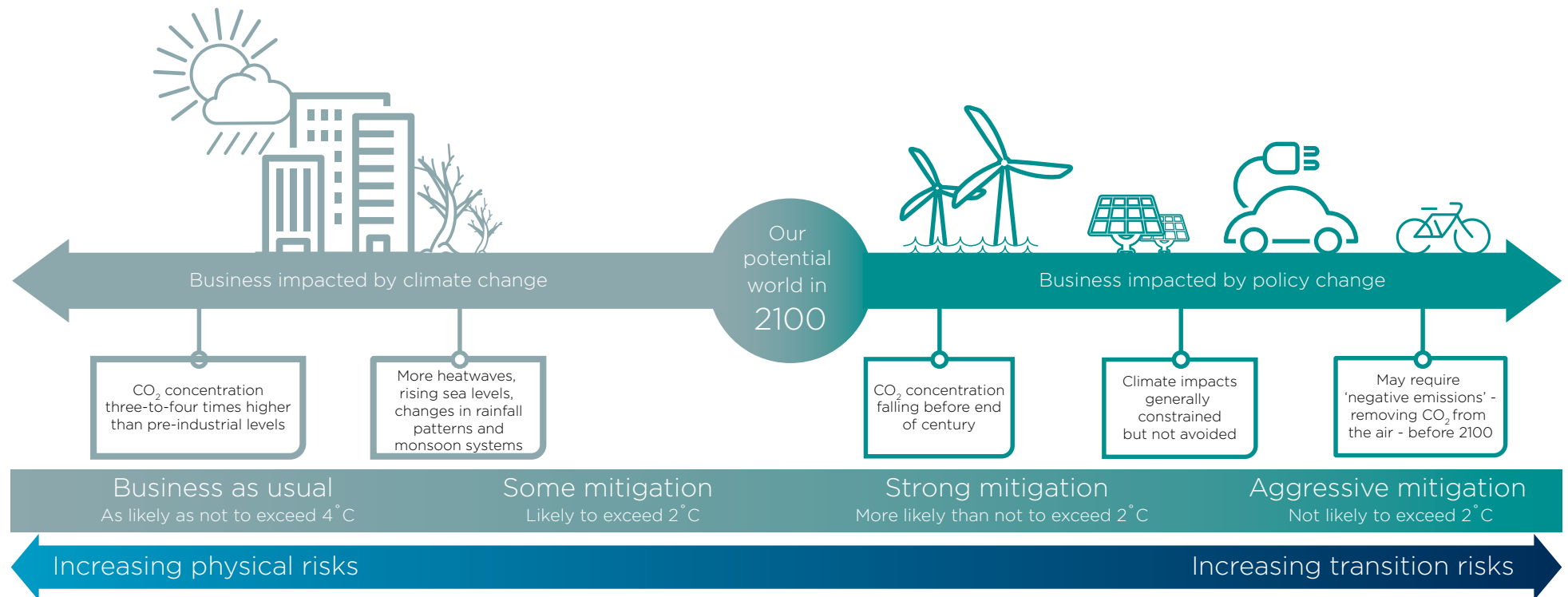


Source: The Bank of England's Response to Climate Change, Quarterly Bulletin, 2017 Q2.

There is a trade-off between the two types of impacts, although transition impacts will typically occur earlier than physical ones. All else being equal, stronger climate mitigation measures will increase transition risks while reducing physical risks, whereas weaker mitigation measures will pose fewer transition risks while increasing physical risks (see figure 3). In addition, transition risks will be greater in scenarios where governments agree strong emission reduction targets but only have weak climate policies, than in scenarios with strong emission reduction targets which are accompanied by clear, consistent plans of action (since the uncertainty is lower in the latter case). Where on the spectrum of possible outcomes we end up will depend on the actions of governments, regulators, companies, investors and individuals.

At one end of the spectrum, we continue to make extensive use of fossil fuels and GHG emissions continue to rise in line with trends over recent decades. In this scenario, average temperatures could increase by 4°C or more by the end of the century, with severe physical impacts. The transition impacts would initially be limited but could become more significant later on as action is taken in response to the physical impacts. At the other end of the spectrum, where major, widespread action is taken to transform the energy system to be “low carbon” by the middle of the century, temperature rises could be limited to 2°C or less. In this scenario, physical impacts would be much lower, but transition impacts would likely be much more significant and occur much earlier.

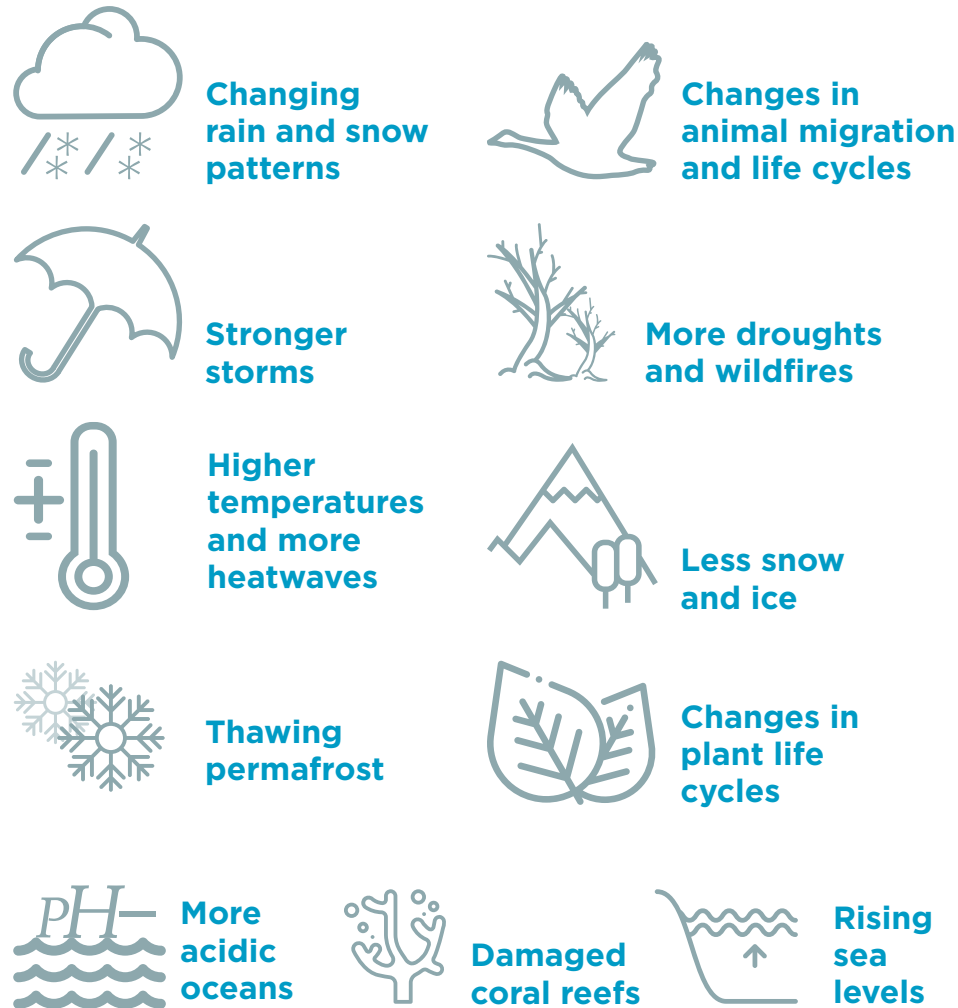
Figure 3: Trade-off between physical and transition risks



Source: Climate Change: Action, Trends and Implications for Business, University of Cambridge, 2013

3. Physical impacts

Figure 4: Physical effects of climate change

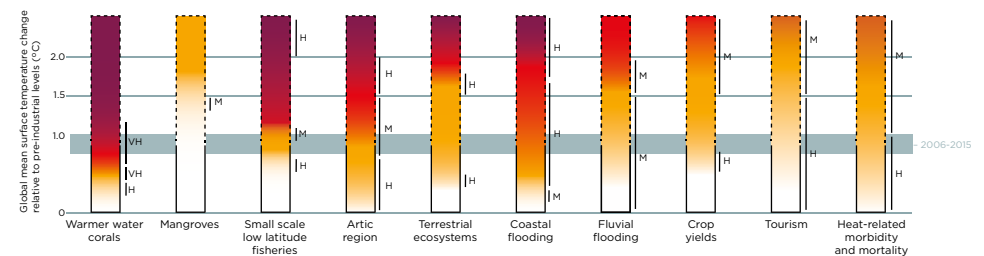


Source: What is Climate Change? Environment Blog, 24 July 2016

The physical effects of rising GHG concentrations are summarised in figure 4. A 2°C rise in global average temperatures compared to pre-industrial times may not sound much, but it is expected to be enough to have significant impacts with knock-on social and economic effects. Figure 5 shows a very high risk (purple shading) to warm water corals, the Arctic region and coastal flooding at 2°C, with high risk (red shading) for several other systems. Given the inertia in the climate system (and the limited mitigation actions taken so far), further temperature rises appear inevitable, with 1.5°C likely to be reached between 2030 and 2052 regardless of actions taken to reduce GHG emissions.

These physical impacts will have economic and financial consequences. Rising temperatures and changing rainfall patterns will affect agriculture, reducing the crop yield in many areas (although increasing it in others), and making it harder for people to work outdoors. Changing rainfall patterns will also affect fresh water supply, placing greater strain on areas already experiencing water shortages, with implications for agriculture, utilities and industrial processes. In some areas, such as the UK, greater seasonal imbalances in rainfall will significantly increase demand for water storage. Rising sea levels will cause flooding of some major cities, requiring the movement of millions of people. In some instances, life in low-lying regions will become unsustainable leading to the mass migration of populations.

Figure 5: Significant physical impacts even at modest temperature rises



Level of additional impact/risk due to climate change: purple = very high, red = high, yellow = moderate, white = undetectable

Source: Global Warming of 1.5°C, Intergovernmental Panel on Climate Change, 2018.

At higher temperature increases, the physical changes would be much more serious because they do not increase linearly with temperature: the impacts of a 4°C rise would be much more than twice as severe as a 2°C rise. Moreover, as temperatures rise, the world may pass through “tipping points” which cause irreversible step changes in global climate, such as ice sheets melting, permafrost thawing and rainforests dying.

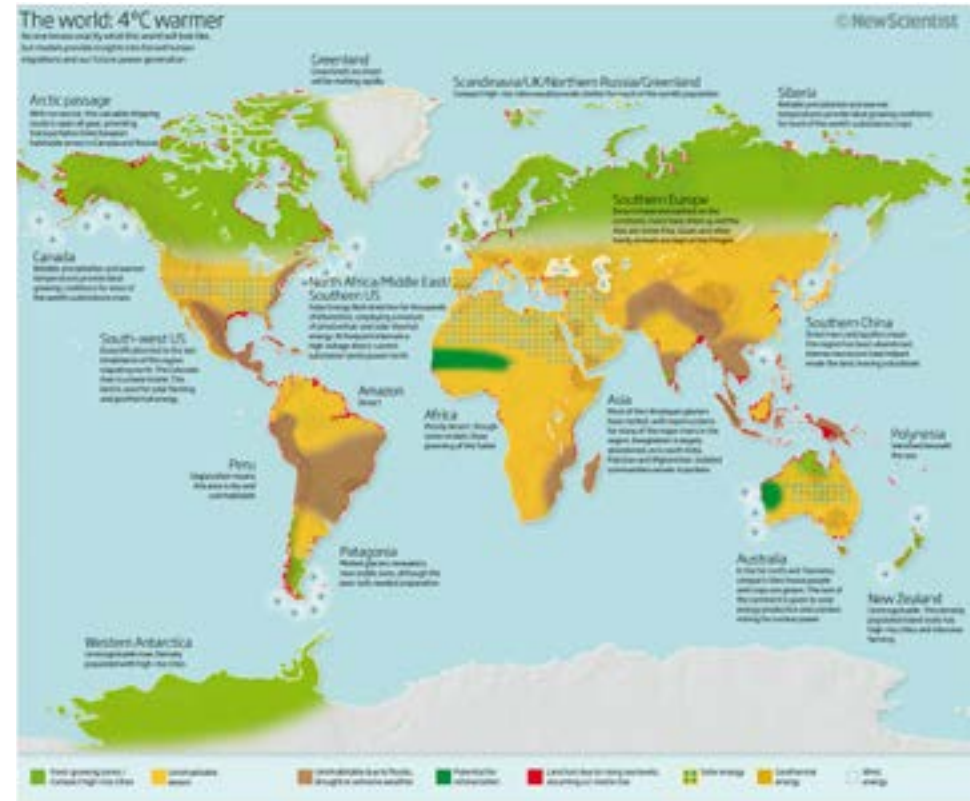
A rise in global temperature of four degrees would create huge risks that would affect the lives and livelihoods of hundreds of millions of people across the world.

Lord Nicholas Stern, Chair of the Grantham Research Institute on Climate Change and the Environment at LSE²

One attempt at illustrating what a 4°C rise might look like, first published in the New Scientist magazine in 2009, is shown in figure 6. Large swathes of the world could become uninhabitable due to flooding, drought or extreme weather (brown shading), desertification (yellow shading) and sea level rise (red shading). Of course, given the uncertainty surrounding any long-term projections, the out-turn could be materially different.

Whilst the more extreme impacts shown on the map are unlikely to be felt within the next few decades, if effective mitigating actions are not taken soon and the map were to prove realistic, we would start to experience them in the second half of this century.

Figure 6: Much more severe physical impacts at larger temperature rises



Source: How to Survive the Coming Century, New Scientist, 25 February 2009

² On the launch of the World Bank’s 2012 report, “Turn Down The Heat: Why a 4°C Warmer World Must be Avoided”

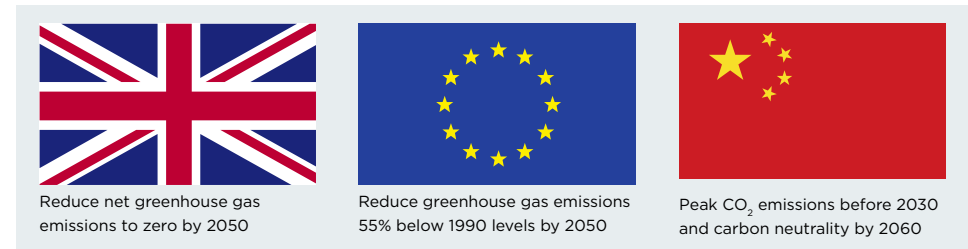
4. Policy commitments

At the UN climate conference in Paris in December 2015, almost 200 world leaders reaffirmed the longstanding goal of limiting global temperature increases to well below 2°C above pre-industrial levels. However, in the light of increasing evidence that even a 2°C rise would have serious negative effects, they made a new commitment to pursue efforts to limit the increase to 1.5°C. The leaders also agreed aims of reaching peak GHG emissions as soon as possible, achieving zero net human-related GHG emissions in the second half of this century, and providing financial assistance for developing countries.

Practically all world leaders remain united behind the Paris Agreement. The Paris Agreement also has support from companies and investors around the world, and many US cities and states.

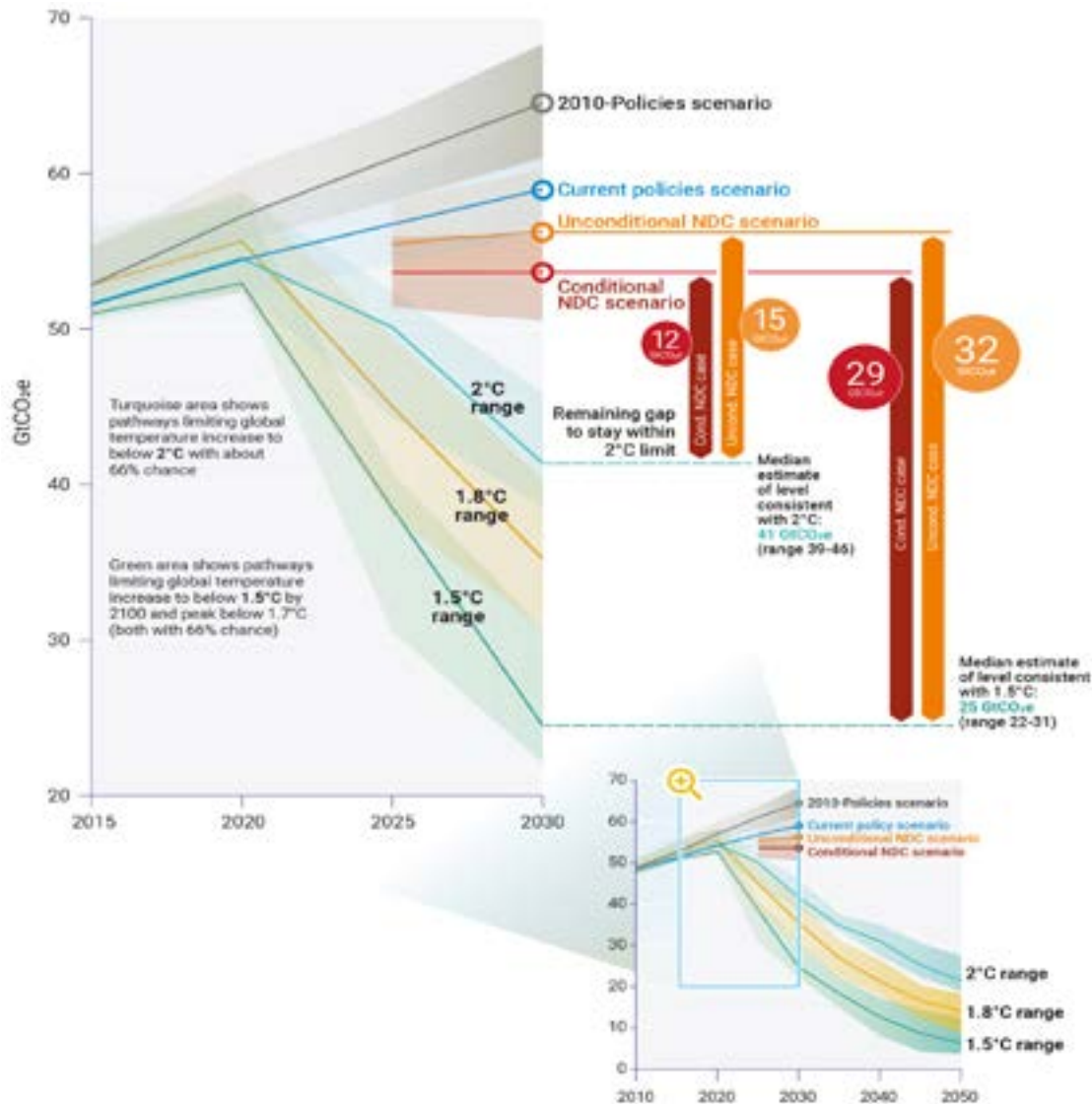
All parties to the Paris Agreement are required to submit “nationally determined contributions” (NDC), ie climate action pledges that include targets for GHG emission reductions. Some countries’ targets are shown in figure 7. There is a five year cycle of reviewing collective action towards the overall goals, to inform updated NDC submissions which – due to a ratchet mechanism – cannot be weakened. However, although parties are obliged to submit pledges, there is no legal mechanism for ensuring they are fulfilled.

Figure 7: Examples of national climate change commitments



The current strong political rhetoric is not yet matched by the scale of action needed to meet the 1.5-2°C target. Analysis by the UN indicates that the first round of NDCs broadly corresponds to the stabilisation of GHG emissions by 2030 (see figure 8). Whilst this is an improvement on historic trends and current policies, figure 8 shows it is nowhere near sufficient to limit temperature rises to 2°C let alone 1.5°C. Instead, meeting these pledges would leave the world on track for approximately 3°C of warming by 2100.

Figure 8: Global GHG emissions under different scenarios and the emissions gap by 2030



Source: [Emissions Gap Report 2020](#), UN Environment

Carbon pricing

A key policy measure is “carbon pricing”, ie charging fossil fuel users for emitting CO₂, either by taxing emissions or requiring them to purchase permits allowing them to emit a certain amount of CO₂. The idea is that those causing climate change pay something towards the resulting social costs, thus providing an economic incentive to cut emissions.

Carbon prices, where used, are currently quite low (eg around EUR 25 per tonne in the EU Emissions Trading System), but economists advise that they will need to rise substantially to achieve the 1.5-2°C target (eg the International Energy Agency uses \$125-140 per tonne in 2040 in its Sustainable Development Scenario). Such measures would particularly affect energy producers and heavy users of fossil fuel energy (eg transport and heavy industry).

Figure 8 shows that, for example, the level of emissions in 2030 associated with unconditional NDC scenario is estimated to be 15 GtCO₂e too high to meet the median estimate of the 2°C range, and 32 GtCO₂e too high to meet the median estimate of the 1.5°C range.

5. Transition impacts

Figure 8 shows that GHG emissions need to fall rapidly and significantly in order to keep temperature rises within 1.5-2°C, implying fundamental changes in the way we produce and consume energy if the Paris Agreement goals are to be met. Such falls in emissions could be achieved through a combination of:

- policy measures, ie governments encouraging/mandating their citizens and businesses to follow certain types of behaviour and discouraging/prohibiting others;
- technological innovation, ie alternatives to fossil fuels becoming cheaper and perhaps more attractive in other ways too; and
- customer preferences, ie individuals and businesses choosing lower carbon options (due to climate change concerns or for other reasons).

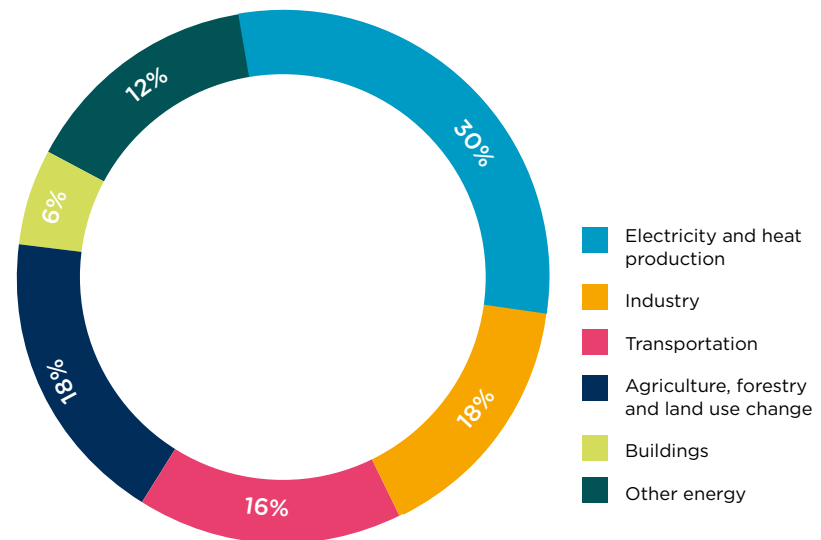
A world with materially lower GHG emissions would look very different from the world we live in today and would likely include:

- much greater use of low carbon energy sources: solar, onshore and offshore wind, hydro, geothermal, tidal, biomass and nuclear;
- much lower share of energy from oil, gas and especially coal;
- where fossil fuels are burned in large centralised plants, use of “carbon capture and storage” to limit GHG emissions into the atmosphere;
- more efficient use of energy, potentially with lower overall energy use (since it is often cheaper to reduce energy use than switch to low carbon sources);
- higher share of end energy use from electricity, due to electrification of vehicles, heating and industrial processes (since most low carbon power generation is in the form of electricity);
- smart (and possibly more localised) grids and energy storage facilities to balance electricity supply and demand (since it is harder, but not impossible, to control renewable energy supplies than fossil fuel ones);
- a shift from private to public transport, more walking and cycling, less flying, and more localised supply chains to reduce energy demand for transport;

- greater use of sustainable agricultural techniques which store more carbon in the soil and reduce methane emissions from cattle, tropical wetlands and rice paddies;
- lower meat consumption (since a lot of meat production is highly GHG generative), more locally grown food and less food waste;
- less deforestation and more reforestation, since trees are good stores of carbon; and
- more “circular economies” with extensive recycling of materials as raw materials become less available.

Given the scale of changes required, they would inevitably have major economic and financial impacts. Figure 9 shows the current sources of GHG emissions, as an indication of where the biggest changes may be felt (noting the Paris Agreement aim of reaching zero net emissions in the second half of this century).

Figure 9: Global GHG emissions by economic sector



Source: Climate Watch, World Resources Institute (2016)

6. Economic and financial implications

There is considerable uncertainty about how physical and transition impacts will affect the economy and financial markets. This is not only because we do not know where on the physical-transition spectrum we will end up, but also because we do not know which transition measures will be implemented or when (whether as a result of policy changes, technological innovation or customer behaviour) or precisely how the climate will react to changing GHG concentrations. What we can say with certainty is that climate change is a source of risks and opportunities for businesses and investors.

Four industry groups have been identified as particularly exposed to climate-related risks and opportunities:

- Energy
- Transportation
- Materials and buildings
- Agriculture, foods and forest products.

Figure 10: Comparison of CO₂ emissions by sector for a global equity index

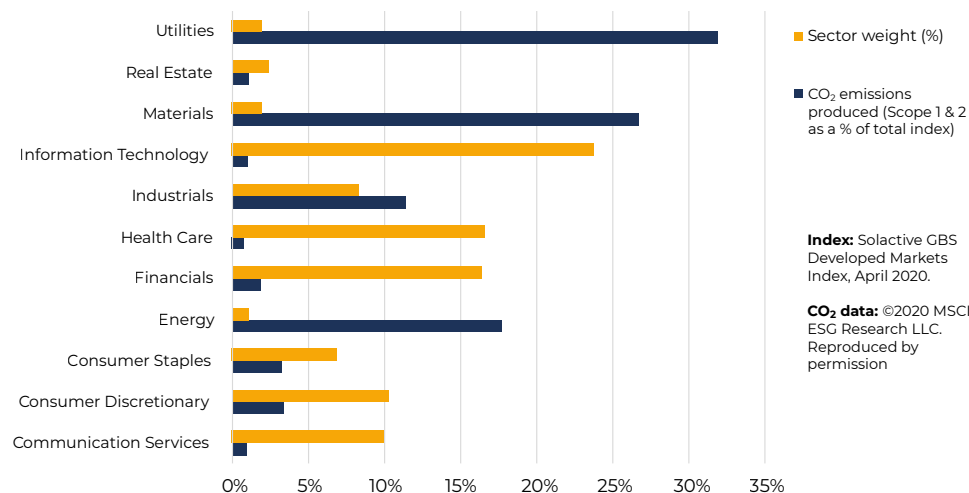


Figure 10 shows that there are particular sectors that are more exposed due to the large share of carbon emissions relative to the low weight of the sector in the index by value. This is most obvious for materials, energy and utilities (much of which is considered as part of the energy sector by the TCFD - see section 7). Although current business models may be threatened by physical and transition risks, there will also be opportunities for businesses to develop products and services that support climate adaptation and mitigation, to become more competitive through more efficient use of energy and other inputs, and to respond to shifts in customer preferences (see box).

Climate change opportunities

Despite the heavy focus on addressing climate risks, a shift to a low carbon economy is also likely to present investment opportunities. The most tangible opportunities are currently in the real assets sector, although there are broader equity and debt investment opportunities as well. A study by the Global Commission on the Economy and Climate estimates that around US\$90 trillion of investment in infrastructure is needed in the period to 2030 as part of the transition to a low carbon world.

Some potential opportunities include:

- renewable energy eg wind and solar farms
- alternative energy sources eg hydrogen and waste-to-energy
- smart grids
- carbon capture and storage
- energy efficiency eg insulation and industrial processes
- resource efficiency eg precision technologies and recycling
- transportation eg electric vehicles and mass transit
- sustainable food and agriculture
- sustainable forestry.

All other sectors will be affected too given the highly interconnected nature of the modern economy. For example, figure 2 (section 2) indicates how financial sector companies have exposure through their lending, insurance and investment activities. Other sectors will be affected primarily through their supply chains. The price of inputs and their transportation could rise, or supply chains could be disrupted by extreme weather events. Businesses could also be affected through changes in customer behaviour, such as reduced demand for their products if consumers need to spend a larger portion of their income on food and energy.

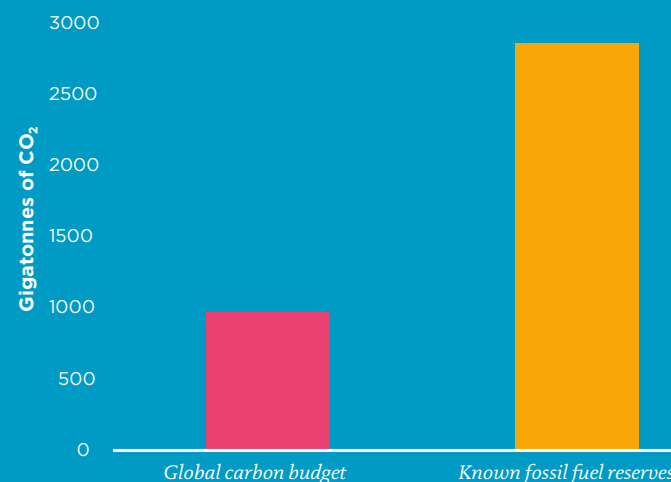
One particular concern is the risk that assets become “stranded” because they lose their economic value well before the end of their expected lifespan as they are either no longer needed or no longer allowed to be used, in a low carbon world (see box).

Stranded assets

Fossil fuel producers are particularly exposed to climate-related risks as the transition to a lower carbon economy poses an existential threat to their business. There is concern that a large proportion of their fossil fuel reserves may become ‘stranded’ and hence worthless, which could mean that these companies are currently over-valued. The International Energy Agency has calculated that, to have an 80% chance of achieving the 2°C target, only around one third of known fossil fuel reserves can be burnt unless some form of carbon capture and storage becomes economically viable (see chart).

Other assets are at risk of stranding too, such as transport infrastructure and industrial plant that relies on fossil fuels, or agricultural land that becomes unviable due to climatic changes. Investors in seemingly long-lived assets such as infrastructure should be particularly mindful of potential changes in demand due to social and environmental trends. Investors in real assets should consider the assets’ potential vulnerability to the physical effects of climate change, particularly extreme weather events.

Carbon content of fossil fuel reserves vs. amount of carbon that can be burnt by 2100 (for 80% chance of meeting 2°C target)



Source: Carbon Tracker, Unburnable carbon 2013: Wasted capital and stranded assets, April 2013

In addition to affecting share prices, climate-related risks and opportunities will affect some companies' ability to repay debt, with implications for fixed income portfolios. Indeed, sovereign debt may be affected too: some countries are heavily reliant on fossil fuel exports; others are particularly exposed to the physical impacts of climate change, such as those with low-lying cities or heavy reliance on agriculture. There could also be effects on interest rates and inflation, with implications for many investments.

Whilst some broad conclusions can be drawn about the industry sectors and asset classes which face the greatest climate-related risks and opportunities, exposure will vary within sectors and some companies will manage the risks and opportunities better than others. This suggests that investment risks need to be considered at a granular level by investment managers, as well as at a strategic level by investors.

Some studies have attempted to quantify the potential financial effects of different climate scenarios. Typically they have considered real world impacts over several decades. However, financial market impacts could be felt much sooner. The "Unhedgeable Risk" study by the Cambridge Institute for Sustainability Leadership modelled short-term shifts in market sentiment caused by greater awareness of climate-related risks, intended to be possible but not probable, and showed they could cause equity and fixed income portfolios to fall in value by up to 45% and 23% respectively.

Climate change: the corporate impact

Companies are recognising the impact climate change is having, not just on the environment, but also on the future of their businesses. Many companies are experiencing the effects first hand. Here are two examples.

Unilever

"We're on the path to decarbonisation – and there's no turning back. Not taking action to avoid runaway climate change would be a moral abdication of our responsibility to the most vulnerable and to future generations. But driving the movement towards a low carbon economy – that's a huge opportunity, and one that Unilever must be a part of."

Paul Polman, then-CEO, Unilever

Aviva

"Making a profit is essential in business. But we will only be in business in the future if we act sustainably and create wider long term social value. That's just good business – and not acting sustainably is very bad business indeed. Climate change in particular represents the mother of all risks – to business and to society as a whole."

Mark Wilson, CEO, Aviva

Source: Unilever - <https://www.unilever.com/sustainable-living/reducing-environmental-impact/greenhouse-gases/how-were-becoming-carbon-positive-in-our-operations/>

Aviva - <https://www.odi.org/news/803-media-note-major-insurers-urge-q20-leaders-commit-2020-fossil-fuel-subsidy-phase-out>

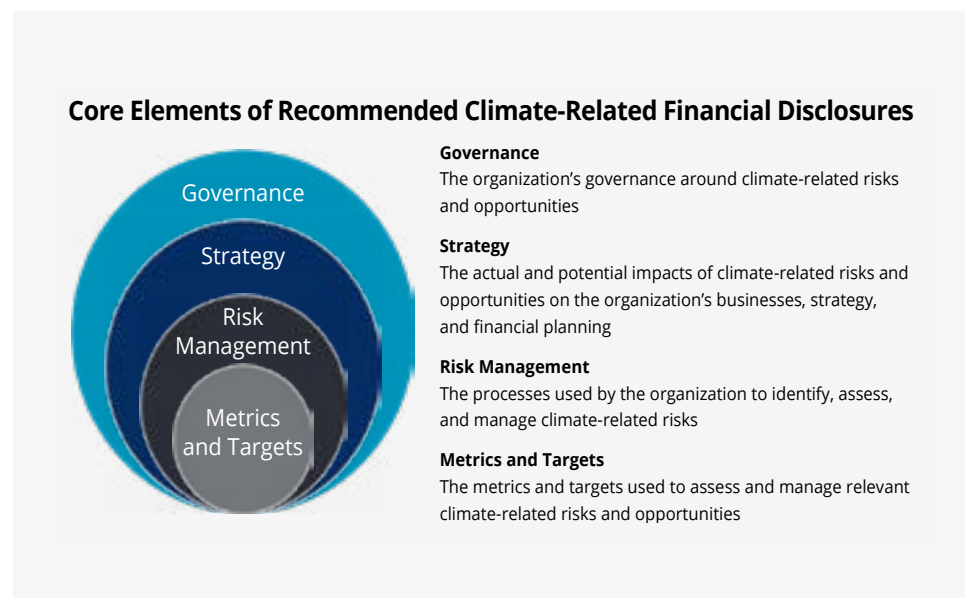
7. Climate change initiatives

We summarise and explain below some of the key initiatives you may have come across. These groups are developing frameworks and guides to assist the industry investors in incorporating climate considerations.

Task Force on Climate-related Financial Disclosures framework (“TCFD”)

The Task Force on Climate-Related Financial Disclosures (TCFD) was established by the Financial Stability Board in 2015 in response to a request by the G20 Finance Ministers and Central Bank Governors. It is chaired by Michael Bloomberg and consists of 32 individuals in a wide range of senior roles across the globe. It was asked to develop voluntary, consistent climate-related financial disclosures that would be useful to investors, lenders, and insurance underwriters in understanding the serious risks that climate change poses to the global economy and organisations within it.

The TCFD published its [recommendations](#) in June 2017, setting out disclosures covering governance, strategy, risk management, metrics and targets. The report also describes the financial implications of climate-related risks and opportunities in detail and is an excellent introduction to the topic.



Source: TCFD, Recommendations, June 2017

The TCFD is uniquely well-placed to drive meaningful improvements and harmonisation in disclosures across the globe due to its high profile members and supporters. It is supported by nearly 1,500 companies and financial institutions from over 50 countries,¹ and has been endorsed by several national governments including the UK. Its recommendations are therefore proving influential despite their voluntary nature.

[1] Source: TCFD, September 2020. <https://www.fsb-tcfd.org/tcfd-supporters/>

The Institutional Investors Group on Climate Change (“IIGCC”)

The IIGCC consists mainly of European pension funds and asset managers with around €35 trillion in assets under management.¹ It aims to mobilise capital for the low carbon transition and ensure resilience to the impacts of a changing climate by collaborating with business, policy makers and other investors.

One of the IIGCC’s current initiatives is the Paris Aligned Investment Initiative. Under this initiative the IIGCC has published the Net Zero Investment Framework for consultation – a comprehensive guide to assist investors with decarbonising investment portfolios and investing in climate solutions.



Climate Action 100+

This is an investor-led initiative where members commit to engage with the world’s largest corporate greenhouse gas emitters. The goal is to encourage more than 100 of the most ‘systemically important emitters’, accounting for two-thirds of annual global industrial emissions, to reduce emissions, and strengthen climate governance and disclosure. To date, more than 4,500 investors worth over US \$52 trillion in assets under management are signatories to the initiative.²



[1] Source: <https://www.iigcc.org/about-us/our-members/> (accessed January 2021)

[2] Source: <https://www.climateaction100.org/about/> (accessed 13 January 2021)

[3] Source: <https://www.transitionpathwayinitiative.org/overview> (accessed December 2020)

[4] Source: <https://www.unpri.org/pri/about-the-pri> (accessed 13 January 2021)

Transition Pathway Initiative (“TPI”)

The TPI was established in 2017 as a joint initiative between the Church of England National Investing Bodies and the Environment Agency Pension Fund. This has developed into a global initiative supported by investors representing over US\$23 trillion in assets under management.³ It provides independent research that assesses how well companies are prepared for the transition to a low-carbon economy.



Principles of Responsible Investment (“PRI”)

The PRI aims to understand the investment implications of environmental, social and governance factors and support its investor signatories in incorporating these into their investment decisions. It was launched in 2006 following a request by the UN to some of the world’s largest institutional investors. It now has over 3,000 members, including asset owners representing around US\$20 trillion, and asset managers representing over US\$80 trillion.⁴

The PRI has developed forecasts based on the Inevitable Policy Response (“IPR”), which is a term for governments’ response to climate change. The PRI believes that markets, and existing forecasts, are not pricing in the financial impacts of the IPR. The PRI’s forecasts aim to show how these might play out, and the term IPR has since become more widely used when discussing climate policy.



8. Conclusion

Despite the uncertainties surrounding climate change and climate policy, we can be confident that the future will look different from the past because of both physical and transition impacts. You might want to think about how and when your investments could be affected in the following global temperature scenarios:



1.5-2°C

Global policy targets met



3°C

Current policy commitments honoured



4°C

Continuation of historic trends

We would be pleased to help you explore your investment beliefs in relation to climate change, including how material climate-related risks are for your investments over relevant time horizons, and the options for actions in terms of investment strategy, manager selection and manager monitoring.

Contact us

For further information please contact your usual LCP adviser or one of our specialists below.



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