HSBC Global Research

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A race on two fronts

Climate mitigation vs adaptation at COP26

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- The less we manage to *mitigate* climate change, the more likely we will have to *adapt* economies and countries
- Mitigation goals tend to grab headlines, but adaptation's relevance could grow as physical climate impacts increase
- Actions differ across mitigation and adaptation; there could be a risk of doing more on one, at expense of the other

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Climate action comes in many forms. Broadly speaking, mitigating involves cutting greenhouse gas emissions out of the world economy to limit future temperature rises; whereas adaptation involves preparing nations, industries and populations for a more volatile climate. Successful mitigation rests on global conviction to decarbonise entire economies, whereas adaptation action is typically more location-specific in nature.

It's a race on two fronts. The more the climate changes, the more we are likely to have to adapt; and the less that is done on mitigating greenhouse gases, the more climate change accelerates - as such the two are linked and can be self-re-enforcing. Even though climate action is not a 'zero-sum game', if resources are finite then diverting capital to address one could come at the expense of action on the other.

2021 events bring timeframes forward, and raise urgency. Recent global weather events and stark scientific findings will sharpen minds. While these raise the urgency to limit the worst of climate change through mitigation, they also highlight the fact that climate change is both already well under way and happening quicker than previously – making adaptation efforts increasingly relevant to global climate discussions.

Adaptation and mitigation at COP26: Headlines might focus on whether countries adopt a global 'net zero' mitigation target, but the devil is likely to be in the detail. Establishing a defined and agreed 'global goal on adaptation' is also a key potential outcome from the climate talks.

Focus tends to be on mitigation, but spending will differ if there is a pivot towards more adaptation. An estimated 95% of global funding on climate action goes on mitigation, and more is generally known about how to decarbonise global energy and industrial sectors. Adaptation action will look different, and is more varied; it can focus on infrastructure resilience, water and food security, prevention of weather-related economic losses, or protecting lives. The need to adapt to climate change is also uneven by geography and skewed towards EM/FM countries.

In a 'tug of war'; is it better to spend to cut carbon, or increase resilience? Indications are that more efforts on both mitigation and adaptation will be needed globally; but the urgency and materiality of each will likely shape decisions for individual countries and companies, particularly if there are only limited funds to tackle both sides of climate change.

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Two sides of the climate coin

- Mitigation action is essential for prevention, but with science pointing to an already changing climate, adaptation's relevance could grow
- Adaptation actions are inherently uneven across geographies and sectors, and also differ in nature to those of climate mitigation
- Decisions at COP26 could set important markers for global goals and mechanisms for future mitigation and adaptation actions

Working to limit, but also learning to live with, climate change

The less we manage to successfully mitigate change, the more likely we will need to adapt to its impacts

Striking a balance when pulled in two directions

Acting on climate change can have many definitions and permeations, but perhaps at the forefront is undertaking efforts to best mitigate its future effects, while also preparing for the impacts that it will bring. In recent years the lion's share of the capital and focus across financial markets, governmental policy and civil society sentiment has been on taking steps to mitigate the cause of global temperature rises – namely reducing greenhouse gas emissions (GHG); with climate change adaptation somewhat taking a second seat at the table.

As the window of opportunity to achieving global 'net zero' emissions shrinks with each passing year, the physical impacts of climate change are growing ever more intense, frequent and closer – pushing the need to adapt up the agenda. Recent updates from the global scientific body on climate change point to the fact that even if climate change mitigation efforts are ramped up at an unprecedented rate – effectively overhauling the energy system to drive out GHGs – global surface temperatures will continue to increase until mid-century (having already warmed more than 1°C to date from pre-industrial averages). This means that adaptation's relevance to the discussion is likely to grow as the physical impacts of climate change move ever-closer.

The relevance of COP26

Upcoming climate talks aim to make progress on global climate ambition …

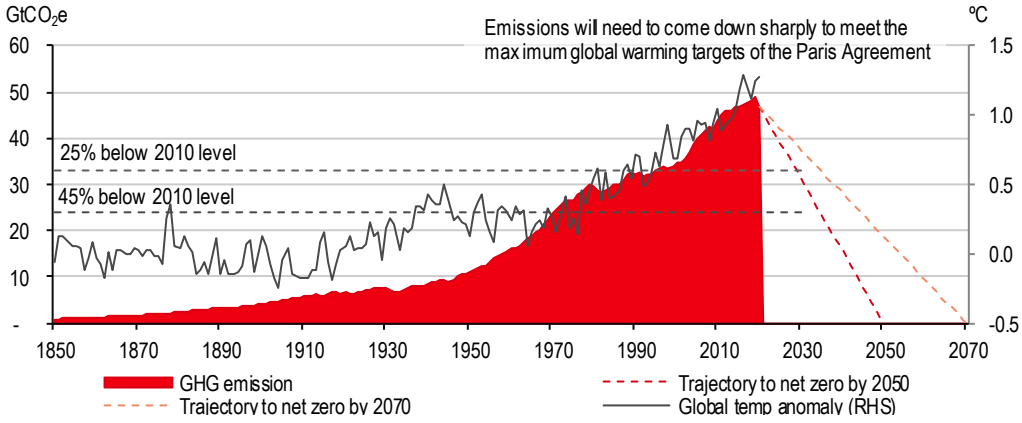
Climate mitigation and adaptation are both set to be high on the agenda at the 26th Conference of the Parties (COP26) in November; outcomes from the talks will involve headline announcement as well as more granular details. Labelled as one of the last opportunities for the world to adopt a global 'net zero' emissions pathway, the ambition of global mitigation goals is perhaps where the widest focus may lie. However, details around how the frameworks and mechanics on how goals are to be delivered (such as climate finance and closing off Article 6 of the Paris Agreement) are key; likewise, the renewal and standardisation of national climate commitments will also be closely watched.

… with mitigation more reliant on world co-operation than climate adaptation, which is more localised

Furthermore, the issue of agreeing a global goal on climate adaptation will also be on the agenda at COP26 – another overhang from the Paris Agreement, which features "increasing the ability to adapt to adverse impacts of climate change" among its objectives (Article 2.1(b)).

The less that is done to mitigate emissions, the more average temperatures rise …

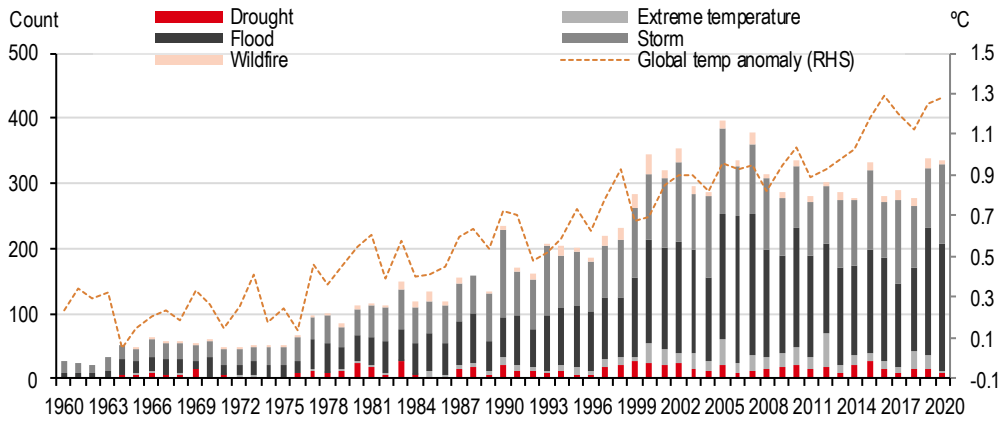
As global emissions rise, so does the temperature …



Source: PRIMAP, UK Met; Note: GHG emissions for 2018 and 2019 are based on CAGR from 2007 to 2010 and 2010 has been estimated based on CO_2 emission reduction in 2020 compared to 2019. In a 2021 report, UN Climate Change put out 2030 target levels of 25% below 2010 for 2°C alignment, and 45% lower for 1.5°C alignment

… resulting in shifting weather patterns, and the need to *adapt* to new conditions …

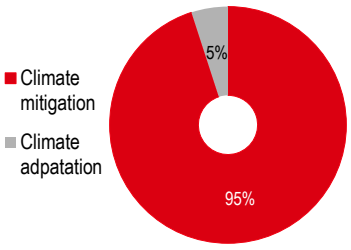
… increasing the frequency of extreme weather events …



Source: EMDAT, UK Met

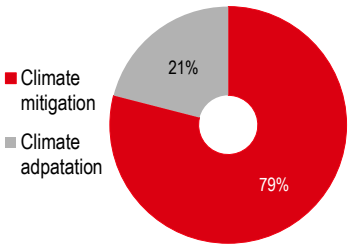
… global spending is currently heavily focussed on climate mitigation

Global funding for climate action (2018)



Source: Climate Policy initiative

Climate capital flows from developed nations to developing world (2018)



Source: OECD

Climate mitigation vs adaptation: similarities and differences

Climate change mitigation and adaptation actions differ as much as they hold similarities, but both are crucial for building a sustainable and resilient future global economy; one seeks to limit the extent of climate change and the other is designed to prepare the world for its impacts.

Mitigation vs adaptation can also be phrased as 'transition' vs 'physical' risks from climate change

Climate change mitigation and adaptation: definitions and examples

Mitigation: actions to reduce the flow of greenhouse gas emissions into the atmosphere, or action that removes historical cumulative GHGs. The goal is to ultimately put the world on a path towards delivering global 'net zero' emissions to limit future average temperature rises.

Adaptation: steps taken to adjusting assets, populations and economies to withstand and be able to operate in an expected future changing climate system. The objective of adaptation efforts is to build a resilient world that allows economic activity and populations to continue to operate in the face of a changing climatic system by reducing potential adverse effects.

Frameworks such as the Taskforce for Climate-related Financial Disclosure (TCFD) label mitigation actions as those which work to minimise *'transition risks'* whereas adaptation efforts are ways to limit or contain *'physical climate risks'*.

Mitigation and adaptation actions can mean quite different things in practise

Examples of climate mitigation and adaptation actions (non-exhaustive)

Climate mitigation	Climate adaptation
Replacing fossil fuel powered electricity generation (such as natural gas or coal) with renewable sources	Re-enforcing storm defences such as levees and flood wall systems
Retrofitting buildings to improve energy efficiency and constructing new 'green' buildings	Protecting low-lying land and properties against the threat of rising sea levels
Increasing use of low-carbon transport forms (EVs, hydrogen powered vehicles) in place of petroleum powered methods	Reforestation to shield against rainfall and managing forests to minimise the impact of fires
Direct air capture to remove historical atmospheric emissions and installing carbon capture equipment at industrial sites	Adapting consumption patterns in water-insensitive industries to adapt to changing freshwater availability
Increase consumption of plant-based dietary alternatives to products that use animal inputs	Developing crops with increased drought tolerance or ability to withstand changing precipitation patterns
Developing hydrogen-based low-carbon synthetic fuels	Preservation of areas of biodiversity
Implementing energy efficiency measures that reduce the consumption of primary energy and emissions	Adapt physical assets to be able to operate in higher temperatures eg. railway tracks
More recycling to reduce need for raw material extraction	Cooling work places to maintain productive environments

Source: HSBC

Not all climate action and risks are created equally

Mitigation actions contribute towards the success of common global goals …

Broadly speaking, actions to mitigate climate change involve reducing or removing GHGs from the common global atmosphere. While geographical regions and economic activities vary in their respective emissions intensity (eg. the US / Europe's emissions per capita or unit GDP are several fold higher than those of many emerging economies; or heavy industry is much more GHG-intensive compared to service-based economic output), the act of reducing a given amount of GHG emissions has the same impact towards curbing global concentration levels, regardless of where the mitigation activity takes place. That is to say, from a global carbon emission mitigation perspective, 1 tonne of CO_2e abated or removed in the UK accounts for the same unit that is abated or removed in another nation, say Mozambique. The mitigation acts are likely to have different costs and contribute to differing national targets, but both serve towards the notion of 'OMGE' – overall mitigation of global emissions.

… whereas the benefits of adaptation actions are more location-specific

This is not the case for climate adaptation; the spread of physical climate risks is inherently location-specific and varies in nature and magnitude. These can be chronic (eg. creeping desertification or gradual changes in rainfall patterns), or acute (eg. increase frequency or intensity of extreme weather events) – in each case requiring different adaptation actions. The geographical spread of physical risks (that will likely need adapting to in the future) is also inherently uneven (see page 11), with a skew towards EM/FM countries.

Spending on mitigation and adaptation will look quite different

Investments in climate change mitigation and adaptation can look very different

Mitigation and adaptation actions – broadly speaking – tend to both be long-cycled investments with the goal of lowering both immediate and longer-terms risks. Spending decisions on each typically take place at a national, industry, company or individual level and are often shaped by policy decisions and priority levels for taking such action.

We've previously discussed the idea that climate change action - both mitigation and adaptation - can suffer from a so-called 'tragedy of the horizons'. This is where the uncertainty of future expected climate impacts can cloud decisions linked to taking nearer-term mitigating actions (which typically involves spending or incurring costs) against such risks. However, we think that the more apparent physical impacts of climate change become in the nearer-term, the more this dynamic may shift going forward.

The pathway to successfully mitigating the worst of climate change is fairly well-known, for example the International Energy Agency (IEA) recently released its roadmap to achieving global 'net zero' emissions by 2050. This laid out a clear and actionable, if ambitious, set of targets and policies to deliver an energy and industrial system in line with the ambitions of a limit of 1.5°C warming. It dictates that spending on energy needs to rise from around USD2trn a year today to USD5trn by 2030, and shift from mostly fossil-fuel based to largely low-carbon forms – and in doing so giving an indication of the distribution of change needed by geography and sector (although it does not address GHGs from areas such as agriculture and land-use for example).

How the world needs to act on adaptation is less clear, and somewhat of a moving target as the weather system continues to evolve and areas of the world increasingly show signs of strain from the climate system. Adaptation spending will look different to that of mitigation by industry and geography, and is more varied; it can focus on areas such as infrastructure resilience, action to improve deteriorating water and food security, methods to prevent weather-related economic losses, or prioritise protecting human lives. Best estimates of potential future adaptation actions are also guided by climate forecast models, which do carry uncertainties.

Big and small changes are needed for both

Mitigation and adaptation actions can be either incremental - where changes are made but the underlying functionality of an existing system or asset is only partially changed, or transformational in nature - actions that change the fundamental attributes of an operation or activity in response to current or future climate change and its impacts.

Interdependency

Action on climate mitigation can interfere with adaptation efforts; and vice versa

Mitigation and adaptation can, and do, overlap in instances where they exert an interdependent relationship. Examples of this include adapting to higher temperatures in places of work or living by using air cooling/conditioning that is powered by GHG emitting sources, hampering climate mitigation efforts. Other examples, include the use of land for managed forests for biomass that is to be used in energy production – areas that could otherwise perhaps be used for adaptation to, say deal with changing rainfall patterns. Similarly, climate change could alter global wind patterns, interfering with the roll-out of wind as a low-carbon energy source.

Market failures

Current economic activity, in most cases, does not reflect externalities associated with climate change. GHGs – the primary cause of a warming planet – are seldom adequately priced to reflect their contribution to economic costs/losses elsewhere in the world. On the flip side, those that will ultimately have to pay to adapt economies are, in cases, emerging / frontier countries that are only responsible for a relatively small proportion of historical GHGs (see page 11).

Science brings the timelines forward for both

IPCC findings highlight the magnitude and pace of physical climate impacts …

The Intergovernmental Panel on Climate Change (IPCC) recently released the first of a series of reports as part of its sixth assessment cycle (known as AR6) which serves as the latest estimates on how much the climate has changed to date, how much it could continue to change in the future, what the associated risks could be, as well as the feasibility of limiting further change. Future reports from the AR6 series are set to address mitigation and adaptation aspects of climate change in more depth during 2022.

… increasing the urgency to take more mitigation *and* adaptation actions

Headline conclusions from the report (see below table) around the pace, magnitude and nature of climate change arguably bring out two key points in the debate around mitigation vs adaptation: i) the urgency to undertake significant mitigation actions has increased as the window to reach global 'net zero' shrinks; and ii) the climate is changing faster than expected (and will continue to change in coming decades), making the need to adapt also more apparent.

Twelve key findings from the IPCC's Physical Science Basis report

Twelve key findings from the IPCC's AR6 WG1	
1. The human influence on the climate can now be better attributed	7. Warming increases the frequency and intensity of extreme events
2. Atmospheric concentrations of GHGs are really high	8. Carbon sinks only work to a certain extent
3. Temperatures are rising 1.4-1.7x faster on land than oceans	9. Tipping points are irreversible changes over centennial or millennial time scales
4. Precipitation will become more frequent and more intensive	10. Highly disruptive events "cannot be ruled out"
5. Sea levels are rising faster than before	11. The carbon budget is running out
6. Climate sensitivity is "near-linear"	12. Regional effects are a lot more nuanced

Source: HSBC (based on IPCC, AR6 SPM)

Temperatures rises risk more frequent weather extremes

Further temperature increases cause weather event probability to rise in a non-linear fashion …

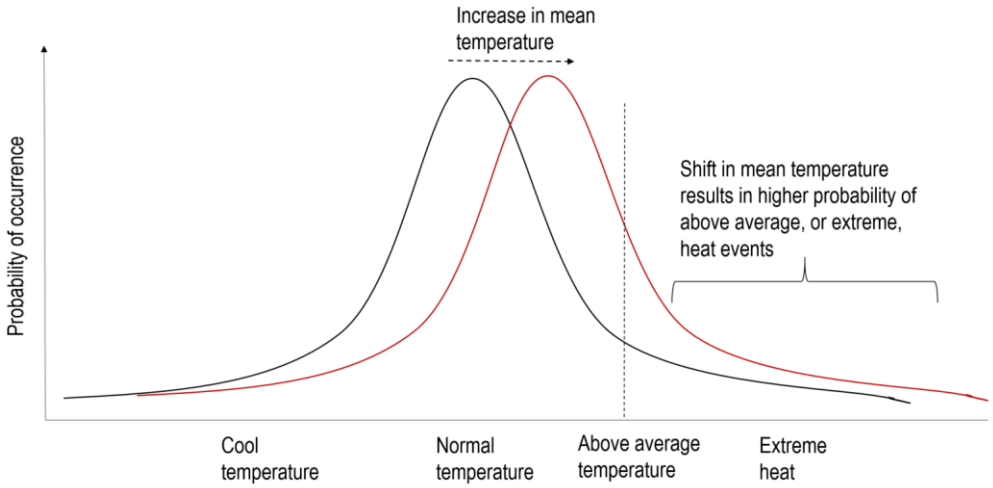
The report considers a range of emissions scenarios that limit long-term temperature rises (by 2100) of around 1.5°C, but also those that see average temperatures rises of as much as 4.4°C. A common finding is that in all of the considered emissions scenarios the *"global surface temperature will continue to increase until at least the mid-century"* – meaning that changes in the climate will continue in coming decades.

While average temperature rises are how the physical impacts of climate change are most commonly framed, many of the acute (rather than chronic/slow-onset) adverse implications of a changing climate are due to variations in extreme weather conditions (eg. heat waves, flooding or hurricanes), rather than long-term average temperatures in isolation. While the idea that climate change will simply mean more tail-risk type events is not the entire picture; the adaptation actions needed to address acute climate change are different to those seeking to deal with chronic effects.

The IPCC also finds that warmer temperatures increase both the frequency and intensity of various extreme events – and that this effect becomes larger "*with every additional increment of global warming*", ie. it is not a linear relationship (see table on following page). This means that changes in several climatic impact-drivers would be more widespread at 2°C compared to 1.5°C global warming, and even more widespread and/or pronounced for higher warming levels. It also cited that human influence is also raising the chances of compound extreme events – where there is more than one acute weather occurrence at the same time in the same region.

… meaning there's a need to prepare for more extreme events, rather than simply higher average temperatures

Illustration of shift in mean temperatures on extreme heat events



Source: HSBC

For practical adaptation actions, the difference between seeking to protect against creeping climate impacts compared to a higher probability of extreme events can mean divergent actions – eg. a coastal asset might only have to incrementally improve sea defences to hedge against slow rising sea levels, but might need a complete overhaul of protection if storm surges/flash flooding is an increased threat.

Similarly, for some economic activities or populations, gradual changes in precipitation may not need as drastic (or quick) protective action, as say a more rapid change in the risk from severe droughts. Nonetheless, for areas of the world that are already under climate strain, the acceleration of slow-moving climate effects could also be impactful enough to warrant a larger re-think of adaptation strategies.

The effect of warmer temperatures on extreme events

	Present	Future		
	1°C	1.5°C	2°C	4°C
Hot extremes (10-year event)	2.8 times, +1.2°C	4.1 times, +1.9°C	5.6 times, +2.6°C	9.4 times, +5.1°C
Hot extremes (50-year event)	4.8 times, +1.2°C	8.6 times, +2.0°C	13.9 times, +2.7°C	39.2 times, +5.3°C
Heavy precipitation (10-year event)	1.3 times, +6.7% wetter	1.5 times, +10.5% wetter	1.7 times, +14.0% wetter	2.7 times, +30.2% wetter
AGR/ECOL drought (10-year event)	1.7 times, +0.3 sd drier	2.0 times, +0.5 sd drier	2.4 times, +0.6 sd drier	4.1 times, +1.0 sd drier

Source: IPCC, AR6 SPM. Note: AGR/ECL refers to "agricultural" or "ecological" drought which depends on the "affected biome".

Climates are changing the world over, but some regions and types of populations are more exposed than others

The IPCC study also states that *"human-induced climate change is already affecting many weather and climate extremes in every region across the globe"*; however, as we discuss later in this report the distribution of these effects is not even in their severity around the world.

Another differentiation on the physical impact is made around the urbanised and coastal areas:

- Cities can intensify human-induced warming locally, increasing the frequency and severity of heatwaves. Urban areas can also be more susceptible to heavy precipitation and high levels of water run off (which might otherwise be absorbed into the ground.
- Coastal areas are expected to be at risk of 'more frequent extreme sea level events' such as storm surges which increase flooding risks.

Window to mitigate the worst impacts gets ever smaller

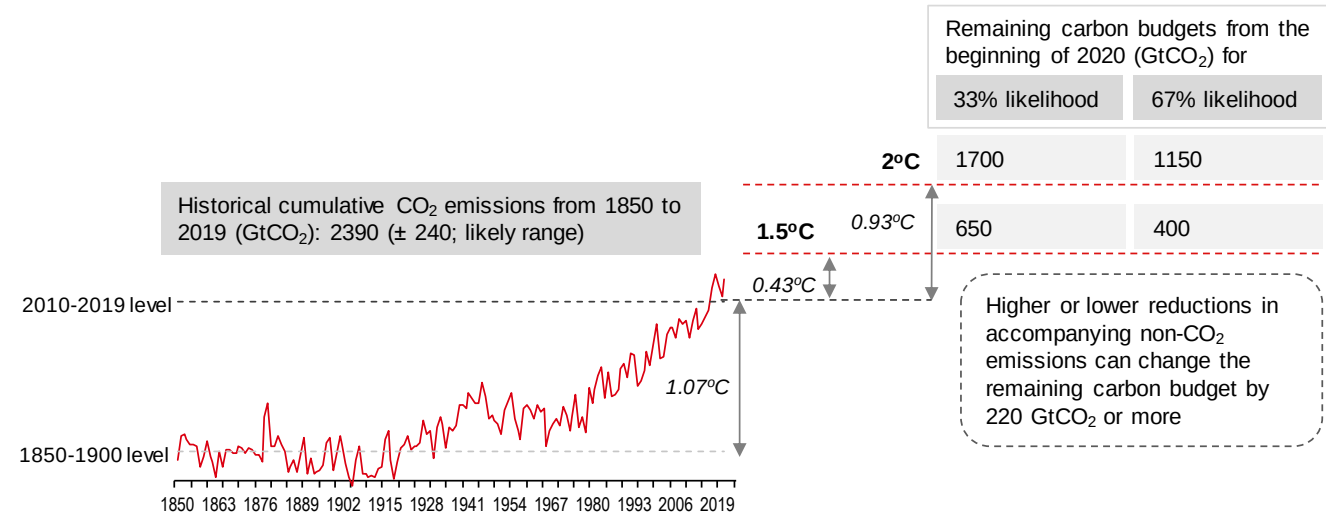
The read-across from the science for mitigation actions and efforts is several-fold; namely:

- The human impacts of climate change are now better attributed, meaning mitigation actions should focus on the causes of GHGs from human activity.
- Remaining carbon budgets (or the atmospheric GHG limits) are shrinking, raising the urgency to act within ever-shortening time periods.
- Mitigation action, to be successful in avoiding the worst of climate change, has to meet an every-more challenging combination of timescale and magnitude – do even more, even quicker.
- The potential severity of impacts from unchecked climate change could arguable raise the implied costs of not acting to mitigate.

At current global rates, each 20 years of emissions translate to ~0.5°C warming

The conclusion from the IPCC is clear: under all of the emissions scenarios it considered, the Paris Agreement goals of limiting average global temperature rises to 1.5-2°C will be exceeded this century "*unless deep reductions in CO_2 and other greenhouse gas emissions occur in the coming decades*." Within this context, it found that the relationship between temperature rises and increases in CO_2 is near-linear with 1,000 $GtCO_2e$ of cumulative emissions estimated to increase global surface temperatures by 0.45°C (in a range of 0.27-0.63°C). On our calculations, this roughly equates to just under 0.5°C of warming for every 20 years of GHGs emissions at the current annual global run rate.

Scope for successful mitigation action shrinks as global carbon budget continues to be depleted



Source: IPCC, AR6 SPM

Mitigation and adaptation at COP26 – the focus and sticking points

Climate mitigation and adaptation will both feature prominently at COP26

In the build-up to the upcoming COP26 climate change talks we discuss some of the key points set to feature, and how each relate to climate mitigation and adaptation agendas. After a year's delay due to COVID-19, this COP is being viewed as one of the last opportunities for the world to adopt a global 'net zero' emissions pathway.

Some of the main points of debate, and potential measures of 'success' include:

- An overall set of agreements that result in ambitious climate goals being adopted and followed through with commitments, that ultimately translate into policies and action.
- The ambition of renewed national climate action pledges or Nationally Determined Contributions' (NDCs) that cover emissions reductions as well as preparing for the impacts of climate change by building up resilience.
- The finalisation of Article 6 of the Paris Agreement, an overhang from previous conferences; the article covers issues such as voluntary co-operation and mechanisms in NDCs to allow for parties to transfer / mitigation actions globally.
- Developing Parties will also be seeking for more clarity and confidence regarding the delivery of a previous aim of USD100bn in annual climate finance (in return for greater ambition and higher levels of transparency).

The goals for COP26 – *from the perspective of the UK as host nation*

Mitigation	Adaptation	Finance	Collaboration
Coal to Clean Power	Financing Resilience	**Public Finance**- *11 priorities including*: • Mobilising private climate finance • Finance for nature and nature based solutions • Gender-responsiveness of climate finance	**Finalising the 'Paris Rulebook'**: • Solution on carbon markets • Resolving issues on transparency • Driving ambition from governments
Nature for people and climate	Habitat protection and restoration		Collaboration between governments, businesses and civil society to tackle climate crisis
Transition to zero emission vehicles	Adaptation Communication	**Private Finance**: • Reporting • Risk management • Returns • Mobilisation	

Source: UK COP26 website

Mitigation – front and centre, but devil is in the details

Ambition levels on climate mitigation actions are often headline grabbing at COP events, and can be seen as binary – the adoption of a goal that is aligned with climate science (either a % reduction in GHG or a temperature limit) can be cheered, whereas failure to agree on such a marker might be viewed as a defeat.

The reality is more nuanced. Firstly, overall global climate mitigation ambitions need to be backed up by the collective efforts implied by the 190+ NDCs. Secondly, the frameworks in place need to be in place for the NDCs and other mitigation actions to be delivered successfully – such as financial support and co-operation mechanics.

Overall mitigation goals need to be backed-up by national commitments, and have mechanics in place to be delivered

As such, the robustness of mitigation pledges and implied actions that may emerge from COP26 need to be weighed up with the operational details on which they rely. Evidence of the potential for mismatches has been evident in recent years; collective NDCs at the adoption of the Paris Agreement were insufficient to deliver on its goals. Furthermore, despite the ambition levels of mitigation goals, global emissions have risen consistently since 2015 (with the exception of the COVID-19 impact in 2020), and look set to rebound sharply in 2021.

Adaptation – setting the goal posts

Article 2.1(b) of the Paris Agreement states that one of the agreement's objectives is "*increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience*". However, the issue of climate resilience and physical impacts broadly-speaking only reached parity with mitigation in the 2018 (COP24) discussions, however this sentiment has been less apparent since then. Adaptation remains a vital issue and especially championed by more vulnerable economies such as small islands or EM/FM countries.

An Adaptation Committee Report (which essentially reviews recent adaptation work and makes recommendations for future work) was supposed to have been adopted in 2019 in Madrid (COP25), but Parties could not agree on the wording – and so this report will remain outstanding at COP26.

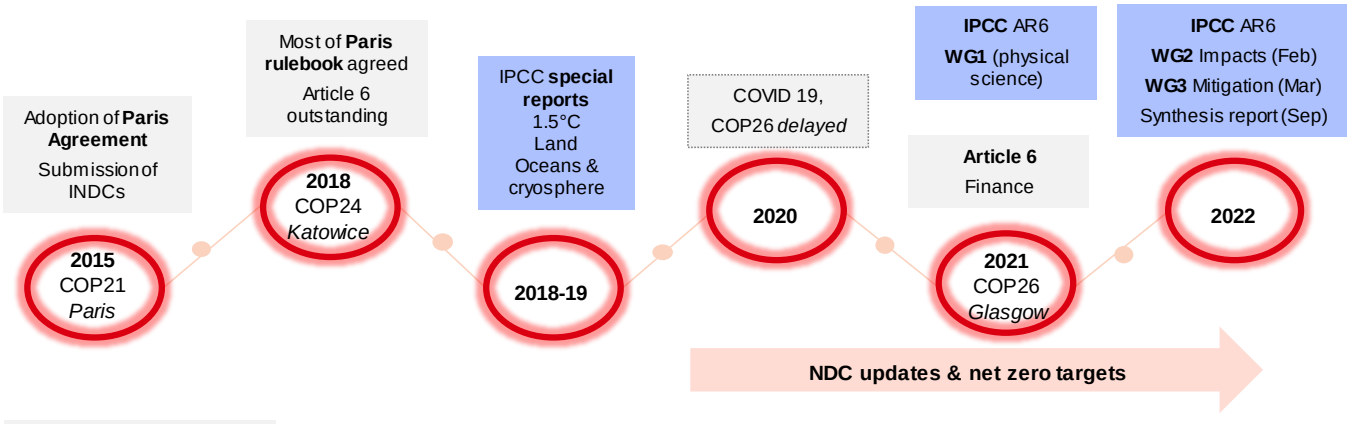
Defining and agreeing a global adaptation goal could be challenging in our view

The sticky issue of agreeing a global goal on adaptation (GGA) will also be on the agenda at COP26. Firstly, there needs to be agreement on the actual definition of a global goal on adaptation, and thereafter, all the usual guidance on how information is to be tracked, reporting, monitoring and governance. These are required not just to assess the progress towards a GGA (i.e. similar to progress towards 1.5°C or 2°C), but also how to mobilise greater adaptation actions. This is tricky in our view because adaptation actions tend to be very localised to regional circumstances.

What to watch in the NDCs

At present, NDCs are a mix of mitigation and adaptation, quantitative and qualitative information, and an array of country-specific information. Establishing common formats, timeframes and reporting at COP26 is one of the key ways to improve transparency and the ability to track action over time. As we discuss later on (see page 11), the balance of intended actions and ambition between mitigation and adaptation will vary significantly across countries depending on the respective risks faced from climate change; eg. some small and particularly vulnerable nations' NDCs are likely to be primarily focussed on adaptation.

Timeline of events leading up to COP26 in Glasgow and the science beyond



Source: HSBC (based on UNFCCC and IPCC)

The relationship between mitigation and adaptation for countries

A country's conviction to act could depend on if it faces physical climate risks …

The distribution of risks (and opportunities) from climate action across both mitigation and adaptation is anything but uniform. The willingness and appetite to take climate action will also depend on the degree to which it ranks among national political and economic priorities.

This dynamic is characterised by uneven incentives to act; for example:

- Some of the nations most exposed to physical climate impacts – and potentially facing some of the highest adaptation costs – can be among the smallest GHGs emitters globally. They might therefore choose to channel efforts on adaptation actions as they may only have a small (or negligible) impact on world emissions should they choose to divert resources decisively towards mitigation.

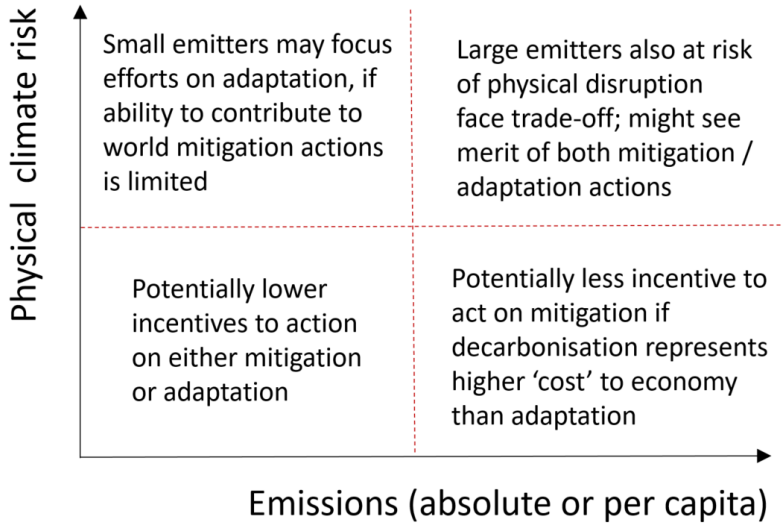
… or economic costs from global decarbonisation

- Large emitters – either on an absolute or per capita basis – may not be suitably incentivised to decarbonise and spend on climate mitigation unless they are expecting to suffer from significant physical impacts in the future.
- Countries that have high economic sensitivity to the trend of global carbon emissions mitigation – eg. large hydrocarbon exporters – could view that adaptation is the smaller 'cost' to pay if it means that important national industries continue to operate.
- Nations that are both large emitters but also facing significant physical risk, (eg. the US and China are world's 1st and 2nd largest absolute emitters but also the top two countries when it comes to number of extreme weather events in 2010-2020) could face an intriguing trade-off of priorities between mitigation and adaptation actions.

… or potentially both

- Fiscal or political constraints will be common across the vast majority of nations – no country to date has written a blank cheque to deal with climate change – meaning that choices between *either* mitigation *or* adaptation undoubtedly will need to be made.
- Other factors are at play such as economic, security or political priorities that relate to climate transition or physical risks. There are also motivations in some countries to act beyond the immediate national interests.
- As a reminder; climate mitigation is more reliant on global co-operation than climate adaptation, which is more localised in nature.

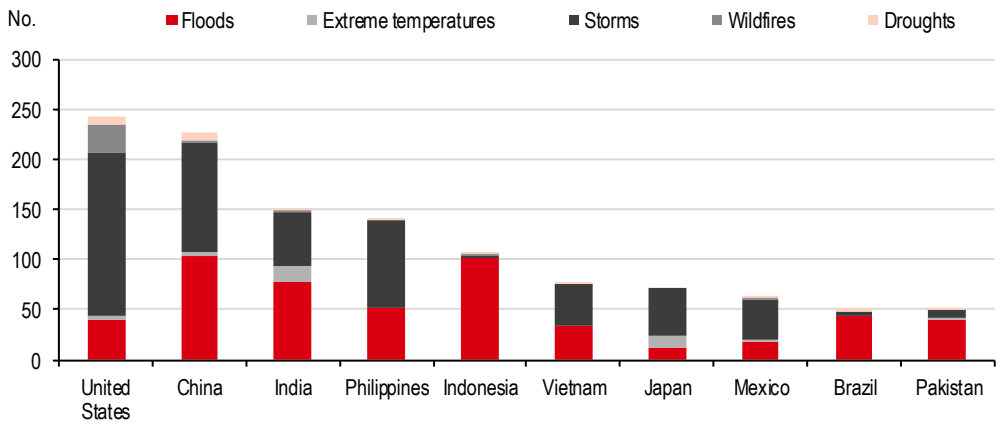
Illustrative plot of potential relationship between national incentives to act on climate



Source: HSBC

Some of the world's largest emitters are also facing higher instances of extreme weather events

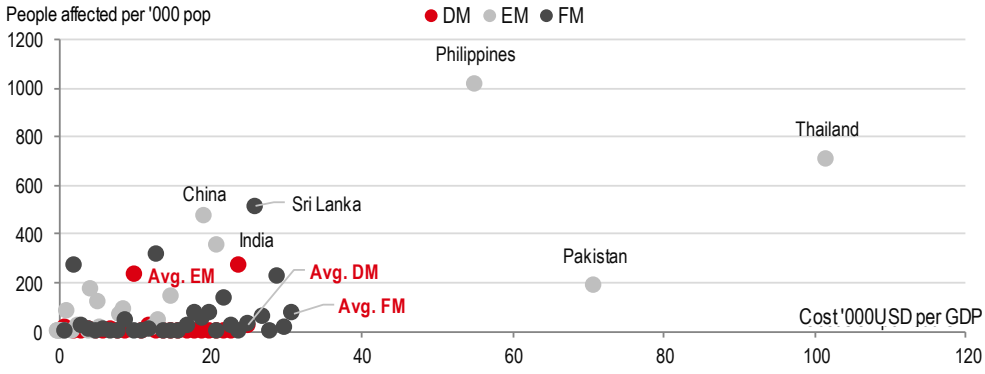
Nations with highest number of extreme weather events over 2010-2020



Source: EMDAT

EM/FM economies and populations tend to be disproportionally exposed to climate impacts

People affected by climate impacts per '000 population vs cost per unit GDP (2009-2019)



Source: EMDAT, World Bank; UN population data. Note: some sample countries are not named

Climate risks and adaptation country rankings, 2021

Greater resilience	Most Vulnerable
1. Finland	1. Sri Lanka
2. Sweden	2. Nigeria
3. Switzerland	3. Egypt
4. Norway	4. Indonesia
5. Canada	5. Côte d'Ivoire

Source: HSBC. Note: Ranking accounts for temperature, water scarcity, air pollution, food systems, ecosystem services, sea level risks and extreme weather events.

Energy, carbon and the macro economy country ranking, 2021

Greater resilience	Most Vulnerable
1. Denmark	1. Kazakhstan
2. Romania	2. Oman
3. Switzerland	3. Saudi Arabia
4. UK	4. Bahrain
5. USA	5. Tanzania

Source: HSBC. Note: Ranking accounts for economic carbon intensity and economic diversification & fossil-fuel dependence.

How much might we need to spend on each, and on what?

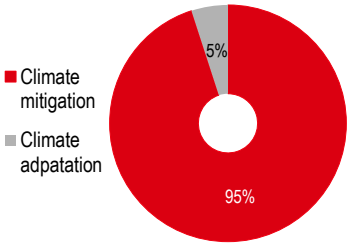
Indications are that spending on both mitigation and adaptation will need to rise going forward

Estimates of the potential costs of addressing the wider climate issue vary and are subject to differing scopes and methodologies; all are subject to uncertainties. One can phrase this as the estimated long-term economic cost of leaving climate change unchecked (up to USD70trln by 2100 according to Moody's), or the amount of capital that might be needed to cut global emissions in manner that limits warming to 1.5-2°C, or the required investment in adaptation that will best protect economies and population from the impact of a changing climate.

Based on studies, the required spend or investment on climate mitigation actions is set to be larger than the cost of adaptation measures needed out to 2050. These are estimates which will no doubt change as physical climate impacts continue to evolve, but also as the window in which to make an orderly transition to a low-carbon economy shortens.

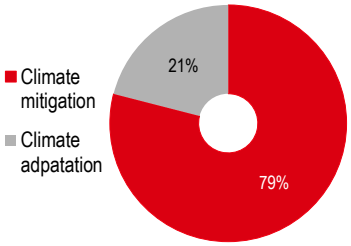
The current state of funding for global action is heavily tilted towards mitigation action, consistent with its more prominent place in the minds of policy makers, financial markets and civil society. Mitigation projects tend to generate a more identifiable or tangible direct return; this is less the case for adaptation actions. If incrementally more capital and attention is to be spent on adaptation efforts in the future, then the nature and distribution of climate action investment could look different – by sector and geography.

Global funding for climate action (2018)



Source: Climate Policy initiative

Climate capital flows from developed nations to developing world (2018)



Source: OECD

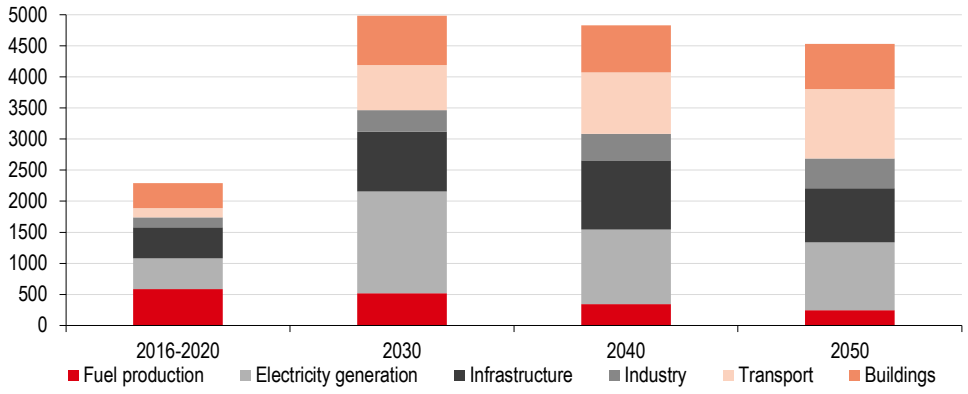
Mitigation action pathway to costs trillions a year

Mitigation actions heavily focus on energy production and use …

One of the clearest indications of the magnitude and nature of spending required to mitigate GHGs from the global energy and industrial sectors – which together account for around three-quarters of total GHGs – came from the IEA's recent net zero emissions scenario. This outlined the investments and actions needed across the globe to deliver a net zero energy system by 2050, but does not account for agriculture and land-use, which would need their own separate additional measures.

As shown in the below chart this entails a sharp increase in energy and industrial spending in coming years and decades, with a decisive shift from fossil-fuel based sources to cleaner energy resources. Overall spending will need to reach USD5 trillion by 2030 and be focussed in areas such as electricity generation (eg. wind farms and solar plants), energy infrastructure (eg. smart electricity girds, CO_2 pipelines), changes to industrial processes (eg. fuel switching or capturing carbon), altering transport methods (eg. using more EVs or fuel-cell vehicles) and buildings (eg. new 'green' offices or houses, retrofitting existing buildings).

Spending to decarbonise energy & industry in IEA 'net zero' 2050 scenario (USD bn)



Source: IEA

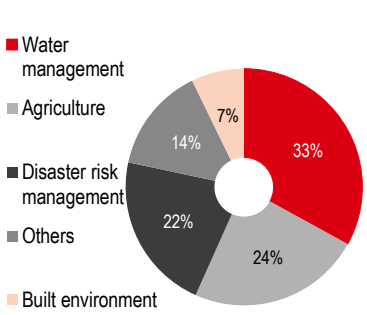
… whereas global adaptation spending is skewed towards water and agriculture, and currently mostly in EM countries

Adaptation costs looks very different

The UN Environment Programme estimates that annual climate adaptation costs in less-developed nations around the world will rise from ~USD70bn today to USD140-300bn in 2030, before doubling again from that level to 2050; these are steep rises from current levels but expected to overall be smaller than mitigation costs. However, what is evident below is the nature of spending on adaptation is markedly different, with water management, agriculture and disaster risk management collectively accounting for around 80% of recent spending. This includes efforts to adapt agricultural output to changing precipitation patterns, preparing for longer forest fire seasons, re-enforcing storm/sea level defences and better managing water resources in areas where it is scarce.

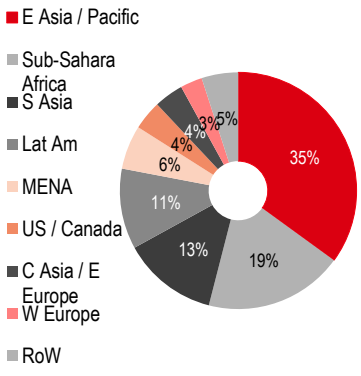
There is also a clear geographical split, with almost 85% of recent climate adaptation spending occurring in developing or emerging countries with areas such as E Asia, Sub-Sahara Africa and South Asia representing the largest regions by spend. Developed markets in Western Europe and North America currently represent less than 10% of estimated global adaptation spending.

Global climate adaptation spend by sector (2017-18)



Source: Global Centre on Adaptation

Global climate adaptation spend by region (2017-18)



Source: Global Centre on Adaptation

So is a dollar better spent on climate mitigation or adaptation?

Circumstances will likely dictate where funds should flow across mitigation and adaptation

Invariably the answer will be 'it depends'. Indications are that, at a global level, total spending on both will need to rise significantly going forward, rather than a rise in capital allocated to one explicitly at the expense of the other – climate action is not a 'zero-sum game'.

As we've previously discussed in this piece, climate mitigation and adaptation actions are not directly comparable and often do not have the same direct objective. Each will likely undergo some sort of similar cost-benefit analysis but there are no global cost curves of climate action that cover both mitigation and adaptation where the most cost-effective steps can be identified and undertaken in a systematic manner. The uneven distribution of potential costs to mitigate and adapt to climate change across nations and sectors further muddy the waters.

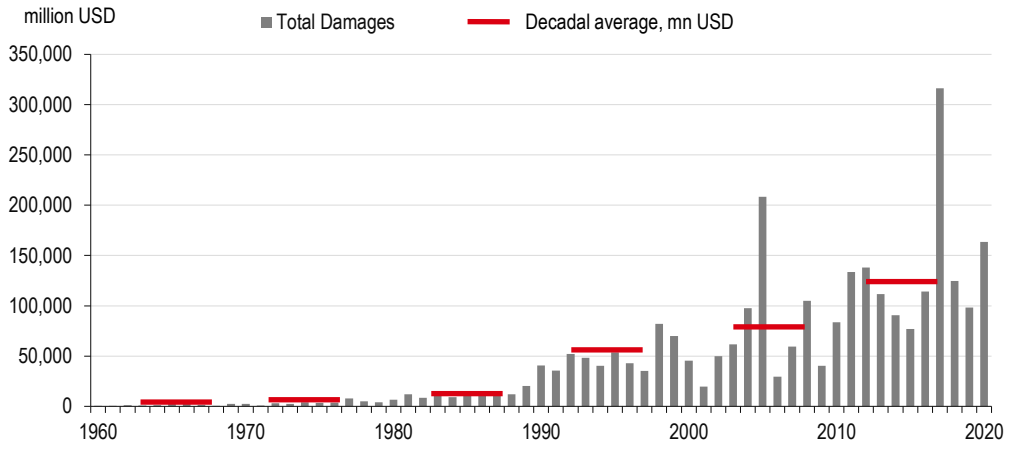
A few largely consistent trends are, nonetheless, evident:

- Relative to previous years and decades, the cost of low-carbon technology as a route to meaningful carbon emission reductions is structurally cheaper and continually improving – boosting the economics of mitigation action.
- However, the window of opportunity for successful mitigation continue to get compressed as carbon budgets shrink, potentially making the need to decarbonise more rushed and potentially costlier.
- The financial costs from extreme weather events continues to rise with temperature increases (see below chart), other impacts from unchecked climate change are also growing (such as chronic or slow-moving effects). The case can be made that this means more should be done on not only mitigation, but also adaptation, and both for preventative reasons.

Mitigation benefits are global; adaptation benefits are local

- It is also the case that spending on climate action of any sort typically has to compete for capital allocation that is often limited in its nature, whether this be at a corporate or national level – this means that the more pressing need to act, or where the greatest risk can be reduced, is more likely to win the argument.
- There are also so-called 'spill-over' effects of spending on mitigation and adaptation that are not easily quantified and not always necessarily reflected in decision making. Examples include the world security risks from failure to mitigate climate change (such as mass migration) and public health benefits from decarbonisation, among others.

Damage costs from natural disasters/weather events since 1960



Source: EMDAT. Note: Note: Disasters included; Extreme temperature, floods, drought, storm, wildfires

Actual decisions to spend/act on climate mitigation or adaptation will be driven by the specifics of the entity making the choice (local or national governments, companies or individuals), the risks/benefit choice they face and their constraints (eg. appetite to spend on both, and/or a fixed amount of available capital). Mitigation action might be important for a corporate to retain its social license to operate, or to avoid future business model disruption. Whereas a local government of a coastal area is more likely to believe that adapting real estate for a more turbulent weather system is the best use of its resources.

We're likely to already be spending more on climate impacts

What is also becoming clear is that the more that the costs of the changing climate are being felt in the near term, the more we may already be spending on climate impacts without knowing it. For example, John Kerry, US Special Presidential Envoy for Climate, recently stated that America "*spent USD265bn two years ago on three storms – Irma, Harvey, Maria*" in reply to a question as to whether spending on climate mitigation action is a wise fiscal choice. His point being that the physical impacts (and costs) of climate change in the US appear to be both growing larger and occurring in a much more immediate timeframe than previously envisaged – and thus potentially altering the balance of the climate action costs/benefit equation.

Do mitigation and adaptation have similar returns on investment?

Studies have tried to look at things more objectively to ascertain the relative returns on capital spent on climate mitigation and adaptation. For example, the Global Commission on Adaptation estimates that spending USD1.7 trillion on climate adaptation over the coming decade could produce ~USD7 trillion in what it calls 'economic returns', while also saving human lives. This indicates that on paper the returns from spending on adaptation could be worthwhile – at least at a societal or state level – especially in the face of growing actual costs of weather events.

Private capital has tended to flow to mitigation efforts, rather than adaptation

Climate mitigation projects tend to generate a more direct or identifiable return on investment (eg. a revenue stream from a clean energy project), whereas this is less true for adaptation, where a larger proportion of the benefits or returns are likely to be felt outside of the immediate project scope. As a result, private capital has tended to flow towards mitigation, with public funds representing a proportionally bigger share of adaptation funding. For example, according to the Climate Policy Initiative, private actors accounted for only 2% to global adaptation spending in 2018

Who's going to pay for it?

Access to capital is also likely to factor - in recent years, capital markets have bought into the idea of decarbonisation as a form of climate mitigation that delivers returns and is aligned with long-term investment objectives of key stakeholders; arguably less so for climate adaptation.

Equity and debt markets in certain geographies have been encouraged to allocate capital as a result of increasing policy clarity around the direction and speed of travel in the energy transition. Companies that are firmly aligned with the global climate mitigation agenda have benefited from rising market valuations and increasingly available forms of funding; green bonds have similarly risen to become part of mainstream fixed income investing.

By comparison, climate resilience bonds (which fund adaptation activities) are the fraction of the size of green bonds. One of the few examples of sizeable adaptation-linked issuances came in 2019 when the European Bank for Reconstruction and Development launched a USD700m 5yr bond to invest in climate resilience projects in urban infrastructure, agriculture and to fund adaptation measure for businesses.

Measuring and comparing is tricky

As the EU taxonomy for sustainable activities explains; while calculating the exact effects of climate mitigation actions is not a perfect science, it can result in an estimated number of tonnes of CO_2-equivalent emissions abated or removed for a given activity, irrespective of location. Factors such as lifecycle emissions impacts and other considerations need to be accounted for, but broadly speaking a relatively defined set of actions and impacts can be identified that count towards mitigation efforts.

Adaptation efforts under the EU rules are proposed to be treated in a more qualitative screening approach to determine if a given activity aids adaptation. This is partly to do with the localised and context-led actions associated with adaptation activities, as well as the fact that "*measured baselines or accepted metrics for adaptation have not yet been developed*" in the view of the EU. As a result; the list or scope of adaptation actions is generally less defined; individual projects are less comparable in nature, and the relevance of each action is dependent on local-specific factors.

EU taxonomy categorisation of climate effects that may require adaptation efforts

	Temperature-related	Wind-related	Water-related	Solid mass-related
Chronic	Changing land / sea temperature	Changing wind patterns	Changing precipitation patterns	Coastal erosion
	Heat stress		Ocean acidification	Soil degradation
	Temperature variability		Sea level rises	Soil erosion
	Permafrost thawing		Water stress	
Acute	Heat waves	Cyclones, hurricanes	Drought	Avalanche
	Cold waves	Storms	Heavy rain	Landslides
	Wildfires	Tornados	Floods	

Source: EU taxonomy for sustainable activities

The EU taxonomy and TCFD account for both mitigation and adaptation

Regulatory frameworks account for both

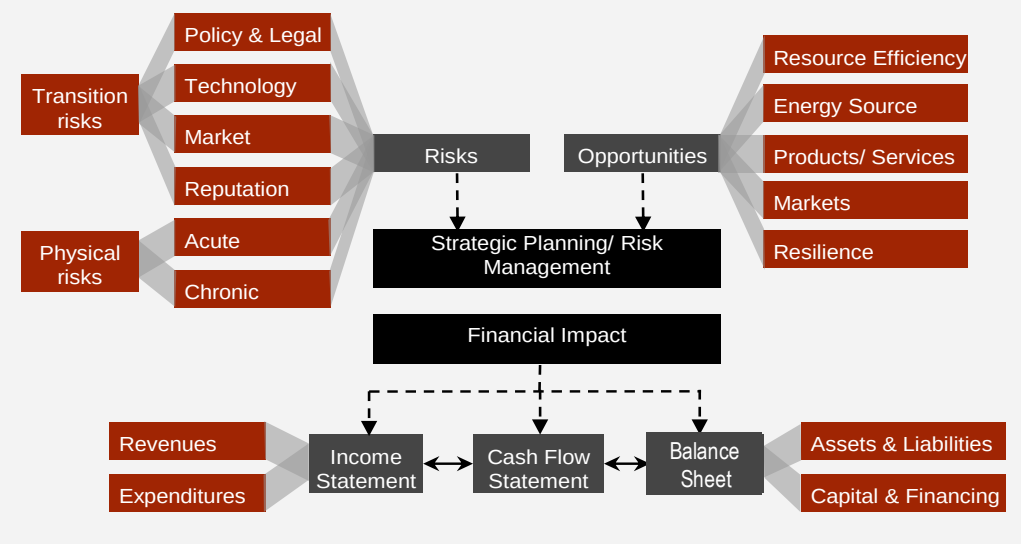
The EU taxonomy provides definitions of climate mitigation and adaptation activities that can account towards levels of 'alignment' in a portfolio or collection of exposures (eg. a collection of equity stocks) under the new rules for sustainable investing in the bloc.

This means that there are criteria around which entities (typically public companies) can disclose the proportions of its revenue or capex that represents exposure to direct climate mitigation/adaptation actions; or so-called 'enabling' activities. This approach is seen as important to better define what corporate actions fall under categories of climate mitigation/adaptation, to improve transparency, limit 'greenwashing' and ultimately shape capital flows.

The Taskforce for Climate-related Financial Disclosure (TCFD) risk framework for reporting on climate information makes a distinction between 'transition risks' and 'physical climate risks' to highlight the differing manifestations of climate effects – see table on following page.

While the framework is constant across sectors, annual reporting from corporates highlights the fact that differing climate issues can have materially different relevance and magnitude across different types of companies. For example, an insurance company or corporates involved in agriculture are perhaps likely to pay more attention to the physical impacts of climate change than, say a car manufacturer.

TCFD framework on climate-related risks, opportunities, and financial impact



Source: Financial Stability Board, Final Recommendations of the Task Force on Climate-related Financial Disclosures, June 2017

Disclosure appendix

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