ZURICH

# Closing the gap on climate action

Zurich Insurance Group 2021

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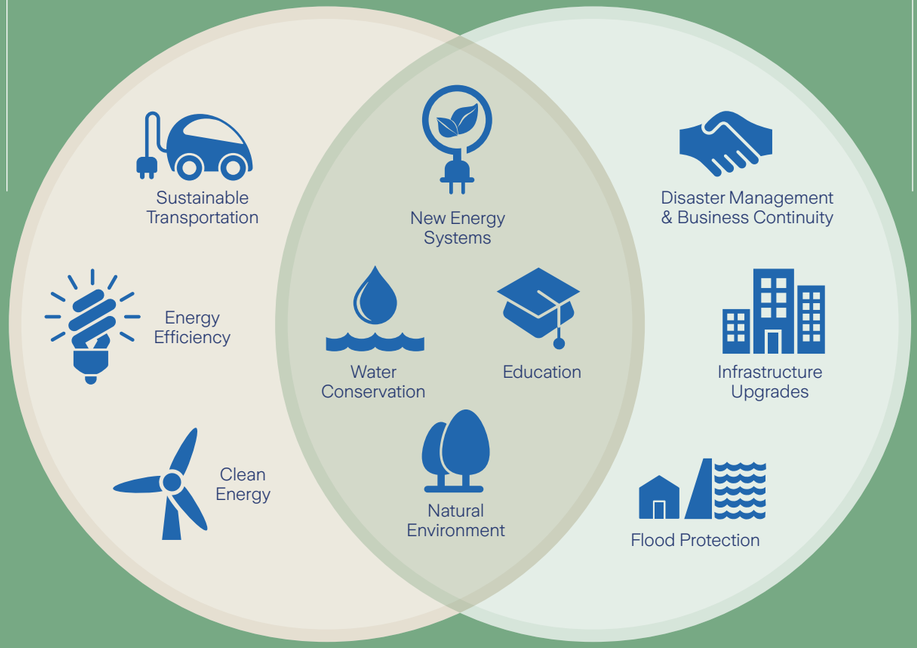
# Introduction: ‘Closing the gap between climate rhetoric and climate action’


2021 has been a year of bold commitments. From governments talking tough on climate at President Biden’s Leaders Summit and at the G7 Summit, to a plethora of corporate announcements stating ambitious net-zero targets. These words are warmly received, but they are not yet cooling the planet.

We are seeing action on climate change, but it is not enough. We need much more. What these commitments have given us, however, is greater clarity about the possible long-term pathways to a greener world and opportunities for more constructive action in the short term.

**Mitigation**
Measures taken to reduce the impact of operations on the environment.

**Adaptation**
Measures to reduce the impact of the environment on operations.



# ‘Closing the gap between climate rhetoric and climate action’

Achieving the Paris Agreement’s goal to limit temperature increase to well below 2 degrees Celsius (°C) and ideally to 1.5°C will be complicated and difficult. We will have to break the relationship between carbon emissions and economic activity, particularly in carbon-intensive sectors. This will mean undergoing an unprecedented transformation of the global economy and, most importantly, the global energy system.

Doing this will require a significant level of investment into new technologies, renewable energy, low-carbon fuels, the electricity grid, energy storage capacity, energy efficiency measures, carbon capture innovations, and many other areas. All of this will have to be done at the same time as we adapt our infrastructure and societies to the ongoing physical effects of climate change. The required investment is an estimated USD 6.9 trillion a year up to 2030.[1]

These are high stakes for businesses, investors, and nations. There are risks, but we’re also being offered a historic investment and business opportunity.

The biggest gamble, the ultimate risk, is to do nothing. During the summer of 2021 we have witnessed the physical risks of climate change with record-breaking extreme weather events across the world – from heat domes and heat waves, to floods and wildfires.

The recent report from the Intergovernmental Panel on Climate Change (IPCC) said we can expect an increase in the frequency and intensity of these events with further global warming. Human behavior has already caused global surface temperature to increase by 1.1°C compared to pre-industrial levels. But the IPCC states that global warming of 1.5°C and 2°C will be exceeded this century unless deep reductions in CO2 and other greenhouse gas emissions occur in the coming decades.[2]

**The time for action is now.**

Our 2019 report served as a guide for businesses on how to build an informed view of the climate-related exposures, vulnerabilities, and hazards. It provided an update on the latest tools and risk management practices and outlined Zurich Insurance Group (Zurich)’s three-step guide to developing climate resilience strategies.

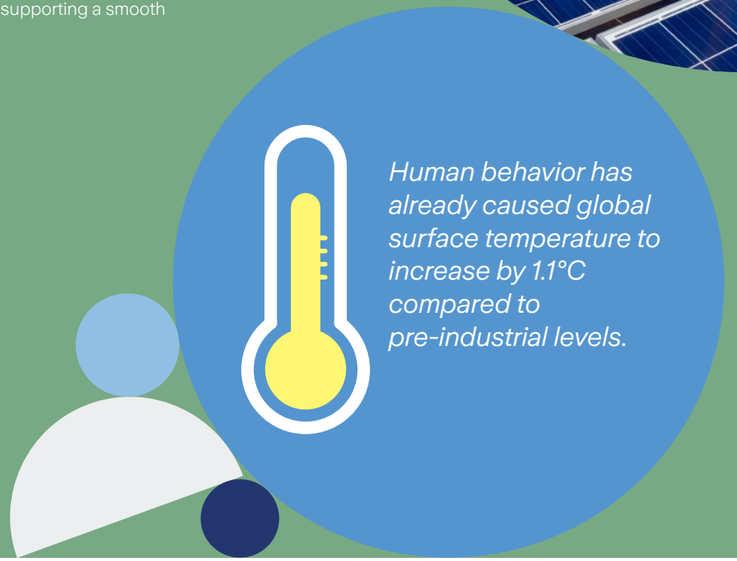
This report looks at how climate change-related risks have evolved, and the response from governments and businesses has progressed in the intervening two years. It also looks forward to the strategic developments that provide optimism about our ability to deliver against the targets required to limit global warming to 1.5°C.

**Chapter 1** covers the latest edition of Zurich’s Climate Change Scorecard, which tracks progress towards a 2°C scenario across 12 climate metrics. The 2021 Scorecard highlights where, sometimes surprisingly, positive developments have been made and where challenges remain.

**Chapter 2** explores how companies can adopt mitigation measures to curb carbon emissions and develop net-zero business models. It draws on market insights, Zurich’s own experiences, and highlights where insurers, as well as risk managers and investors, can help companies and societies manage the transition risks associated with decarbonization, supporting and accelerating the transition to a 1.5°C world.

**Chapter 3** focuses on resilience and the unavoidable physical risks associated with ongoing climate change. It advises on how businesses can include adaptation measures into their strategies to tackle these risks and leverage them as opportunities.

Finally, **Chapter 4** addresses the debate on climate policy. It offers recommendations on where government action in the short term can have the biggest impact in supporting a smooth transition to net-zero.



*Human behavior has already caused global surface temperature to increase by 1.1°C compared to pre-industrial levels.*

# Chapter 1: Five years on from the Paris Agreement

In the 2015 Paris Agreement, almost all countries agreed to hold global temperature rise to well below 2°C compared to pre-industrial levels, and to pursue efforts to limit temperature increase to 1.5°C.

In his closing remarks, the then Secretary-General of the United Nations Ban Ki-moon, described these ambitions as “the floor, not the ceiling” and said the agreement would be reviewed every five years with “what is needed in line with science.”

So where do we stand, more than five years on and with the Conference of Parties (COP) 26 in Glasgow on the horizon?


*The IEA now forecasts global energy demand will increase by 4.6 percent in 2021*


## 1.1 Current state of play

In the immediate aftermath of COP 21, greenhouse gas emissions continued to rise at an unchanged pace. Then, in 2020, the COVID-19 pandemic subdued global energy demand as lockdowns designed to limit transmission of the virus decreased industrial output and caused a sharp fall in vehicle usage and air travel. According to the International Energy Agency (IEA),[1] global energy demand contracted by 4 percent in 2020 leading to a 5.8 percent decline in global CO2 emissions. Emissions fell further than energy demand as the pandemic impacted demand for oil and coal more severely than other energy sources.

These statistics offer a glimpse into a net-zero future. There was much talk about a sustainable recovery and a desire to “build back greener.”

At the same time, it highlights the magnitude of the task at hand as the 5.8 percent fall in global CO2 emissions will need to be replicated every year for decades to meet the goals of the Paris Agreement. Yet the fall in emissions during 2020 was associated with huge economic and societal costs.

Meanwhile, energy demand and emissions began to creep up towards the end of 2020. The IEA now forecasts global energy demand will increase by 4.6 percent in 2021, which offsets the 4 percent contraction in 2020, and CO2 emissions will rise by almost 5 percent. A renewed focus on emissions reduction is needed.

### What is COP?

World governments have come together annually for the UN’s climate change conference – known as Conference of the Parties (COP) – since 1995.

During that period, climate change has gone from a fringe issue to a global priority. COP 21 took place in Paris in 2015 and for the first time every country agreed to work together to limit global warming to well below 2°C and aim for 1.5°C.

In this Paris Agreement, the G20 countries committed to national plans that set out how much they would reduce emissions – known as Nationally Determined Contributions, or NDCs.

The goal for COP 26 in Glasgow in November 2021 is to enhance those commitments and accelerate action towards achieving the goals of the Paris Agreement and the UN Framework Convention on Climate Change.

### Climate Change Scorecard

Zurich's Climate Change Scorecard reflects a mix of positive developments and remaining challenges. Since 2017, our scorecard has measured 12 climate change-related areas that aim to capture progress in three critical areas: policy, technology, and broader societal trends.

The scorecard became greener in 2020, mainly due to the pandemic. Energy demand fell due to the collapse in economic activity, which was combined with an improvement in energy efficiency. Carbon emissions fell by more than energy demand, due to a shift from fossil fuels to renewable energy. Fossil fuel subsidies slumped, though this largely reflected a collapse in both oil prices and demand, requiring less subsidies to be paid out.

As the global recovery has been swift and strong, and oil prices have recovered, we suspect most of these green developments will be reversed in 2021.

The trend on carbon pricing is more sustainable. The share of global carbon emissions covered by some form of a pricing scheme rose above 20 percent for the first time, due to the rollout of a pilot emissions trading system in China. The average price of carbon increased due mainly to positive developments in Europe where the price of carbon almost doubled.[2]

Other categories show no change compared to last year, yet this masks some important developments. On policy, we expected new climate legislation to recede in 2020 as the pandemic took priority. This is what initially happened, but legislative activity rebounded sharply in the first half of 2021. Progress on net-zero among corporates was also expected to deteriorate, as they struggled with the crisis. Instead, we saw a growing number of companies announce commitments and take action on climate change. A similar picture was seen with investments and new technologies, where progress was expected to deteriorate, but momentum was maintained and, in some cases, improved. While the crisis has delayed some progress, attention to climate change has proven sticky.




1. Carbon pricing
2. Corporate action
3. CCUS technology
4. Social trends
5. Energy supply
6. Legislation
7. Energy demand and efficiency
8. CO2 emissions
9. Investment
10. Energy intergration and storage
11. Fossil fuel subsidies
12. Electrical vehicles

- Not on track for 2°C scenario
- Improving but more is needed
- On track if pace is maintained

## 1.2 New commitments, new hope

At the virtual Leaders Summit on Climate in April 2021, President Biden announced that the U.S. will target a reduction in CO2 emissions of 50-52 percent by 2030 compared to 2005 levels. Other leaders announced new targets or reaffirmed existing commitments, including EU President Ursula von der Leyen, who outlined the EU's goal to reduce CO2 emissions by at least 55 percent by 2030 compared to 1990 levels, and Chinese President Xi Jinping who said China will strive to peak CO2 emissions before 2030 and achieve carbon neutrality before 2060.

Our Climate Change Scorecard considers the revised deadlines of these climate change commitments – many brought forward from 2050 to 2030 – to be of greater significance than the actual emissions reduction targets. These tighter deadlines will inject greater urgency and ensure we see meaningful policy decisions and tangible actions sooner. It also means we will know within the next 12–18 months if these commitments are credible or just statements of intent that are not backed up by concrete actions or investments. If we do not see early action to back up governmental commitments, then the risk of a chaotic transition increases – rather than a "race to zero" we may have to endure a crash landing.

## 1.3 New green technologies

Finding a way to curb our reliance on fossil fuels depends on developing new green technologies and infrastructure that either provide alternative forms of clean energy or create efficiencies that reduce emissions. All while protecting our planet's biodiversity.

*Annual global clean energy investment must more than triple by 2030 to USD 4 trillion to achieve net-zero emissions by 2050.*

### Clean energy

Electricity generation from renewable sources increased by almost 7 percent in 2020 and is predicted to rise by more than 8 percent in 2021 to 8,300 Terawatt-hours (TWh) – the fastest year-on-year growth since the 1970s.[3] This growth will push the share of renewables to an all-time high of 30 percent in 2021. Combined with nuclear, low-carbon sources of generation are expected to exceed output from the world's coal plants in 2021 for the first time.

The economics of energy supply mean there is a caveat to this optimistic picture. In the short term, rapid increases in energy demand as the world rebounds from the pandemic, especially the larger economies in Asia, combined with drought conditions affecting the supply of hydroelectric power, mean that the renewable energy supply is struggling to meet needs.

This means fossil fuels, especially thermal coal, are back in demand and are attracting higher prices. This is exacerbated by supply constraints driven by financiers refusing to fund new coal projects and supply disruptions related to weather, transport infrastructure, and geopolitical trade barriers. Despite the tight thermal coal market, which is likely to remain in the short term, the IEA predicts thermal coal electricity will increase 5 percent in 2021 to exceed pre-pandemic levels and grow a further 3 percent in 2022 as electricity demand rebounds.[4]

So, while growth in renewables is a positive step in the longer-term transition to net-zero, the momentum needs to be increased. Annual global clean energy investment must more than triple by 2030 to USD 4 trillion to achieve net-zero emissions by 2050.[5] Renewable sources will need to account for 90 percent of global electricity generation by 2050, compared to 29 percent in 2020, with solar and wind accounting for 70 percent.

### Electric mobility

Globally, sales of electric cars increased by 41 percent to 3 million in 2020 – representing 4.6 percent of all new car sales.[6] But despite a decade of rapid growth, electric cars still only represented 1 percent of the global car stock in 2020 with 10 million vehicles.

In the IEA's 'Net Zero by 2050' scenario,[7] it indicates that electric vehicles will need to account for more than 60 percent of total passenger car sales by 2030 (up from 4.6 percent in 2020) with the car fleet almost fully electrified worldwide by 2050.

This will require a step-change in policies to influence consumer demand, whether it is overcoming range-anxiety or the economics of purchasing a new electric car. It is also constrained by the supply economics of batteries. Demand for batteries for transport is forecast to reach 14 TWh in 2050 – 90-times higher than in 2020. This translates into greater need for critical minerals. For example, demand for lithium for use in batteries will grow 30-fold by 2030 and more than 100-times higher in 2050 than in 2020.[8] This shortfall may be addressed by new battery technologies, either in lithium-ion or other chemistries, as well as developing a sizeable battery recycling industry. For the time being, current battery technology will ultimately be constrained by mineral supply.

Electric vehicles are not the only solution for road transport. Hydrogen fuel cells and the development of a reliable zero-carbon hydrogen supply chain are a priority for long distance commercial transportation in many countries.

Electrification and hydrogen are not just about transport. They also offer clean alternatives for the heating and cooling of domestic and commercial buildings, and as fuel in light industry (replacing diesel power generation) and even in heavy industry, such as steel production with more recycling of steel in electric arc furnaces and the use of hydrogen to fuel blast furnaces.

## Maritime shipping

Maritime shipping was excluded from the Paris Agreement, yet it accounted for 2.9 percent of global emissions in 2018 with emissions projected to increase by 90–130 percent of the 2008 baseline by 2050.[9] This is because current zero-carbon fuels and technologies are not available at the size, scale, or price required for the maritime industry.

It means global supply chains, many of which depend on maritime shipping, will become more carbon-intensive unless new lower carbon fuels and propulsion units – together with upgraded vessels and a new global refueling network – are developed as part of a transition pathway to reduce emissions across the shipping value chain.

There are several zero-carbon, or low carbon fuel options in development including:

- **Hydrogen:** It is currently costly to produce, but the switching process requires the fewest transformations for ship owners. It is dependent on developing low-cost, widely available fuel cells and sufficient quantities of low-carbon hydrogen.
- **Ammonia:** It has a higher energy density than hydrogen, but has other issues with toxicity, emissions, and high ignition energy.
- **Electrification:** It has challenges with energy storage for long sea voyages requiring large scale battery units, reducing cargo capacity.
- **Biofuels and methanol:** They are cost efficient and can be used in existing engines. But they have scale and land-use challenges with developing sufficient volumes of biofuel, which may have to be prioritized for other sectors – like aviation – that are more difficult to decarbonize.

Despite these challenges, A.P. Moller-Maersk – one of the world's largest shipping companies – announced it will operate the world's first carbon neutral liner vessel by 2023.[10] It will be fueled by carbon neutral e-methanol or sustainable bio-methanol. Maersk intends to have a carbon-neutral fleet by 2050 and is exploring several carbon-neutral fuel options. It expects multiple fuel solutions to exist alongside each other in the future, with methanol (e-methanol and bio-methanol), alcohol-lignin blends, and ammonia as the primary fuel candidates for the future.

As new fuel technologies are developed, existing technologies can reduce emissions as an interim transition pathway. These include liquefied natural gas (LNG), which is 20 to 25 percent less carbon intensive than heavy fuel oil (HFO), and emits less nitrogen oxides (NOx) and sulphur oxides (SOx).[11] The prevailing view is that LNG will have a role to play as a transition fuel in the next decade, but there are concerns related to methane emissions in the supply chain.

Other energy efficiency approaches are needed. For example, improved hull and onboard mechanical design, larger ships, new digital technologies to improve operations such as ship speed and port scheduling, and the retirement of older, less efficient vessels.[12] As with decarbonization pathways in other sectors, there is no "silver bullet" and shipping's future will involve different parts of the sector using different fuels, in what is sometimes called a "poly-fuel" scenario.

## Aviation

Aviation, like maritime shipping, was excluded from the Paris Agreement as it was deemed too difficult to allocate emissions to any one country, but mounting scrutiny from investors, regulators, and consumers is putting pressure on airlines to decarbonize.

The challenge is the limited range of technical options for decarbonizing the airline industry. Electric airplanes, or hydrogen fueled planes, seem several decades into the future and different solutions are likely for short-haul vs. long-haul flights. On top of that, demand for air travel is growing, especially in Asia, and solutions need support from major airline engine suppliers and governments.

Aviation accounted for 2.4 percent of global CO2 emissions in 2018,[13] but to date most industry climate action has focused on carbon offset programs or improving fuel efficiency. The industry has a good record on fuel efficiency, halving carbon emissions per passenger since 1990 and achieving an annual fuel efficiency improvement of 2.3 percent since 2009.[14] Yet more needs to be done to modernize fleets and improve operational efficiency to counter annual passenger mile growth that will increase absolute emissions over time.

Carbon offsetting is one of the few options for the aviation industry to compensate for emissions within the timescale of the Paris Agreement. The challenge – and business opportunity – is finding negative emissions technologies that can operate at scale and can be certified for carbon sequestration. These may include bio-sequestration, or nature-based approaches such as enhancement of forest carbon stocks, or technical solutions involving carbon capture (covered in more detail later in this report).

The industry set up the Carbon Offsetting and Reduction Scheme for International Aviation (Corsia) to ensure any rise in global aviation emissions above 2020 levels are offset. However, there are no guarantees the carbon credits purchased by airlines to offset their emissions under Corsia would be of a high quality. This has led some critics, especially in Europe, to suggest expanding the scope of the EU's emissions trading system for aviation.[15]

An alternative approach, rather like the maritime industry, is to explore lower carbon fuel transition pathways. Sustainable aviation fuel (SAF) is jet fuel produced from sustainable sources such as cooking oil and other non-palm waste oils from animals or plants; solid waste from homes and businesses; forestry waste, such as waste wood; and energy crops, including fast-growing plants and algae. Most SAF reduces carbon emissions by up to 80 percent compared to conventional jet fuel.[16]

The main issue is supply and cost. In 2019, 2.4 million gallons of SAF were produced in the U.S., which compares to the 21.5 billion gallons of conventional jet fuel used by U.S. airlines during the same year – indicating that SAF accounted for just over 0.01 percent of the nation's total jet fuel supply. On top of this, SAF is three to five times more expensive.[17]

Plans are in place to increase SAF volumes and reduce costs through scale efficiencies. In March 2021, Airlines for America, the trade organization that represents the major U.S. airlines, announced its member carriers, which include American Airlines, Delta, and United Airlines, pledged to work with the government and other stakeholders to rapidly increase annual production of SAF to 2 billion gallons by 2030 as part of its commitment to achieve net-zero carbon emissions by 2050.[18]

### Carbon capture

Carbon capture, utilization and storage, or CCUS, is an important group of emissions reduction technologies that abate emissions within an industry's own operations, especially in the 'hard-to-decarbonize' industries (such as steel, cement, and glass manufacture) where the chemistry or physics of production make alternative approaches technically very difficult.

CCUS technologies either capture CO2 from the source, such as power plants and industrial facilities – this is called abatement – or they capture it from the atmosphere, which is considered "neutralization" and referred to as carbon dioxide removal (CDR). In both cases, the captured CO2 is compressed and transported by pipeline, ship, rail, or truck and used in a range of applications, or permanently stored by injecting it deep into sealed geological formations, including depleted oil and gas reservoirs.

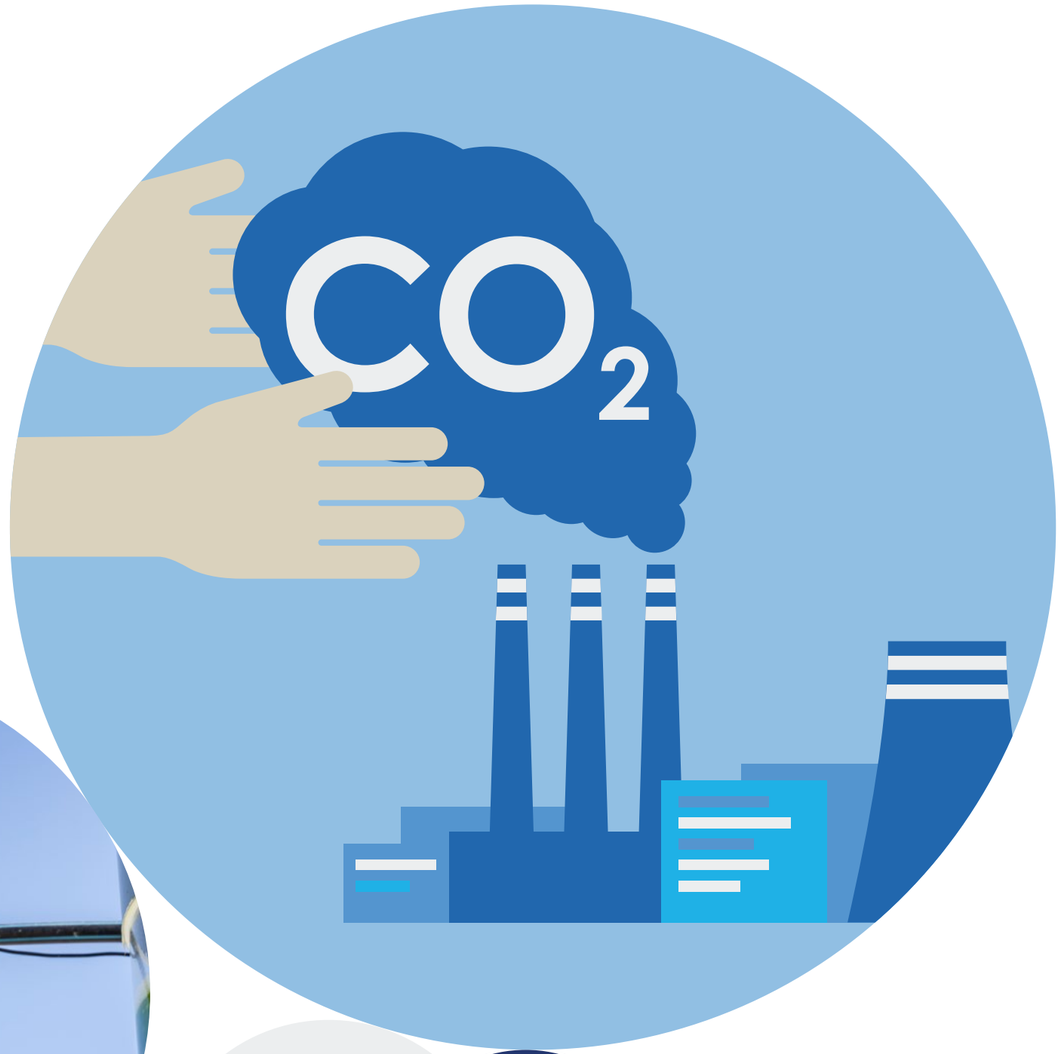
Importantly, CCUS is potentially a key component of net-zero reduction commitments. Not only by decarbonizing a range of industrial processes, but also through the decarbonization of hydrogen production.

Conventionally, hydrogen is produced by splitting natural gas into hydrogen and CO2 through a carbon-intensive process called "steam methane reforming" – this is commonly referred to as "grey" hydrogen. If CCUS technologies are used to capture this carbon, then it is referred to as "blue" hydrogen. "Green" hydrogen is the cleanest option as it splits water into hydrogen and oxygen by electrolysis powered by renewable energy sources – with no CO2 created during the process.

Blue and green hydrogen can decarbonize a wide range of industries, power generation, and transportation. Not all countries are focused on hydrogen, although Japan and the U.S. are two OECD nations with hydrogen as a key part of their nationally determined reduction commitments.[19]

In 2020, CO2 capture capacity from power and industrial facilities totaled 40 million metric tons of CO2 (MtCO2).[20] However, to achieve net-zero emissions by 2050, the IEA indicates that carbon capture capacity needs to grow exponentially to 1,670 MtCO2 by 2030 and to 7,600 MtCO2 by 2050.[21]

Despite progress, our Climate Change Scorecard considers CCUS to not be on track for a 2°C scenario. These technologies are vital to enable carbon-intensive industries, including hydrogen production, to achieve net-zero and are needed if we want to remove historical carbon emissions.




## 1.4 Green investment

The development and rollout of new green technologies and infrastructure must be financed by an unprecedented level of investment. The OECD's USD 6.9 trillion annual infrastructure investment target will require the "greening" of existing investment flows as well as incremental new green investment flows into the energy sector, transport, and other infrastructure.[22]

Currently there is a green investment gap too large to deliver on the Paris Agreement. But recent EU and U.S. announcements designed to help to reposition their economies for a greener and more sustainable recovery offer encouragement.

A third of the EU's EUR 1.1 trillion 2021-2027 budget is dedicated to fighting climate change, coupled with a EUR 750 billion NextGenerationEU stimulus package that aims to make Europe greener, more digital, and more resilient. In the U.S, Biden has vowed to invest trillions of dollars to revamp the country's infrastructure, including investment into clean transportation, clean water, and clean power infrastructure, as well as building resilience to climate change.

These ambitions represent a big step forward, but they – and other public finance measures – will not be sufficient to close the green investment gap. Governments will need to mobilize private sector investment by providing certainty and direction on climate change mitigation strategies, as well as investment incentives and significant regulatory and market reform.

### Green bonds

Green bonds are a tried and tested approach for attracting "green finance" for specific climate-related or environmental projects. The green bonds market passed the USD 1 trillion milestone in cumulative issuance in December 2020 since market inception in 2007.[23]

Green bonds help a broad spectrum of issuer types – from corporate to supranational – invest in green technologies. A majority of the proceeds from green bonds flow directly into the generation and transmission of renewable energy, as well as energy efficiency projects. Transport operators are also among the largest green bond issuers with the New York and Los Angeles Country metropolitan transportation authorities, France's SNCF and Japan's fast train network operator JRRT all prominent green issuers in 2020.

Sovereign green bond issuance is also gaining momentum. Germany became the second-largest green bond issuer in 2020 following the debut of its USD 12.8 billion green sovereign bond. France continues to be a sovereign leader and was the fifth-largest source of green bonds in 2020.

Ahead of COP 26, both Italy and the UK are entering the market in 2021. Italy raised EUR 8.5 billion (USD 10 billion) in its debut in March. The UK will issue its first sovereign green bond, or "green gilt", in September with issuances in the 2021-22 financial year to total a minimum of GBP 15 billion (USD 21 billion). The UK will also become the first country to offer a green retail savings product – tied to its sovereign green bonds – via its National Savings & Investments (NS&I) platform.

Further good news came on June 1, 2021, with the European Commission announcing it will issue an estimated EUR 80 billion of long-term green NextGenerationEU bonds in 2021, to be topped up by tens of billions of euros of short-term EU-Bills to cover the remaining financing requirements.

Despite this expansion, the green bond market represents less than 1 percent of the overall USD 128.3 trillion global bond market. There is huge potential to scale up this market, particularly given strong investor demand, though one of the challenges is the difficulty of identifying well-defined green assets and projects, while also avoiding risks of greenwashing and a lack of liquidity.

*Transport operators are among the largest green bond issuers with the New York and Los Angeles Country metropolitan transportation authorities, France's SNCF and Japan's fast train network operator JRRT all prominent green issuers in 2020.*

## 1.5 Carbon pricing and fossil fuel subsidies

At Zurich, we believe a global price on carbon is one of the most effective methods to change behavior and reduce demand for carbon-intensive products, services, and energy sources. For this reason, it is included in the Climate Change Scorecard.

Carbon pricing also stimulates investment into clean technology and innovation and provides confidence to fund large infrastructure projects required for a net-zero transition.

Market-distorting fossil fuels subsidies contradict this economic incentive, and our Climate Change Scorecard considers them to be a major roadblock on the way to a clean energy future.

### Carbon pricing

Article 6 of the Paris Agreement, which covers rules on how countries can use international carbon markets, was never agreed on in the French capital. But this has not stopped progress.

According to the World Bank, 64 carbon pricing instruments are now in operation around the world, covering over 20 percent of global emissions and generating USD 53 billion in revenue – a 17 percent increase in revenue compared to 2020.[24] Revenue growth is driven by the rise in EU allowance prices and the launch of China's emission trading system in January 2021 across its power industry, which produces 30 percent of its national emissions.

Despite this growth, the World Bank considers the current level of carbon pricing as falling short of what is needed to achieve the goals of the Paris Agreement. Prices are too low. Only 3.76 percent of emissions are covered by a carbon price at or above the World Bank's recommended USD 40-80/tCO2 range needed to meet the 2°C scenario. Even higher prices will be needed over the next decade to reach the 1.5°C target.

In another positive development, the EU is in the process of establishing a carbon border adjustment mechanism that would place a carbon price on imports of certain goods from outside the EU, to reduce the risk of carbon leakage.

### Fossil fuel subsidies

In 2020, the value of global fossil fuel subsidies (covering oil, electricity, natural gas, and coal) fell 40 percent versus 2019 to USD 180 billion – the lowest annual figure since the IEA began tracking these figures in 2007.[25] Subsidies for oil products represented half of this total.

This is seen as a positive trend in the Climate Change Scorecard. But it may just be a short-term turnaround as a key driver in this decline was the fall in fossil fuel demand and prices caused by the pandemic. A rebound in fuel prices and energy use could push the value of these subsidies higher in 2021.

## 1.6 Action needed to meet commitments

Since the adoption of the Paris Agreement, momentum to tackle the climate crisis has been building. Progress has been made by all stakeholders: governments, businesses, investors, and individuals. But the progress has not been anywhere near fast enough. This is reflected in Zurich's Climate Change Scorecard where 7 out of 12 indicators remain amber and require further action to achieve a 1.5°C future, while others continue to show little improvement.

Rhetoric continues to trump action. This needs to be reversed. As a reminder of the need for action, 2020 was one of the three warmest years on record – despite cooling La Niña conditions – with a global mean surface temperature of 1.2°C above the pre-industrial baseline.[26]

The IPCC's recent report was a sobering report card on climate change.[27] We will exceed 1.5°C and 2°C without deep reductions in CO2 and other greenhouse gas emissions. But it offered seeds of hope. It's crystal clear: we are the cause of climate change, which means we can be the solution.

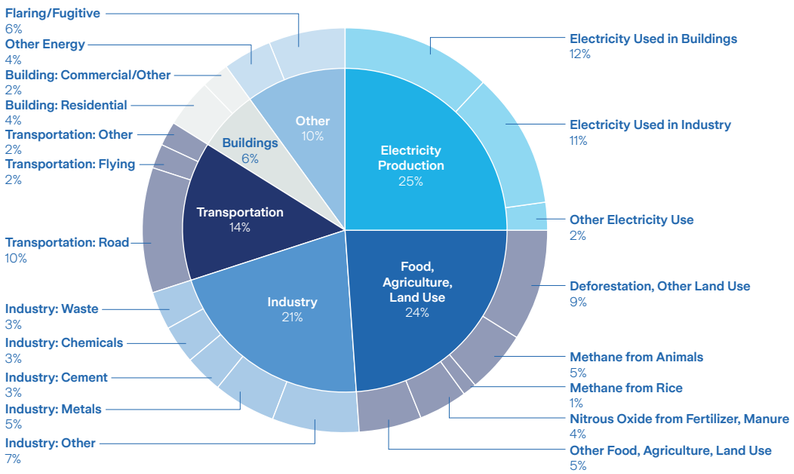
# Chapter 2: Corporate action: The drive to Net-Zero

All businesses generate emissions – both directly and indirectly – as can be seen in Figure 1.

This chapter examines key trends, as well as the metrics from the Zurich Climate Change Scorecard (see Chapter 1). From this analysis it looks at three priority areas that businesses must focus on to achieve net-zero:

1. **Abatement:** Identifying and implementing the most cost-effective emission-reduction options, and even changing business models to decarbonize company operations and supply chains. Abatement should be the immediate priority for all businesses.
2. **Compensation:** Investigating compensation approaches (i.e. financing unabated emissions in the value chain) once all abatement opportunities have been exhausted.
3. **Neutralization:** Exploring nature-based and technical carbon dioxide removal (CDR) initiatives.

**Figure 1:** Source: Detailed breakdown of global greenhouse gas emissions, by major sector and key emitting activities. Emissions data are taken from each chapter of the IPCC Fifth Assessment Report, Working Group Three. Graphic by Jonathan Foley© 2021.




## A Short Primer on Climate Change Terms

**Abatement:**
The elimination of sources of emissions within a company's value chain. For example, through carbon capture technologies, but also changes in production processes, operations, and products and services.

**Avoided emissions:**
These relate to avoided emissions from activities such as conservation and protecting forests from deforestation, or the development of low carbon technologies. Examples include products/services that avoid emissions, such as low-temperature detergents, fuel-saving tires, energy-efficient ball bearings, and teleconferencing services.

**Carbon credit:**
An emissions unit that is issued by a carbon crediting program and represents a reduction or removal of emissions. An umbrella term for voluntary **carbon offsets** and various forms of **compliance carbon credits**, such as the EU Allowance (EUA) trading units under the EU's emissions trading system (ETS).

**Carbon Dioxide Removal (CDR):**
The IPCC defines CDR as "anthropogenic activities removing CO2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products." Also known as **negative emissions**.

**Compensation:**
This refers to measurable climate mitigation outcomes resulting from financing unabated emissions in the value chain. This may include mechanisms like carbon credits, which include carbon offsets.

**Neutralization:**
This refers to the measures taken to remove CO2 from the atmosphere to counterbalance the impact of emissions within the value chain that cannot be eliminated. Neutralization of unabated emissions can only occur through negative emissions.

## 2.1 The net-zero conundrum

The priority for carbon-intensive sectors (as well as governments and the finance sector) must be to undertake swift action to halve emissions by 2030 to achieve a trajectory of a 1.5°C, or net-zero, future by 2050. Businesses will need to invest in new technologies and in some cases entirely new business models to drive deep decarbonization.

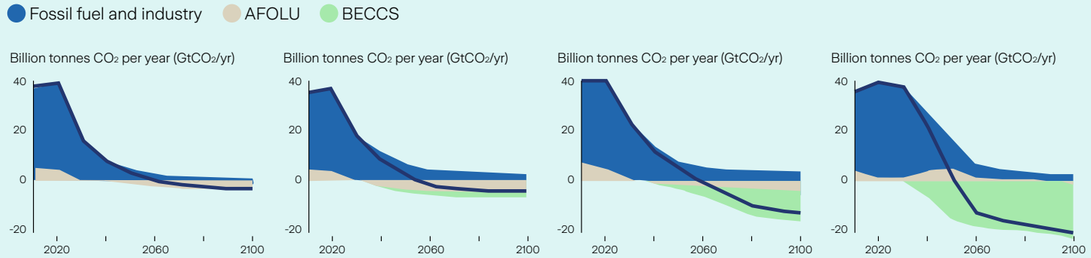
This is implicit in the IPCC scenarios that keep global warming within the Paris Agreement's 1.5°C limit. In Figure 2, the blue shaded areas represent the required emissions reductions from fossil fuels and industry.


Figure 2 shows that in addition to emissions reductions, all IPCC 1.5°C scenarios rely on large-scale carbon dioxide removal (CDR) using land-based carbon sinks and technical approaches. In Figure 2, green shaded areas represent the CDR required from Bioenergy with Carbon Capture and Storage (BECCS), gray areas are the removals required in the Agriculture, Forestry and Other Land Use (AFOLU) sector.

The challenge is to accelerate corporate action that supports emissions reductions, while also developing and tracking their own net-zero targets. There are a range of emissions mitigation strategies and tactics falling under the abatement, compensation, and neutralization categories (see Figure 3 below), with the following timing.

- **Abatement:** The top priority for the next 5 to 10 years.
- **Compensation:** Very important for the transition over the next 5 to 10 years. Companies need to understand the efficacy of their compensation efforts, while supporting the scaling of voluntary carbon markets and ensuring they are underpinned by assets, or projects that effectively remove carbon.
- **Neutralization:** Long-term carbon dioxide removal (CDR) will be needed to finally reach net-zero over the next 30 years. In the next 5-10 years, abatement is the focus for the technical solutions that are already developed, like carbon capture, utilization and storage (CCUS), but CDR solutions, both nature-based and technical, will need to be developed at scale as well.

Breakdown of contributions to global net $CO_2$ emissions in four illustrative model pathways




**P1:** A scenario in which social, business and technological innovations results in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

**P2:** A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

**P3:** A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

**P4:** A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

**Figure 2**: Source: IPCC – 'Characteristics of four illustrative pathways' IPCC[1]

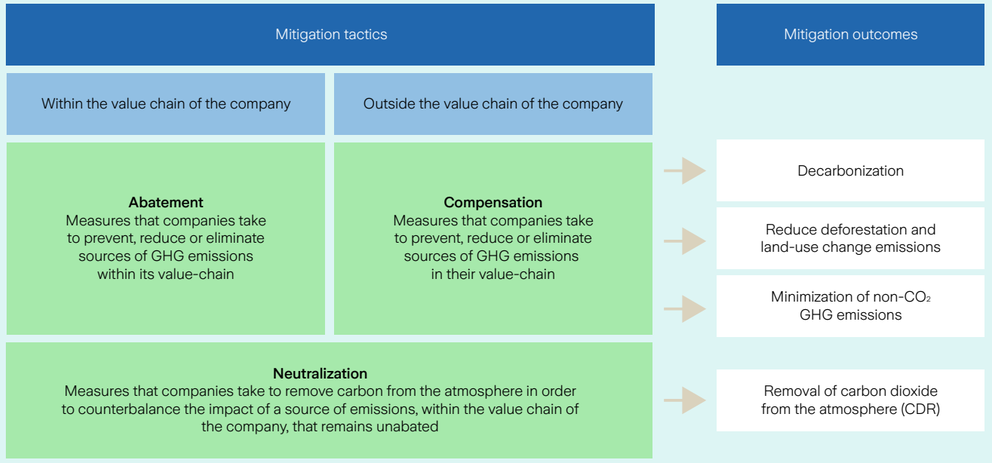



**Figure 3**: Source: CDP/SBTi – 'Taxonomy of climate mitigation tactics and outcomes'[2]

## 2.2 Developing climate change strategies that drive 'abatement'

The Zurich Climate Change Scorecard rates "corporate action" as amber: "improving but more is needed to achieve a 2°C future." This represents a positive shift, as in the three years from 2017-2019 it was in the red, "not on track." Yet, more still needs to be done to shift from ambitious statements to action and implementation. This is true as much for governments as it is for business. In this section, we explore how companies are developing and implementing their climate change strategies.

### Net-zero and business

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) published its Special Report on Global Warming of 1.5°C. It explained that to limit global warming to 1.5°C, global CO2 emissions would need to decline by 45 percent from 2010 levels by 2030 – and then reach "net-zero" by around 2050. A new buzzword was born.

Since then, businesses have been talking tough on net-zero. For example, more than 100 companies and organizations, including IBM, Mercedes-Benz, and Unilever, have signed up to The Climate Pledge, a public commitment launched by Amazon and Jeff Bezos, to be net-zero carbon emitters by 2040. What does it all mean?

To develop a net-zero strategy, businesses must first understand what is meant by net-zero. At a global level, the IPCC provides a clear definition:

*"Net-zero emissions are achieved when anthropogenic (i.e., human-caused) emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period."*

The Science Based Targets initiative (SBTi) developed the first global science-based standard for companies to set net-zero targets. It sets out two guiding principles to achieve net-zero emissions consistent with a 1.5°C future:

1. To achieve a scale of value-chain emission reductions consistent with the depth of abatement achieved in pathways that limit warming to 1.5°C with no or limited overshoot.
2. To neutralize the impact of any source of residual emissions that remains unfeasible to be eliminated by permanently removing an equivalent amount of atmospheric carbon dioxide.


### Developing a Climate Change Strategy

Within the broader sustainability context, it is important to understand the double materiality of climate change:

- **Inside-out:** How the company impacts climate change. Typically, through its own emissions and reported historically through approaches like the early Carbon Disclosure Project (CDP), and
- **Outside-in:** How climate change impacts the business and ability to operate. Often reported using the framework from the Taskforce for Climate Related Financial Disclosures (TCFD), and the latest versions of CDP reporting.

To manage the impacts from both elements it is important to understand how climate change considerations can be integrated into a company's existing risk management framework. From the strategy of the organization through to governance arrangements (including roles and responsibilities). This includes defining how climate risks fit within the organization's risk appetite and integrated into established risk identification, measurement, management, monitoring and reporting activities, and scenario analysis processes – as well as exploring the link to supporting business decisions and management actions.

A key consequence of this is to build and coordinate capabilities across the organization to address climate change holistically with multiple stakeholders: investees, customers, employees, regulators, and the broader community in which the organization operates. For instance, the Zurich Flood Resilience Alliance has been engaged in pre-event climate change adaptation work since 2013 and supports more than 300 communities across 23 countries to build community resilience to flood (see Appendix 2 for more information).

An important step in setting and communicating strategy is putting in place the processes and capabilities to develop scenario-based climate risk assessments that allow the organization to develop potential climate pathways and consider the potential strategic responses available.

With investors increasingly wanting assurance that companies understand and manage the impacts from climate change, the elements above also provide the basis to disclose within the TCFD framework on the governance, risk management strategy, and measures or metrics of the impact of climate change used by your business. Primarily, this enables investors to make key investment decisions, as well as allowing wider stakeholder engagement.

To achieve meaningful emission reductions and communicate them in a credible way, many organizations are developing their own science-based targets, following recommendations from the Science Based Targets initiative (SBTi). The SBTi methodology provides an excellent way of not only deciding what is the best strategy to decarbonize, but also to set interim targets on the way to achieve net-zero goals by 2050.

### How are companies already moving towards net zero?

We reviewed publicly available data from 100 key Zurich corporate customers and other corporations to assess their climate strategies and the steps they are taking to achieve net-zero.

Companies within the manufacturing and transportation industries have committed to a net-zero future with many focusing on circular economy practices. In fact, even those that have no public commitment to net-zero are working on circular economy or waste management, which is already an important step towards reducing energy use and limiting emissions.

Reducing emissions and maintaining a competitive industry is the rationale behind the EU's plans to develop a circular economy. Changing the consumption of raw materials by designing products using recycled materials and ensuring the products themselves are, as far as possible, completely recyclable is at the heart of these actions. This will be particularly important in sectors and technologies where new dependencies are emerging as part of the economy's energy transition, for example cobalt and rare earths metals in batteries for electric vehicles or other applications.

There is a clear focus on green energy, both in developing and implementing new technologies, and by utilizing green energy across their organizations.

Another large contributor to business emissions are those produced within the value chain outside of direct operations. These are mostly considered Scope 3 emissions (see box on next page). Companies can, for example, influence activities within their supply chains either by selecting partners that are aligned to their climate goals or working with existing partners in understanding the changes that need to take place.

Positive climate impact can be gained by identifying emission reduction opportunities such as converting fleets to electric or hydrogen-powered vehicles within the supply chain, or by working with your partners to adopt nature-based solutions. For example, using sustainable agriculture practices that avoid deforestation.

Technologies to reduce the emissions required to heat buildings are also rising in popularity. They are designed to reduce the energy requirements to heat domestic or commercial premises and cover the remaining energy requirements from renewable energy sources. The technologies focus on high levels of building insulation and on designing new buildings that are deemed "zero carbon"– so well-insulated that they do not need much heating or cooling, and use heat exchangers to recover any lost heat or cold. Renewable heat technologies include biofuels, solar heating, geothermal heating, and heat pumps.

"Greening" agriculture is also critical to a net-zero future for businesses in the agricultural sector and those relying on agricultural products. Many are looking at how regenerative farming techniques can reduce reliance on "oil-based" farming with its over-concentrated use of synthetic pesticides and fertilizers, focusing instead on soil quality and its effectiveness as a carbon sink. It does not just impact the food and beverage industries, but also packaging and clothing, anywhere a naturally grown material is used to produce the end product.

We see that regardless of industry, more and more businesses are prioritizing net-zero within their own strategies. Those that are not direct producers of emissions, including companies such as Zurich and others in the financial services industry, are committing to achieving net-zero within their investment or underwriting portfolios. Pension funds are looking for green investments to facilitate the transition and other large financing bodies are increasingly measuring the environmental impact of their investments.

While net-zero ambitions may seem to be focused on adapting, changing, and investing in infrastructure, it clearly creates a huge opportunity for our customers as they are also directing R&D efforts towards low carbon technology. These and other opportunities should also be embedded into a net-zero strategy as we look at how businesses, governments, and society can move towards net-zero together.

There is no one approach for each company or individual, but there is only one approach for the planet.

### Reducing and abating emissions

All businesses generate emissions – both directly and indirectly – during the activities they undertake to create a product or service. To reach net-zero, businesses must take actions to remove, reduce, replace, or offset emissions across the entire value chain and, crucially, undertake a robust monitoring, accounting, and reporting process.

But first, businesses need to understand their value chain carbon footprint. Then, develop and implement a decarbonization strategy that includes a suite of evolving mitigation tactics that cover the three groups, or Scopes, of emissions categorized by the Greenhouse Gas Protocol – the global standard for corporate accounting and reporting emissions.

### Scope 1, 2 and 3 Emissions – What are they and how to reduce them?

Scope 1 emissions are under the direct control of the business, so the first step is to identify the major sources of emissions then **remove**, **reduce**, **replace**, or **offset**.

- **Remove** the source of the emissions by avoiding carbon-intensive activities, if possible.
- **Reduce** emissions is the next best step. This can be done by improving efficiency by, for example, upgrading or replacing boilers, furnaces, and processing equipment.
- **Replace** carbon-intensive energy sources, such as fossil fuels, with cleaner, low-carbon alternatives. For instance, switch to renewable energy, biomass, biodiesel, biogas, or bioethanol. Consider converting the company fleet or distribution and delivery network to electric.
- **Offset** any remaining Scope 1 emissions.

**Scope 2** emissions come from the energy that a business uses. They are considered indirect emissions, but there are opportunities to reduce them. The first step is to collate information from energy suppliers to understand the carbon footprint under Scope 2.

The easiest and quickest way to cut Scope 2 emissions is to switch to a renewable or low-carbon energy supplier. Another way to make reductions – and reduce costs – is to improve the energy efficiency of the property portfolio and business operations, and to optimize manufacturing and production processes.

**Scope 3** emissions are beyond a company's direct control so cutting them can be a challenge. Reducing Scope 3 emissions also differs from business-to-business, industry-to-industry, and country-to-country. A good place to start is to work closely with suppliers, customers, and other companies in the value chain.

For instance, you could redesign products or services to be lower carbon, or remodel packaging to increase the volume per shipment – or source supplies locally – to reduce transportation emissions.

But Scope 3 emissions are often a blind spot, according to the Climate Action 100+ net-zero Company Benchmark, which assesses company performance on emissions reduction, governance, and disclosure. It found that half of businesses with an ambition to achieve net-zero by 2050 do not cover the full scope of their value chain emissions.

### Don't forget your customers' emissions

Scope 3 emissions cover customers as well as suppliers. It is why Zurich is one of eight insurers that co-founded the UN-convened net-zero Insurance Alliance (NZIA).

They have committed to transition their underwriting portfolios to net-zero emissions by 2050. As risk managers, insurers, and investors, the insurance industry has a key role in supporting the transition. NZIA members will individually set science-based interim targets for every five years and independently report on their progress publicly on an annual basis.

Zurich considers net-zero underwriting a critical step in reducing emissions beyond its own operations and investments. It has identified the thermal coal, oil sands, and oil shales sectors as particularly carbon intense and will no longer underwrite or invest in companies with business models dominated by these fossil fuels and without plans to transition to less carbon-intensive business models.

### Reducing emissions in the heavy industries

Heavy industries such as iron and steel, chemicals, and cement account for almost 20 percent of global CO2 emissions.[3] The challenge for decarbonizing these industries is that many processes require high-temperature heat for blast furnaces, etc. This is usually generated by the combustion of fossil fuels as it is difficult to generate these temperatures using electricity alone.

There are cleaner options. These include replacing fossil fuels with "green" or "blue" hydrogen, biofuels, or in some cases a technology shift to enable renewable electricity. Reductions in carbon-intensity can also come from greater energy efficiency, the use of recycled input, and material efficiency strategies. A change of use, so that lighter, lower-carbon intensity cement or steel can be manufactured is another option.

However, some sectors, such as ammonia production, generate emissions in the production process, so decarbonizing them will require new processes rather than a different energy strategy. Cement production, for instance, relies on a chemical reaction to turn limestone (CaCO3) into lime (CaO), but it releases waste CO2 that cannot be eliminated by changing fuel or reducing energy use.

### Carbon capture use and storage (CCUS)

For “hard-to-decarbonize” heavy industries, carbon capture, use and storage (CCUS) is increasingly becoming part of their abatement strategies. CCUS is a group of emissions reduction technologies used to abate emissions within an industry’s own operations, where the chemistry or physics of production make alternative approaches technically very difficult.

The captured CO2 is compressed and transported by pipeline, ship, rail, or truck and used in a range of applications and products that effectively remove the CO2 from the atmosphere, or it is permanently stored by injecting it deep into sealed geological formations, including depleted oil and gas reservoirs.

CCUS used to be considered an expensive method of abating emissions, which is true if it is applied to fossil fuel power alone. But CCUS becomes significantly cheaper at scale when multiple sources of CO2 can access a transport and storage network.[4] It should be viewed as a driver of new business opportunities in a new clean growth economy.

CCUS is an enabler for decarbonizing a wide range of sectors in an economy, including industrial processes and in some circumstances energy, or as a storage site for CO2 in various carbon dioxide removal (CDR) processes. Most importantly, it can be used to produce decarbonized hydrogen, which has wide-ranging applications in decarbonizing many other sectors – the so-called hydrogen economy envisaged in many countries’ nationally determined reduction commitments.

Conventionally, hydrogen is produced by splitting natural gas into hydrogen and CO2 through a carbon-intensive process called “steam methane reforming.” But by using CCUS you not only abate the emissions, you create a clean “blue “hydrogen that can help decarbonize a wide range of industries, power generation and the transportation sector, including trains, heavy trucks, and shipping.

There is also an opportunity to create a CO2 storage services sector, which could utilize existing skills, capabilities and infrastructure from decommissioned oil and gas facilities, and support a wider drive for CDR. As well as an abatement strategy, carbon capture is also considered to be a “neutralization” method, which is explained in section 2.4 of this chapter.


## 2.3 Developing climate change strategies that drive 'compensation'

A compensation strategy should be designed to finance all unabated emissions in the value chain – once all abatement opportunities have been exhausted. There are several approaches to consider:

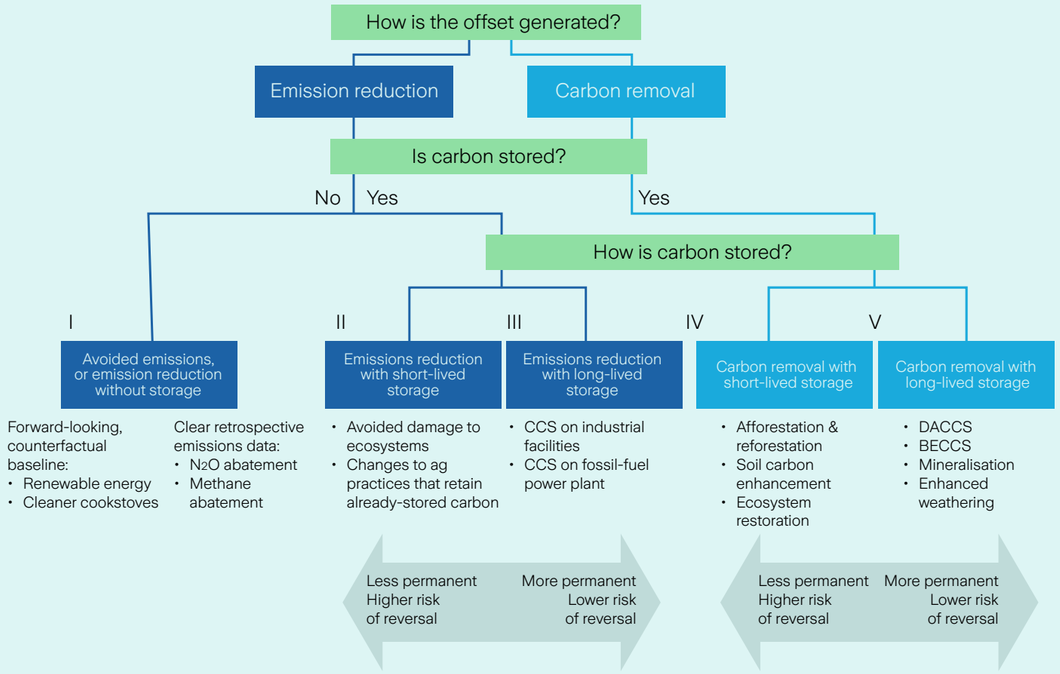
### 2.3.1 Carbon credits

In the absence of a global price on carbon, participating in voluntary carbon markets is an important way for businesses to drive economically efficient "compensation" and "neutralization" for emissions that cannot otherwise be abated. Carbon credits are a market solution to decarbonization, allowing a company to still emit carbon in certain sectors or territories if they purchase offsets for these emissions elsewhere. This allows a tradeable value to be placed on carbon, without multilateral agreement of a global carbon price.

Carbon offsets take the form of avoidance, reduction, or removal credits (see Figure 4). **Avoidance** and **reduction** credits ensure no additional emissions are released into the atmosphere. **Removal** credits are preferable, as they are created by taking active measures to remove and store carbon already present in the atmosphere, such as reforestation and Biomass Carbon Removal and Storage (BiCRS), Bioenergy Carbon Capture & Storage (BECCS), and Direct Air Carbon Capture & Storage (DACCS) projects.

To date, carbon credits – either in the form of voluntary offsets or regulated cap-and-trade schemes, like the EU's emissions trading system (ETS) – have been an important mechanism to reduce emissions. They create financial incentives to either reduce or avoid emissions, or to even remove carbon from the atmosphere.

**Figure 4:** Source Smith School of Enterprise and the Environment, Oxford University: 'Taxonomy of carbon offsets' [5]




## Financing your transition

Just like Zurich, an increasing number of investors are embarking on net-zero journeys with the aim of decarbonizing their portfolios. As a result, companies will experience increased scrutiny, but also financial support for their transition journey.

Financed emissions from investments should be included within the Scope 3 inventory. Accordingly, high emitting companies will be a source of increased amounts of financed emissions as well as transition risks in an investor's portfolio. Those that are less emissions-intensive, offer investment opportunities into direct climate solution technologies, or have set their own science-based targets and can demonstrate progress on their transition will become more interesting assets to hold. It is therefore important for companies to define their science-based targets, then communicate the feasibility and credibility of implementation to investors to maintain optimal access to capital.

### Green bonds

Green investments are required to finance the development of new green technologies and infrastructure that will enable the world to transition towards net-zero. The OECD estimates that the total required investment is USD 6.9 trillion a year up to 2030.

While green investments are possible in a variety of asset classes, from blended finance vehicles, via infrastructure investments to private equity or debt funds – listed bond markets are attractive for both investors and companies.

The purchase and issuance of green bonds is becoming an increasingly important tactic for investors to help finance the transition, and a source of funding for companies' abatement and neutralization actions. For instance, Zurich has invested over USD 4 billion in green bonds (next to other green impact investment assets such as infrastructure and private equity) that help avoid 2.9 million tons of CO2 a year.

Issuing green bonds can also finance the acceleration of a business' net-zero journey. Volkswagen, for instance, came to market in 2020 with a pair of green bonds totaling USD 2.2 billion that will help finance its electric vehicle program.

## 2.4 Developing climate change strategies that drive 'neutralization'

While the priority focus for companies is to reduce carbon emissions through abatement measures, the SBTi states that businesses should take "neutralization" measures to remove CO2 from the atmosphere to counterbalance the impact of emissions within the value chain that cannot be eliminated. As stated earlier, the IPCC considers carbon dioxide removal (CDR) to have an important role in all of its 1.5°C pathway scenarios. That role becomes more vital if 2050 net-zero targets are missed as it would increase the reliance on net negative emissions after mid-century to return warming to 1.5°C.

A range of CDR approaches will be required to remove CO2 at scale, as each potential approach has scale limitations, constraints, and trade-offs. For example, relating to land use, water use, and biodiversity.

About 40 million metric tons of CO2 (MtCO2) were stored in 2020 using carbon capture and storage technologies, mainly for abatement. To address CDR requirements, this level of storage capacity needs to grow exponentially over the next 30 years from 0.5 to 1.2 Gt of CO2 per year by 2025, and to significant volumes in the medium term, removing as much as 6 to 10 Gt of CO2 globally per year by 2050.[6]

There are two main approaches to CDR: technical solutions and nature-based solutions. Neither approach is currently operating at the scale, or cost level, to store the required volumes of CO2 envisaged in net-zero scenarios.

### Technical solutions

These involve capturing CO2 emissions from the atmosphere and storing them deep underground in geologic reservoirs. There are two main categories of technical CDR solutions:

- **Biomass Carbon Removal & Storage (BiCRS)**. These are processes that use biomass to remove CO2 from the atmosphere, which is then stored underground or used in long-lived products. To avoid conflict with other sustainability goals, these processes must be developed in a way that does not damage, and ideally promotes, food security, rural livelihoods, and biodiversity.
  - A subset of BiRCS is **bioenergy with carbon capture and storage (BECCS)**. In this process, purpose-grown plants and trees are harvested as biomass then burned to generate heat or electricity. The emissions are captured then stored. Alternatively, biomass is converted into liquid fuels – known as biofuels. CO2 is released as part of the chemical process and is again captured and stored. In both cases, negative emissions are generated as biomass draws carbon from the atmosphere as it grows. A CCUS power station fueled by biomass or CCUS facilities that process biomass into biofuels would both be considered BECCS technology.
  - BECCS was identified in the IPCC 1.5°C Report as the main CDR mechanism to comply with the Paris Agreement timeframe. Its role as a major CDR mechanism is constrained as it is land- and potentially water-intensive and limited in spatial suitability. Under appropriate circumstances and with adequate safeguards, BECCS could still provide CO2 removal.
- **Direct air carbon capture and storage (DACCS):** This involves removing CO2 directly from the atmosphere using chemicals known as sorbents. A process called absorption dissolves CO2 into the sorbent. A second process is adsorption, where CO2 molecules adhere to the surface of the sorbent material. The sorbents are treated so that the CO2 is released for sequestration.
  - The challenge with DACCS is that it is expensive and energy intensive. But it has large potential for cost reductions as scale increases. And – unlike BECCS – there is no potential risk to food security, rural livelihoods, and biodiversity.

The transportation and storage of CO2 at scale, permanently in geological reservoirs, is a set of technologies that are both feasible and technically demonstrated. BiRCS, BECCS, and DACCS will require storage sites and the costs of storage will significantly reduce as more sites become available. Especially as CCUS schemes, for abatement, are implemented at scale to reduce emissions and their storage capacity can then also be accessed for CDR purposes.

### Nature-based solutions

This involves the enhancement of natural carbon stocks through the following approaches:

- **Forestry practices:** These include afforestation and reforestation, improved forest management, the elimination of deforestation and the natural regeneration of forests, assisted or otherwise.
- **Wetland-related practices:** These focus on conserving and restoring peatlands and coastal wetlands, such as mangroves.
- **Restorative agriculture:** This broad category includes practices that build soil carbon, such as no-till agriculture and cover crop rotation (collectively known as regenerative farming techniques that enhance soil health and productivity) to agroforestry and improved livestock management.
- **Enhanced bio-sequestration:** These techniques replace marginal agricultural land with managed indigenous flora, which is coppiced regularly and buried in anoxic, saline pits to avoid composting.
- **Ocean-based practices:** These include restoring seagrass meadows or growing kelp or shellfish to restore or expand marine ecosystems.
- **Enhanced weathering of minerals on land:** This requires large volumes of materials, which implies negative impacts from mining and transport. But this could permanently store a sizable amount of $CO_2$.

These approaches to nature-based solutions have the associated risk of impermanence due to wildfires, or deliberate deforestation. Mechanisms to manage these risks are needed, especially if these projects are the basis of financial products such as carbon credits or offsets.

### Planting trees in the forest and hope in our hearts

The “Zurich Forest” project supports non-profit organization Instituto Terra to regrow part of what was once the largest single wooded place on Earth: the Atlantic Forest in Brazil.

Zurich’s grant covers the planting of one million seedlings of 120 scientifically selected native species. But it is more than just a reforestation project. Instituto Terra aims to re-create native forests, restore the biodiversity of plants and animals, protect soil, and revive and maintain water sources on the former cattle farm. In the Zurich Forest, a tree will be planted for each of Zurich’s 55,000 employees, with the remainder available to customers when they purchase insurance.

Reforestation is a tangible example of how small steps each day can add up to a giant leap over time. The Zurich Forest was barren farmland just 20 years ago and is fast becoming a biodiverse rainforest also thanks to our support.

# Chapter 3: Corporate action: Adapting to climate change

Stifling heat waves and destructive wildfires across North America, the Mediterranean, and Siberia, devastating floods in Europe and China, and deadly monsoon rains in India. The events of summer 2021 have clearly shown why our work to limit global warming to 1.5°C or 2°C is critical. We are already experiencing the physical risks associated with climate change and adapting to these risks is going to be a way of life for future risk management.

But it is not only physical climate risks that will require adaptation. As Chapter 2 outlines, governments and businesses are making ambitious commitments to achieve net-zero. While the transition to net-zero is a source of opportunity there are also risks associated with the implementation of the strategy if it is not managed carefully. Whether site risks arising from the installation of solar panels on a roof, financial and operational risks from new carbon regulation, or liability risks crystallizing around products and services – identifying and adapting to these physical and transition risks will be critical to business resilience.

## 3.1 Types of Risk

Identifying climate risks requires ongoing mapping and assessment against three key risk types: physical, transition, and liability.

- Physical risks are associated with the consequences of climate change on physical assets and can drive indirect as well as direct impacts or consequences. For instance, record low levels on the River Rhine in Germany in 2018 led to major supply interruptions that caused many industries to halt production because of raw material shortages. It is estimated the decline in Rhine traffic caused a EUR 5 billion loss in German industrial output in the second half of 2018.[1]
- Transition risks can arise from the impact of changes to laws, regulations, or societal expectations impacting the cost of doing business. They can also come from changes in demand driven by changing economic incentives or social norms.
- Liability risks arise from a failure to mitigate, adapt to, disclose, or comply with changing legal and regulatory expectations. Climate litigation is increasing worldwide, reflecting advances in attribution science, evolving legal disputes, and changing public sentiment. It is also being driven by a greater focus from regulators and investors wanting to ensure businesses provide necessary disclosures and comply with an ever-evolving regulatory landscape.

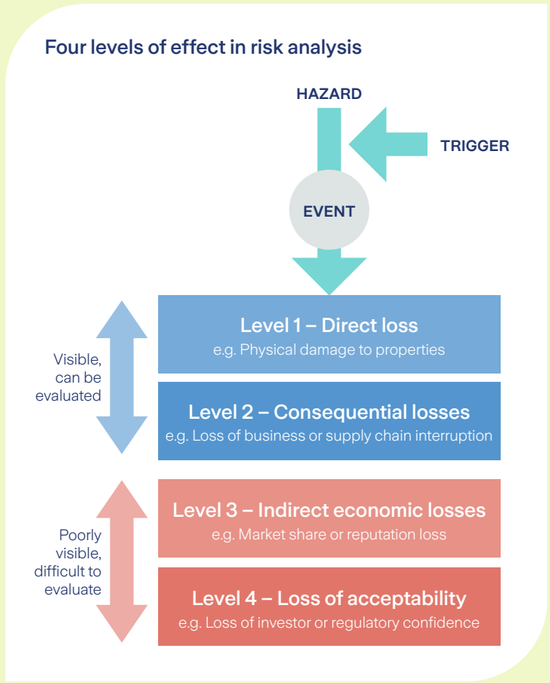



**Figure 5:** Scenarios developed as part of the risk assessment exercise should consider the "cascade" effect of an event, i.e. multiple consequences triggered by a single event but manifesting themselves because of the characteristics of the system. As an example, lightning disrupting local power supply, causing loss of pumps in local drainage system, resulting in flooding. The consequences range from physical damage to loss of reputation (operators of drainage system and power network).

## 3.2 Understanding the challenge

The good news is that there are well-established methodologies and risk management approaches to help businesses build resilience against climate risks. We detailed these in our last Climate Risk Report in 2019, including the three key steps of a climate resilience adaptation strategy (see graphic below). The methodologies that should be applied to manage and adapt to climate risks have not changed since then, but the world has. There has been a significant shift in public awareness of risks and commitments to transition. The speed at which investor and regulatory obligations are evolving has accelerated. The tools and data available to assess and quantify climate change risks may appear to be overwhelming and there is no clear guideline or standard on how to perform such assessments.

### The three key steps of a climate resilience adaption strategy:

Identify the broad business and strategic risks

Develop a granular view of the risks involved

Develop a mitigation strategy

It requires a significant shift in the way companies manage their approach to climate resilience and adaptation. Climate risks should not be managed alongside, or in addition, to core business risks – they need to be integrated into the heart of corporate risk management, due to the complexity of these risks and their potential impact on the company and communities in which they operate.

Robust governance – including CEO and Board-level sponsorship – is essential for delivering timely and business-aligned risk solutions. Risk tolerance levels need to be set, climate risk assessments repeated on a regular basis, and risks (or opportunities) swiftly identified across the organization. While dedicated sustainability units may define, monitor, and report on this activity; risk management teams should play a crucial role in delivering risk assessments from group level to individual sites. This will require identifying, quantifying, and analyzing risks across the entire organizational value chain.

The graphic on the next page provides an overview of the assessment process in which natural hazards (current risks) and climate change (future risks) may be considered at each step. The data, tools used, and granularity of the output developed at each step may be adjusted iteratively, based on the results and specific needs of the analysis.

This framework can be used to develop risk scenarios for both physical and transition risks. The Zurich Hazard Analysis methodology, or similar tools such as total risk profiling, may be used to visualize these scenarios and develop a catalogue of solutions, whether for physical or transition risks. The severity and probability of potential consequences, as well as the “risk tolerance” boundaries, are defined through a collaborative approach, based on the organization’s risk appetite.

# Recommended modular approach for assessing natural hazards and climate risks

## Options for carrying out a comprehensive assessment process

### Necessary initial steps

1 **Data quality review**

2 **Definition of scope**

### These steps can be stand-alone analyses or a sequence of progressively more detailed assessments

3 **Global exposure analysis**

4 **Account loss modelling**

5 **Desktop study of key sites**

6 **On-site visit for key sites**

### Outcome and follow-up

7 **Resilience solutions**

+

8 **Additional related services**

**1. Review data**
Test all available climate data for accuracy and quality. Benchmark global data against alternative local sources where available.

**2. Define scope**
Define business-relevant criticalities based on the organization's value chain. Include hazard parameters defined by time horizons, multiple climate change scenarios, or specific perils.

**3. Undertake a Global Exposure Analysis**
This provides an overview of site and infrastructure exposure to natural hazards at global and regional levels. The output can be used in setting strategy, planning resources and the supply chain, or identifying locations that should be assessed in more detail.

**4. Account loss modeling**
Scenario-based estimates can be applied to quantify losses in extreme events adjusted for future climate change. This provides a view on the adequacy of the insurance structure, as well as an alternative method to identify high-risk sites.

**5. Desktop study of key sites**
This is a site-specific high-level scenario analysis of potential losses informed by global climate projections and local hazard data, using details of buildings and the value chain. This allows for an estimate of the potential property damage or business interruption.

**6. On-site visit for key sites**
Assess the quality of controls of selected sites with risk engineering specialists. This should cover physical controls (i.e., engineered protection measures) and organizational controls (e.g., emergency response planning) during a plausible future loss scenario.

**7. Resilience solutions**
Install engineered protection measures that are designed, planned, implemented, and maintained according to the specific requirements of each site. Continually test them to ensure they remain available, reliable, and fit for purpose.

## 3.3 Data – a key component

The effective assessment of climate risk and the understanding of the most efficient mitigation measures depends on high quality data. This data may either relate to the organization itself (locations of physical assets and suppliers etc.) or to external data required for the analysis, e.g. natural hazards or climate change data. The risk assessment process is iterative, allowing additional data to be added with each iteration.

While procurement of data relevant to the organization may be a relatively straightforward process, determining the relevant natural hazards and climate change data may be quite complicated.

Conventional tools, including hazard maps, zoning maps, and building codes, rely primarily on historical data. But global warming is leading to changes in the frequency, intensity, and duration of extreme climate events, which means historical data does not provide an accurate picture of the future.

These tools are being adapted to consider climate change implications, but forward-looking, or scenario-based data cannot predict what an extreme weather event might look like.

Forward-looking climate data is produced by running climate models that are driven by assumptions about future global emissions and land use. These assumptions create a narrative about the future state of the world called a scenario. Because of the uncertain nature of these assumptions – that are influenced by future human behavior, geopolitics and technology – multiple scenarios are produced to describe plausible future global evolution.

Climate research institutes across the world work with their own climate models, which may differ in the physics, methodology or scope of study, but the scientific output is standardized by the World Climate Research Programme (WCRP CMIP) and summarized in periodic reports by the Intergovernmental Panel on Climate Change (IPCC). This means the same scenarios are used by researchers to maximize the comparability of their results.

The previous generation of scenarios were based on assumptions about the future concentration of emissions (referred to as RCPs, Representative Concentration Pathways), which lead to different global temperature changes. RCPs are now complemented by a new set of scenarios referred to as SSPs (Shared Socioeconomic Pathways), which model global emissions based on narratives on alternative but plausible socioeconomic developments, including population, economic growth, and urbanization.[2] These different SSPs lead to a range of different climate model outputs for the physical parameters that help us understand what future climates may look like.

Worldwide, research groups have developed around 100 climate models,[3] based on the scientific understanding of how the oceans, atmosphere and land interact, including detailed physics, chemistry, and biology. The output of climate models running future scenarios are projections of climate variables over time, including surface temperature, precipitation and wind speed, or atmospheric parameters such as pressure and humidity.

These output variables can be combined from different models to increase the range of possible values (a multi-model ensemble); from different simulations of the same model and scenario, albeit with different initial conditions (initial condition ensemble); or from slightly different physics (perturbed physics ensemble), which lead to a range of outputs.

Because of the global nature of these models, the output resolution is too low to be useful in comparing local impacts of climate change across a portfolio of locations. To do this requires data to be transformed using additional data sources, including regional climate models, elevation models and local historical measurements.

The data output by climate models is usually daily or monthly and may not tell us about the magnitude of extreme events – information that is useful for risk assessments. Therefore, statistical methods are used to build up a distribution of possible values (usually model ensembles), and to quantify extreme values of those distributions.

There is inherent uncertainty in climate change data. This is due either to the assumptions in the evolution of global socioeconomic factors and associated emissions, or due to the model, as scientific understanding is steadily evolving. The best way to use climate data for risk assessment is in relative or hypothetical terms – to identify regions of higher or lower risk, prioritize locations, or inform scenario analysis by considering a range of outcomes or multiple data sources.

### Bring in the experts

In response to customer needs, Zurich established Climate Change Resilience Services (CCRS) in 2020 to help businesses identify, assess, quantify, mitigate, and adapt to evolving climate risks.

CCRS builds on Zurich's existing natural hazards risk advisory service. It brings together climate data, customers' information on their assets, and Zurich's in-house expertise to develop tailored solutions for climate change risks.

CCRS experts also support customers in all phases of the design and implementation of the solutions.

## 3.4 Risk quantification

Once a business identifies and assesses potential climate risks, the next step is to quantify and prioritize these risks. For organizations with multiple locations, the process may start at a global level (i.e., consider all locations), then proceed to the individual locations and potentially specific processes at location level.

There are a range of quantitative and qualitative tools that can be used to quantify and prioritize risks. These tools may be used individually or in combinations, depending on the scope of the analysis, available data, resources available, or other factors, including:

- **Catastrophe models:** These conventional insurance tools provide financial metrics to assess potential losses across a portfolio of sites in particular regions, for specific perils. These tools help develop risk transfer (insurance) solutions, as well as identifying high-risk locations. But they do not cover all regions and perils. They can be adjusted to incorporate future scenarios.
- **Hazard maps:** Based on historical data, or including projected changes, hazard maps help understand the peril-specific exposures of sites across the geographic footprint of the organization. This can build a view of overall climate risk or help understand which locations are potentially driving the risk.
- **Historical losses:** An assessment of prior losses help to understand recent events and provide a deeper understanding of the performance of organizational measures, physical controls (both public and onsite), and local emergency response measures. Zurich's Post-Event Review Capability (PERC) methodology is an example.
- **Scenario assessments with a "future-risk" component.** These in-depth assessments can be performed for one or multiple sites (concentrated in a specific region and potentially impacted by a single event) and help build an understanding of the potential impacts of an event, as well as for developing solutions for uncertain future conditions.

## 3.5 Adapting to climate risk

Understanding at a detailed level and in a dynamic way the physical and transition risks posed by climate change to a business is only half the resilience puzzle. Designing and deploying effective adaptation measures is the other key piece.

Effective climate risk management can reduce either the frequency or the severity of a disrupting event. For an example of reducing frequency, a facility that has well-designed and maintained flood protections that are properly deployed during flood warnings is likely to be flooded less often than a facility without such protections. For severity, a company with good emergency response and business continuity plans may still be impacted by a flood, but is likely to suffer lower losses if critical equipment and stock can be protected in advance and the business can get back up and running quickly after the event. The solutions must consider the entire value chain, including factors outside the effective boundary of the site, such as infrastructure, utilities, supply chain and other issues potentially affecting the entire community or region.

Building resilience to physical climate risks involves a range of measures – both physical and organizational – that will be different across industries and activities and geographies.

### Physical (engineered) solutions

These are resilience measures that are built or designed to control a defined level of hazard. For example, in some countries and regions where hurricanes are common, buildings are required to be designed to be resilient to particular wind speeds.

The building envelope should protect the operations and activities on site, with additional controls beyond the main buildings – such as mobile flood barriers. These solutions can require significant investment, so an additional analysis that estimates how a site would be impacted by an extreme event with and without additional protection can help select what level of protection is required.

Physical resilience solutions are not limited to structures. They can extend to natural protections, such as the management of vegetation around the site to provide firebreaks as protection against wildfires, or community-based solutions, devised and implemented in collaboration with public bodies that benefit both workers and those who live nearby.

### Organizational measures

Organizational measures usually need less upfront investment, but require time, training, and cultural change. They may include emergency response management measures to establish actions to protect workers and operations before a disaster strikes, or a business continuity plan that routes production to alternative plants. Rolling out training to site managers on how to protect employees from extreme heat is another example of an organizational control.

These protection measures only work if they are properly maintained and available when required. For example, those responsible for site safety must know how to implement mobile flood protection by undertaking annual drills. And an emergency response plan is not effective if a new site manager has not been thoroughly briefed during on-boarding.

An organization may find that some future risks it identifies will exceed their risk tolerance, and the cost of protecting against those risks is too high when compared to the residual risks. At this point, strategic decisions must be made about whether to relocate or make adjustments to the processes or activities carried out at the site.

Amid all this uncertainty, one thing is sure – start sooner rather than later on understanding your exposure to potential climate risks, then quantify their likelihood and impact. A structured assessment that is founded on solid risk management principles and includes relevant stakeholders will make this complex process more manageable and maximize buy-in from across the organization. This is the basis for designing an effective climate risk management strategy, which is central to building organizational resilience to climate risks.

### Risk transfer: the role of insurance

Insurance is the third pillar of a comprehensive risk management strategy. The three pillars together will support an organization to reduce the impact during an event and in the recovery phase.

Incorporating the other two pillars – physical and organizational protection measures – will help make insurance affordable and will work together towards loss reduction.

# Chapter 4: Getting to Net-Zero: Actions required from policymakers to support transition

## 4.1 Overview

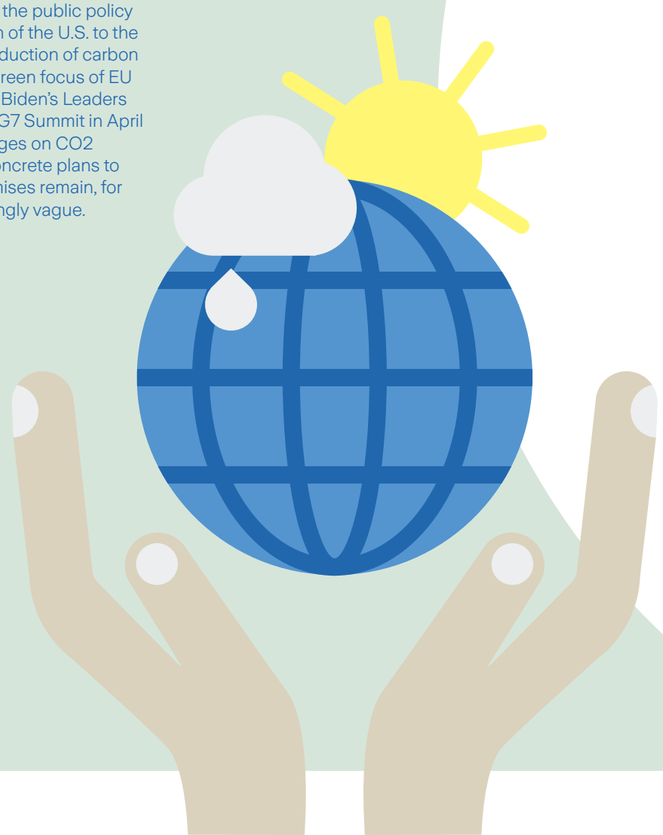
The timeframe for taking action to deliver a smooth transition to achieve the goals of the Paris Agreement is shrinking. Action is urgently needed to reduce carbon dependency.

Zurich's 2021 Climate Change Scorecard shows that positive progress has been made in the last 12 months in some areas, and Chapter 2 highlights that there is much that businesses can and are doing to advance towards net-zero.

Fast and determined government action will be required to create the certainty and clarity around transition pathways, which will be essential if a net decarbonization of the global economy is going to be achieved by 2050.

Certainty around political commitment to net-zero and the policy actions that will implement those commitments are fundamental to making progress. Without this clarity it will be difficult to make the investment case for new low-carbon technologies or to create the pipeline of investible green projects required to really scale green financial markets.

As highlighted in Chapter 1, 2021 has seen positive developments on the public policy front – including the return of the U.S. to the Paris Agreement, the introduction of carbon pricing in China, and the green focus of EU recovery funds. President Biden's Leaders Summit in March and the G7 Summit in April saw leaders reiterate pledges on CO2 reduction by 2030. Yet, concrete plans to deliver against those promises remain, for the most part, disappointingly vague.



**The upcoming COP 26 climate change conference provides a clear opportunity to agree on policy actions to deliver against these ambitious climate commitments. Progress in the following three areas would be highly beneficial in supporting the transition:**

**1. Carbon pricing:** The price of emitting CO2 must be aligned with net-zero outcomes. Implicit subsidies for fossil fuels must be eliminated and the true value of low carbon solutions reflected in cost of finance. The most efficient way of achieving this would be through the establishment of a meaningful price for carbon at a global level. That seems politically unlikely, but the expansion of local and regional cap-and-trade schemes, scaling voluntary markets, and the development of "carbon single markets" between jurisdictions, can still provide momentum for transition in the absence of a global framework.

**2. Standardized data:** To encourage investors to make choices that support transition requires an internationally consistent approach to transparency and disclosure. Without a coordinated approach, we run the risk of greenwashing and increased cost and complexity, both in terms of disclosure and extracting meaningful information from those disclosures. Transparency and comparability provided by consistent and credible data on climate sustainability will also help bridge the gap where a clear carbon price might not be available.

**3. Finance and risk sharing:** The investment requirements of transition are far too large for the public sector to meet alone, but governments can catalyze private financing of transition projects by taking a share of risk and investing directly to support resilience and adaptation. Sovereign issuance will be essential to scaling green debt markets and governments will have to take a key role in facilitating the flow of finance to support the climate transition.

Strong policy support will also be central to developing and scaling up negative emission technologies required for carbon dioxide reduction (CDR) and neutralization outlined in Chapter 2. Past experience suggests a combination of financial incentives and government mandates will be the most effective route to scaling these technologies.

Financial incentives, through a price on carbon, subsidies, or tax rebates, have been vital to the deployment of renewables and electric vehicles. In addition, the adoption of these technologies has been accelerated by deployment mandates, such as renewable portfolio standards or phase-out commitments on internal combustion engine vehicles. This "incentives + mandate" approach should also be applied to the development of negative emissions technologies.

Governments can kick-start the drive to net-zero by working with industry and investors, engaging citizens in the process, and focusing on key policy changes. But without further action, the risks of a disorderly transition, with all the social and economic costs that would involve, will increase. Failure to make progress in the short-term will have consequences for the long-term.

## 4.2 Carbon pricing: Priorities for action in policymaking

As stated in Chapter 1, at Zurich we consider carbon pricing as one of the most powerful instruments for achieving net-zero. By penalizing polluters, a meaningful carbon price applied globally will align economic incentives with reduced carbon dependency and help decouple economic prosperity from carbon emissions. A price on carbon emissions gives companies and households an incentive to reduce emissions. However, the political challenge is considerable and any quick agreement on an international price for carbon looks unlikely. That does not mean there is not scope for progress in the short-term, building on existing pricing frameworks to enhance their impact and extend their scope.

### Approaches to pricing carbon

There are three main ways for governments to introduce an explicit carbon price:

1. **A carbon levy, or tax, on CO2 emissions.** A carbon levy sets a fixed price on carbon consumption and should reflect the scientifically approximated cost.
2. **A cap-and-trade system.** Governments can set an emissions cap and issue a certain quantity of emission allowances or certificates consistent with that cap. Emitters must hold allowances for every ton of CO2 they emit and may buy or sell allowances. This establishes a price for emissions based on supply and demand.
3. **Hybrid schemes.** These can combine a cap-and-trade system and a carbon levy – setting a floor price for carbon – so the carbon price does not drop too low.

The structure that is chosen to generate an explicit carbon price is less important than the scope of coverage and level at which the price is set. Optionality around structures should be considered to allow for tailoring to address jurisdiction-specific political and economic challenges.

### Raising the quality of carbon markets

In the absence of government action, there is still scope for private voluntary markets to develop a meaningful price for carbon. The Taskforce on Scaling Voluntary Carbon Markets (TSVCM) is one such initiative that creates scalable, transparent, liquid, reliable, and high-quality carbon markets. Increased carbon credit quality will lead to higher prices, which in turn will drive companies towards further decarbonization efforts in their own operations.

However, more attention is required to ensure the quality of voluntary carbon markets. Clear standards and methodologies need to be developed by independent, non-conflicted, non-market participating experts to ensure the quality of carbon credits and avoid green washing.

### Effective carbon pricing

For carbon pricing to drive a net-zero transition, the scope of current mechanisms must be extended to capture a greater percentage of emissions, together with an explicit target for minimum global prices. The High-Level Commission on Carbon Prices estimates that a carbon price of at least USD 40–80/tCO2 is required by 2020, rising to USD 50–100/tCO2 by 2030 to cost-effectively reduce emissions in line with the temperature goals of the Paris Agreement.[1]

To be politically sustainable, any commitment to increase the minimum price of carbon will need to be balanced by distributing revenues to mitigate the impact on affected sectors of the economy (e.g., cement or steel producers) or segments of the population (e.g., rural communities).

According to the World Bank, USD 53 billion of revenue was raised by carbon levies in 2020.[2] For carbon pricing to be viable, governments must address the social impacts of increased energy and transport costs, as well as changes in labor markets. Carbon pricing revenues should also be used by governments to invest in further decarbonizing the economy.

In a world of local and varied carbon price mechanisms, it will also be necessary to implement adjustment mechanisms to prevent carbon leakage across borders and distortions to international trade. In the absence of an overarching international framework (a "WTO for carbon markets"), "climate clubs" between individual jurisdictions could be created to agree on mutual climate compensation mechanisms.

### The European 'climate club'

In July 2021, the European Commission adopted a new Carbon Border Adjustment Mechanism (CBAM) that will put a carbon price on imports of targeted product sectors (e.g., cement, steel, aluminum, electricity, and fertilizer) to prevent "carbon leakage." This will ensure emission reductions within the EC contribute to a global emissions decline, instead of pushing carbon-intensive production outside of Europe. It also aims to encourage jurisdictions and industries outside the EU to take steps in the same direction.

### Article 6.2: Exporting emission reductions

Article 6.2. of the Paris Agreement is designed to allow participating countries to make emission reductions overseas and count them toward their own home country climate targets. For example, climate change mitigation activities can be implemented in one country and the resulting emission reductions transferred to another country and counted towards its nationally determined contribution (NDC).

Agreements between countries provide the legal framework for commercial contracts between sellers and buyers of emission reductions. The "mitigation results" must be real, verifiable, and permanent. The agreements regulate the prevention of double counting and the transfer of reduction achievements, while providing for the possibility of mutual monitoring. In addition, agreed criteria can ensure projects protect the environment, promote sustainable development, and respect human rights. Switzerland reached the first agreements of this kind with Peru and Ghana.

## Policy recommendations for carbon pricing

1. Governments should set out a clear phased approach to the introduction of minimum carbon pricing consistent with achieving their nationally determined contributions (NDCs) for 2030. In wealthier countries, the price will need to be set between USD 80 and USD 100/tCO2 by 2030.
2. To prevent carbon leakage, jurisdictions should form coalitions. These "climate clubs" can introduce cross-border adjustment mechanisms in line with WTO rules.
3. Further agreements under Article 6.2. of the Paris Agreement (see box) should be concluded. Early agreements can be used as a model with resulting knowledge and experience shared with other jurisdictions.
4. Carbon pricing should be fiscally neutral, and revenues used for defined and well-communicated purposes, such as investing into climate and energy related projects, or used to address possible social impacts of carbon pricing.

*Article 6.2. of the Paris Agreement is designed to allow participating countries to make emission reductions overseas and count them toward their own home country climate targets.*

## 4.3 Standardized data: Priorities for action in policymaking

Action to reach a meaningful explicit price for carbon across multiple jurisdictions is a necessary but not sufficient condition to drive transition. Action will be required to provide the transparency investors need to allocate capital efficiently in support of transition. Without consistency in the data produced to inform investors, the risk of greenwashing and misallocation of funds will persist, undermining efforts of investors and firms to deliver on climate commitments.

### Data Transparency

There are two key elements to the delivery of data transparency. First is the development of taxonomies to provide a common understanding of which activities are legitimately part of the transition to net-zero and which are not. The second is cross-sectoral, through the implementation of standardized disclosure obligations – these do not need to be identical across all jurisdictions, but they must be compatible.

The EU is the most advanced in terms of defining a taxonomy to underpin broad-based disclosure. Though focused on "green" as opposed to transition activities, the EU taxonomy is science-based and should be compatible with other taxonomies as they are developed. Extending taxonomies beyond green activities to those which may be relevant for transition will ensure they support short-term planning as well as longer-terms strategies for meeting 2050 targets.

Consistent, or at least compatible, definitions of where activity sits on the transition spectrum are a first step; determining an applicable set of disclosure metrics is a second. The Taskforce for Climate-related Financial Disclosures (TCFD) has set out a widely adopted set of disclosures. Furthermore, the International Financial Reporting Standards Foundation (IFRS) started efforts for a sustainability reporting standard that should lead to further standardization of disclosures.

### Insight into physical risks

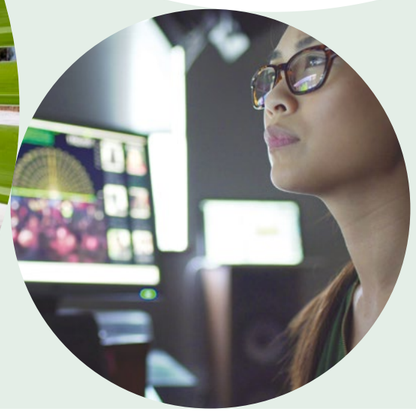
Even if climate change can be restricted to 1.5°C, physical risks from climate change are likely to increase. Businesses and governments will need to adapt to increasing severity and frequency of natural catastrophes, as outlined in the latest assessment of the Intergovernmental Panel on Climate Change (IPCC).[3]

Financial risks are not the only ones that are important in the context of climate transition. Data on physical risks is critical to understand the expected changes in risk and create transparency on their financial impacts. As a recent European Central Bank (ECB) paper found, insurability of risks is a key element of ensuring economic resilience in the light of catastrophic events. Providing transparency on those physical risks – in particular, risk location – will facilitate the development of cost-efficient adaptation measures and ensure those risks can continue to be insured.

Governments, public authorities and the insurance industry own much of this data – examples include: building codes and related physical risk data, data on natural hazards, and data on geographical topography – and should work together to deliver a comprehensive and consistent picture to inform risk planning and investment in adaptation.

### Nature risks

Accurate data and transparent reporting will be essential to halt the global decline in biodiversity,[4] or "nature-based assets.' The scale and complexity of the issues are challenging and there is a difficulty in comparing biodiversity impacts in different habitats. It will be important to relate nature-based risks to financial risks to encourage companies to take action to conserve biodiversity. Therefore, Zurich welcomes the exploratory work being conducted by the Taskforce on Nature-related Financial Disclosures (TNFD) to establish a reporting system for nature-based assets.



## Policy recommendations for standardized data

1. There should be an internationally aligned set of science-based taxonomies that covers transition as well as other green activities. The International Platform on Sustainable Finance (IPSF) and regulators are working together to define same types of taxonomies. The platform is focused on making sure that taxonomies are aligned. This work should be accelerated.
2. The International Financial Reporting Standards Foundation's (IFRS) work on developing climate-related standards based on TCFD recommendations should be completed quickly and adopted globally. Only with mandatory reporting in all sectors of the economy can consistent standards with reliable and comparable data be generated. Governments should commit now to the adoption of these reporting standards and make them binding.
3. To inform a clear understanding of physical risks, G20 governments should promote investment in adaptation measures and support insurability, while establishing a voluntary public-private risk hub for granular data sharing of climate-related risks.
4. Governments should establish public-private partnerships to diversify risk through disaster funds. According to a recent review by the ECB,[5] the insurance sector can help to maintain economic growth after a natural disaster. As the ECB suggests, governments can mitigate physical risk by means of insurance coverage and adaptation measures.

## 4.4 Finance and risk sharing: Priorities for action in policymaking

As the Zurich Climate Change Scorecard illustrates, there has been positive progress on carbon pricing schemes, even if the total scope of emissions covered remains low. If countries collaborate to develop "climate clubs", then the basis of a global carbon market might be achieved. However, an imminent breakthrough agreement on a comprehensive agreement looks unlikely. If governments are to meet their ambitious carbon pledges, there will need to be innovative financing approaches to leverage public sector funds effectively to "crowd-in" private investment.

According to the International Energy Agency (IEA), all parts of society must contribute towards the transition to net zero. To reach net zero emissions by 2050, the IEA estimates that annual clean energy investment needs to triple to USD 4 trillion by 2030.[6] Over the next three decades, that represents over USD 100 trillion in total clean energy investment.

Mobilizing that investment will require unambiguous commitment by governments to transition, as well as better and more consistent data with clear price signals to ensure markets are incentivized to allocate capital to low-carbon activities.

With almost USD 27 trillion assets globally, the insurance industry can play a key role in providing finance to support transition. To facilitate investment, opportunities must be aligned with the regulatory and fiduciary duties of these large investors. The types of investment that insurers and other institutional investors can make are constrained for good reason – they need to provide stable returns over the long term to meet their contractual obligations to policyholders – but this does mean they are not well-placed to provide significant equity and credit risk to help finance the transition to net-zero.

To fully mobilize the investment power of institutional investors, there needs to be ambitious development of green debt markets. Now worth around USD 1 trillion, with expectations of a further USD 300 billion issuance in 2021,[7] the green bond market is proving highly attractive. However, there is significant scope for further development – particularly in the market for government green debt.

Sovereign green bonds represent only 0.3 percent of tradable government debt, but there is significant scope for expansion due to their low cost of funding and scalability. Government debt constitutes an important part of institutional investor portfolios and green government bonds would fit into the portfolios of pension funds and insurers. These bonds also provide greater transparency and accountability and help facilitate the financing of green projects with lower funding costs.

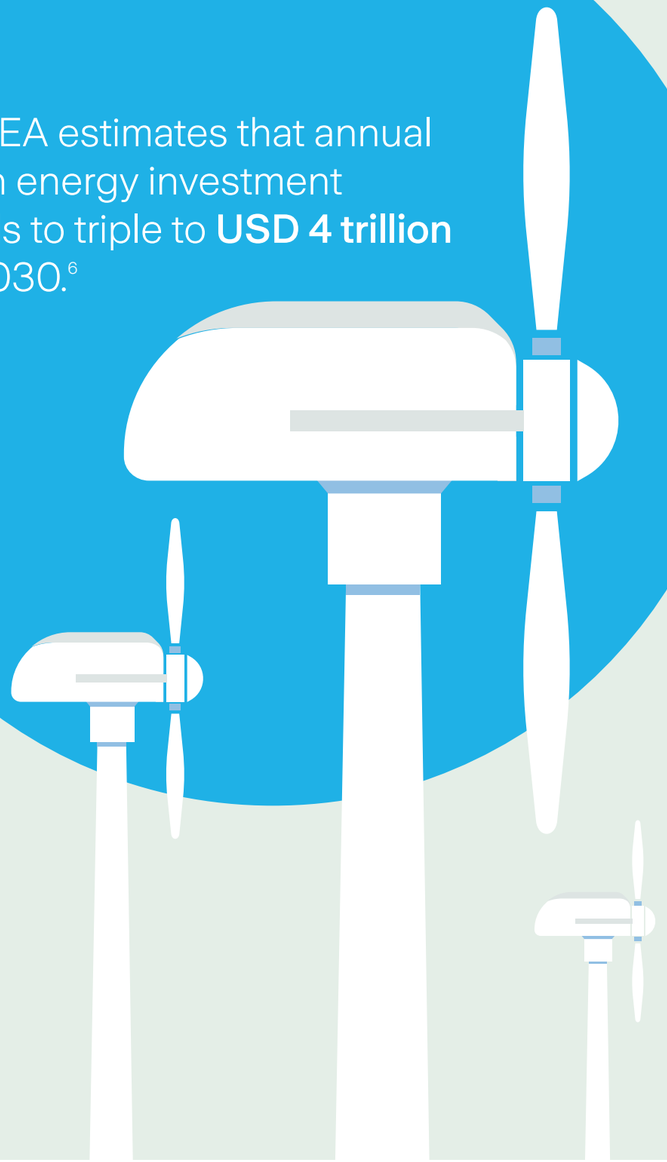
Given the attraction of green government debt, there is a strong case for using the proceeds of green bond issues to not only finance domestic transition activity, but to also fund development aid that meets COP 21 commitments to provide USD 100 billion funding for developing economies. At a sub-national as the Zurich Flood Resilience Alliance demonstrates, USD 1 invested in adaptation saves USD 5 in post-event costs. At a sub-national level, the development of green municipal bond markets could also provide finance for resilience and adaptation projects, which will be essential to mitigate future physical and financial risks that will arise even in the most optimistic climate outcomes. The existing U.S. municipal bond market for long duration green financing, for instance, could be extended by including adaptation projects within the remit of 'green' to finance recover and "building back better" programs around the globe within a well-developed market.

Aside from green bonds, governments should consider working with private investors to bridge the green investment gap by developing public/private blended finance options. Governments can absorb risks that markets cannot, which means they can support "crowd-in" investment and help accelerate the flow of investible projects coming to market by taking first loss risk in equity and using debt instruments to finance green infrastructure projects.

Governments can also play a critical role in supporting the scale-up of new tools and technologies by bridging insurance gaps and taking financial risks. Earlier chapters have highlighted the importance of carbon dioxide removal for delivery of a 1.5°C future. Technological solutions will need to be scaled up in coming years if sufficient carbon is to be extracted from the atmosphere to keep us on track for a net-zero world by 2050. A clear policy framework that provides predictability and certainty around investment returns will be essential to support that development.

Insurers will have a key role in managing the range of risks associated with large-scale engineering projects. Most of these risks are well understood and manageable. But long-term liability risks associated with possible carbon leakage are a different proposition and are more difficult for the market to absorb. Public-private collaboration will be needed to define and share the pooling of these risks.

The IEA estimates that annual clean energy investment needs to triple to **USD 4 trillion** by 2030.[6]



## Policy recommendations for finance and risk sharing

Governments should:

1. Commit to a program of green bond issuance to help develop the market quickly and efficiently.
2. Work with the private sector to develop incentives to increase ex-ante private investments and boost the use of public recovery funds to support resilience. This can be facilitated on an international level by the Financial Stability Board and the OECD.
3. Support the identification of investment opportunities, especially at the municipality level, and help local authorities as impact measurement, reporting, scaling, and pooling are challenges for local authorities eager to issue marketable and standardized bonds.
4. Create financial incentives for negative emissions technologies to drive neutralization, including a price on carbon, subsidies or tax rebates and deployment mandates, which have been applied on other areas (e.g. renewable portfolio standards or phase out commitments on ICE vehicles). This “incentives + mandate” approach should also be applied to the development of negative emissions technologies.
5. Make explicit inclusion of adaptation within remit of ‘green’ recovery and building back better programs.
6. Improve transparency on investment opportunities by developing a toolkit that connects investors to investments.

# Acknowledgments

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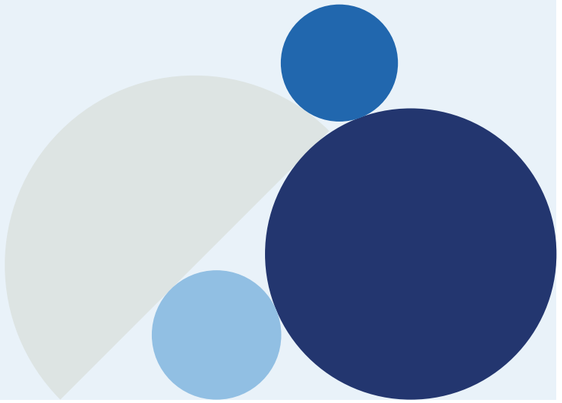

# Appendix 1 – Zurich's position on climate change

Climate change is perhaps the most complex risk facing society today. It is intergenerational, international, and interdependent. Zurich strives to be a leader in helping the world better manage climate risk and improve resilience against it: we aim to help prevent risks before they can have an impact.

In 2019, Zurich became the first insurer to sign the UN Global Compact Business Ambition Pledge for 1.5°C – a Paris Agreement for the business sector – and set a Group-wide climate strategy. Our 1.5°C Future Plan focuses on three actions we can take as a business: setting CO2-based reduction targets, innovating for sustainable solutions, and developing a deep understanding and integration of climate risk.

### Aiming for net-zero emissions

Zurich aims to be a net-zero emissions company by 2050 and is committed to using every lever at its disposal: in its operations, investments, and insurance products and services.

The Group's operations have been carbon neutral since 2014. In March 2021, Zurich announced its intermediate targets for reducing its CO2e emissions in line with a 1.5°C Future. To support these targets, the Group launched an internal 'carbon fund' to allow Zurich to set a realistic internal price on its operational emissions and support innovative solutions.

As a founding member of the UN Net-Zero Asset Owner Alliance in 2019 – a group of 40 institutional investors that represents USD 6.6 trillion of assets under management – Zurich has committed to fully decarbonizing its Group asset portfolio of about USD 200 billion by 2050, with intermediate targets set for 2025 for direct real estate investments and listed equities and corporate bond investments. We also require companies we invest in to set science-based targets that are aligned with the goals of the Paris Agreement and are committed to help finance the transition. We will keep raising our allocation to climate solutions and are committed to build an impact investing portfolio that helps avoid 5 million tons of CO2e per year.

In July 2021, we became a founding member of the Net-Zero Insurance Alliance to create an industry-wide standard that will allow us to set targets for insurance products and services. Together with our peers in the alliance, we will develop a methodology for measuring the carbon footprint of insurance as well as guidelines and tools to help the industry achieve net-zero in underwriting.

### Innovating for sustainable solutions

As a leading global insurer, our success depends on our customers' success at navigating the transition to a net-zero economy while simultaneously building their resilience to the increasing physical impacts posed by climate change. We are strengthening our customer-centric approach by providing a growing suite of products and services. In 2020, for example, we launched Climate Change Resilience Services focused on enabling commercial customers to understand, manage, and adapt to the current and future physical climate risk exposure of their global operations.

These are in addition to traditional solutions that can help support the adoption of transformational technologies like carbon capture and storage, sustainable agriculture, hydrogen as a fuel, sustainable infrastructure, electric vehicles, renewable energy, and voluntary carbon offsetting markets.

We are continuing to audit our portfolio and engage with our customers that are exposed to thermal coal, oil sands and oil shales, and ending relationships where progress is unlikely. Out of 268 customers and investees identified that are exposed to these energy sources, Zurich has terminated relationships with over one-third.

### Mobilizing employees through the Zurich Forest Project

To complement our business-focused climate strategy, as well as to mobilize employee support for climate action, Zurich is supporting an ambitious reforestation project with non-profit Instituto Terra to regrow part of the Atlantic Forest in Brazil. Each Zurich employee can attach their name to a tree and become a custodian of the forest created by planting one million native seedlings.

### Our climate targets:

- Science-based targets for investment portfolio (by 2025, cut emissions intensity of listed equities and corporate bond investments portfolio by 25% and of direct real estate investments by 30%) and operations (50% reduction of absolute emissions by 2025 and 70% reduction by 2029).
- Help to avoid five million tons of CO2 equivalent emissions per year through impact investments.
- Understand and monitor the carbon intensity of our underwriting portfolios, developing key metrics to support alignment to a 1.5°C Future while ensuring customers themselves successfully navigate the transition.
- Continue building internal carbon fund to drive down emissions from operations.
- Adopt 100% renewable electricity in operations by end-2022.
- Transition global car fleet to 100% electric vehicles by 2029.

View the Sustainability Report 2020

### Further climate measures

On September 7, 2021, Zurich announced a set of new global climate actions that include:

- Operational measures, including cuts to air travel of 70 percent, that will reduce CO2 emissions by more than 40,000 tons per year, equivalent to the amount absorbed annually by 2 million trees. Other actions focus on vehicles, food, paper, and real estate.
- An expansion of Zurich's range of sustainable products and services to help customers transition to net-zero. This includes the launch of the insurance industry's first carbon neutral fund and the expansion of insurance offerings for the clean energy sector.

Learn more about Zurich's new climate actions

We want to be known as one of the most responsible and impactful businesses in the world.

**Mario Greco**
Group Chief Executive Officer

# Appendix 2 – The Zurich Flood Resilience Alliance: Resilience in the community

Floods affect more people globally than any other natural hazard and cause some of the largest economic, social, and humanitarian losses. The Zurich Flood Resilience Alliance has been engaged in pre-event climate change adaptation work since 2013. It supports more than 300 communities across 23 countries and aims to build community resilience to flood for two million people.

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While floods have been the Alliance's focus, the core of their work looks at how communities adapt to the risks posed by specific climate change hazards. Resilience is built by looking at interventions that consider the hazard specifically – they look at resilience of what, to what, and for whom. The Alliance's approach is also being developed to focus on heatwaves.

The Alliance's work is defined by the Flood Resilience Measurement for Communities (FRMC), a holistic framework that is used to understand and measure community flood resilience.

The FRMC differs from more traditional approaches as it uses extensive insights to prioritize solutions that reflect local community needs. Insights are derived from household surveys, key informant interviews, focus group discussions, and the use of secondary sources according to context and need. For instance, the focus is not always on how to stop the next flood, but how a rice farmer might find a secondary source of income should the river break its banks.

Informed by insights from the FRMC analysis, Alliance members work with communities to identify the most effective approaches to build resilience, which typically cover these three areas:

- Improving risk awareness and developing community members' capacity to use information from early warning systems.
- Protecting assets that help maintain livelihoods, and provide diversified ways to earn a living, despite a changing climate.
- Using solutions in tune with the environment, such as biodykes.

The FMRC is publicly available and can be accessed here.

In January 2021, a new Adapting to Climate Change program was introduced that extends the work of the Alliance to help 4 million people overall become more resilient to flooding by 2024 – double the current number. The program will be extended to more urban and developed regions – its original focus was on rural communities in developing countries. And, finally, the experience of the Alliance and the FMRC

The Zurich Flood Resilience Alliance is a multi-sectoral partnership which brings together community programs, new research, shared knowledge, and evidence-based influencing to enhance community flood resilience across the globe. Since it started in 2013, the Alliance has grown from originally five members to now nine members, all heavily engaged in the disaster risk reduction and resilience space. On the ground, Alliance members help people measure their resilience to floods and identify and implement appropriate solutions before disaster strikes. Alliance vision is that floods should have no negative impact on people's ability to thrive. The Alliance is working to increase funding for flood resilience; strengthen global, national, and sub-national policies; and improve flood resilience practice. The first phase of the Alliance was from 2013 to 2018 within four countries, currently running the second phase in around 23 countries and have ambitions to reach 3.9 million people.

All partners except the Zurich-related entities are funded by the Z Zurich Foundation.

# Appendix 3 – Zurich Climate Change Scorecard terminology

## Score card on climate change

Progress is judged vs the IEA Bridge scenario when relevant scenario data are available. This applies to: carbon pricing; CO2 emissions; energy use; energy efficiency. For other indicators, we make an assessment based on the change in the indicator and, when appropriate, the level vs target.

**Carbon pricing:** Equal weighted score of (1) the direction and change in the share of emissions covered by carbon pricing scheme; (2) average price vs target price, target price = 100USD / tCO2.
Source: World Bank Group

**Corporate action and positioning:** Average score for corporate action and corporate positioning.

**Corporate action:** MSCI scores for management practices related to climate change relevant dimensions, current ranking vs maximum ranking of 10.

**Corporate positioning:** Level of emphasis on climate change related topics in corporate reporting, medium to high emphasis relative to low emphasis or no mentioning.
Source: Datmaran

**CCS technology:** External tracker of progress in CCS technology and number of projects.

**Social trends:** Size and direction of change in the number of articles published on climate change related topics.
Source: Datmaran

**Energy supply:** External tracker of progress on gas, nuclear, heat pumps, renewable power and coal, equal weighted score.
Source: IEA

**Legislation:** Number of global regulatory initiatives that impact corporate transparency on climate change issues, annual change vs historical average.
Source: Datmaran

**Energy demand and efficiency:** Equal weighted average of scores for energy efficiency:

**Energy demand:** World primary energy consumption (min tons of oil equivalent). Direction and size of change.
Source: BP Statistical Review

**Energy efficiency:** Energy usage per global GDP. Direction and size of change.
Source: BP Statistical Review, IMF

**CO2 emissions:** Direction and size of change.
Source: BP Statistical Review

**Investment:** Direction and size of change in investment into clean energy, vs estimated target level.
Source: Bloomberg BNEF clean energy trends, World Bank

**Energy integration and storage:** External tracker on progress in energy storage, smart grids, demand response, digitalisation, hydrogen, cogeneration of heating/cooling, equal weighted score.
Source: IEA

**Fossil fuel subsidies:** Global fossil fuel subsidies, direction and size of change.
Source: IEA

**Electrical vehicles:** External tracker of technological progress in the sector.
Source: IEA

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