Carbon Pricing for Investment Decisions

An Analysis of Global and European Carbon Markets

Customer version | Swiss edition

Zürcher Kantonalbank

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Analysed regions: Global
Sectors: All
Relevant SDGs: 13 Climate Action | 7 Affordable and Clean Energy | 9 Industry, Innovation, and Infrastructure | 12 Responsible Consumption and Production

Summary

Global carbon pricing systems have long been criticised for being toothless tigers. Most recently, governmental efforts to strengthen existing mechanisms (e.g., linear reduction factor) and to implement new ones (e.g., carbon border adjustment mechanism, CBAM) have massively picked up momentum. This analysis evaluates existing and planned carbon pricing mechanisms and their potential impact on economic sectors, geographies, and company valuations to help investors make better investment decisions.

This analysis came to three major conclusions, presented below:

1. **The use of carbon markets depends on the region:**
   Although some carbon markets have developed considerably and already cover relatively large areas (e.g., the European Union), regional differences must be respected. Markets differ in terms of regulation, scope, coverage, and price. There is no global price yet. For example, carbon pricing plays a minor role in the US. Although China is the largest market, its carbon market is still relatively rudimentary compared to Europe. The introduction of CBAM could encourage non-EU countries to increase their own carbon pricing ambitions. Despite all this, significant investments in low-emission assets and clean technologies need to be made to foster decarbonisation (ca. 8–9% of global GDP annually, according to McKinsey).

2. **Carbon risk is unevenly distributed across sectors and countries:**
   Assuming a global carbon price, the most exposed sectors are on average utilities and materials. Their market valuations face a relatively high potential downside risk. China and India are among the countries that have the highest carbon risk exposure due to their large power, steel, cement, and chemical industries. The US, on the other hand, has quite a diversified economy with a large service sector that compensates some of the downside risk from other carbon-intensive sectors. Overall, the least affected sectors are health care, real estate, communication services, information technology, financials, consumer discretionary and staples.

3. **Advocacy for a carbon-adjusted company valuation:**
   As of today, carbon pricing is mainly relevant for company valuations in Europe. Nevertheless, other regions (e.g., USA, China) will be increasingly affected by stronger regulation (e.g., CBAM) in the future. Carbon pricing can therefore have a significant negative impact on a company's value. Despite a company's primary sector exposure – and thus its overall carbon risk – fundamental stock analysis is critical, as other indicators influence the impact of carbon prices on valuation. These factors include the ability to
   – reduce overall carbon intensity,
   – absorb higher carbon costs through operating margins,
   – pass on carbon costs/capital expenditures to customers,
   – replace old assets ("lock-in risk"),
   – be financially flexible, and
   – hedge/purchase carbon allowances in advance.

1 The great decarbonisation

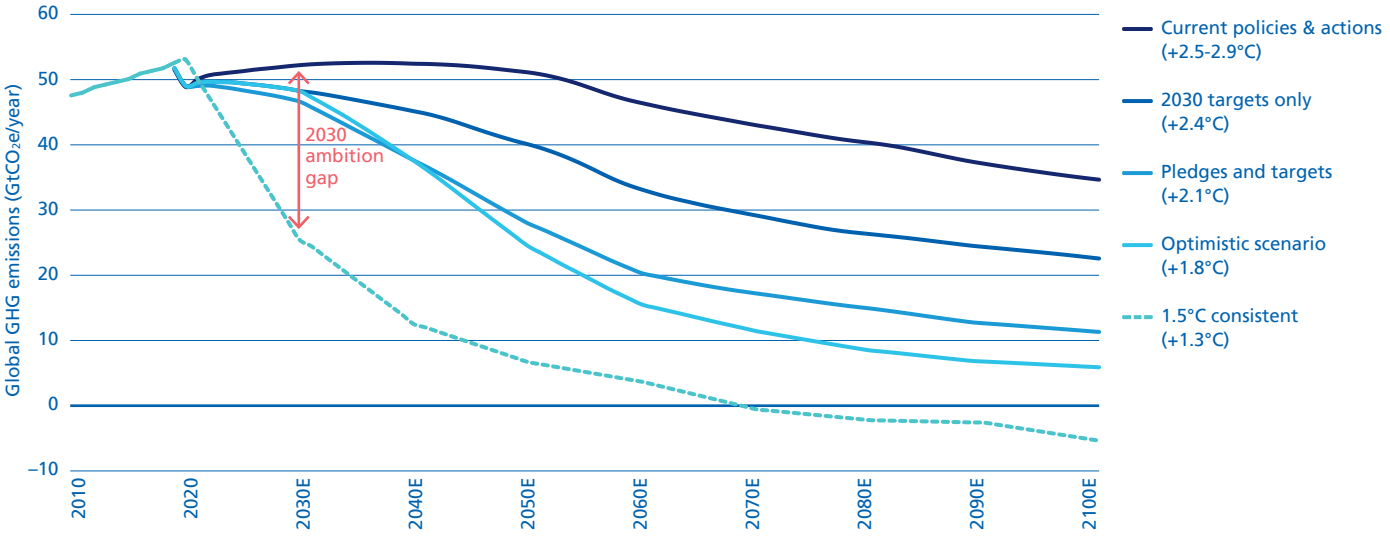
Climate change is one of greatest challenges of the 21st century. There is scientific consensus that the increase in global warming is caused by humans and is therefore a global problem that knows neither borders nor countries. The effects of greenhouse gas (GHG) emissions on climate and biodiversity are devastating and risk harming future generations to come.

Current policies project that warming will be 2.5 to 2.9°C above pre-industrial levels by the end of the century (see Exhibit 1). National actions to reduce emissions will limit warming to 2.4°C (2030 targets). If supplemented by binding long-term or net-zero targets, global warming could be limited to about 2.1°C, with a probability of approx. 66%. Limiting warming to 1.5°C above pre-industrial levels (best-case scenario) means that GHG emissions must be reduced rapidly in the coming years and decades until they reach net-zero by 2050 (Paris Agreement).

Assuming a global warming of +2°C, there is a very high likelihood that unique and threatened systems are at risk, with potentially severe consequences. Extreme weather events will also occur more often. The impact is also said to be unevenly distributed between groups of people and regions, but the risks are generally greater for disadvantaged people and communities. Global aggregate impacts are moderate to high under a +2°C scenario, reflecting a loss of the Earth's biodiversity and overall global economic damage. This also holds for large-scale singular events, which are abrupt and mostly come with irreversible changes to physical and ecological systems. Limiting global warming to below 2.0°C is therefore needed to mitigate most of the severe risks.

Several policies and mechanisms (e.g., the Paris Agreement) are in place to strengthen reduction efforts and circumvent key climate risks. Nonetheless, putting a price on carbon is proving to be an important driver of this change, as a price on carbon can incentivise whole industries, channel capital flows, mobilise knowledge, foster innovation, and make clean energy as well as low-carbon products more competitive.

Exhibit 1:
Global GHG pathways



Source: Climate Action Tracker (2021), Intergovernmental Panel on Climate Change (2022).
Remarks: Median GHG pathway values except for 2030 targets and optimistic scenario.

2 Relevance of carbon pricing systems

The increased regulation of GHG emissions in the last three decades has led to new carbon taxes and carbon markets. Carbon pricing via cap-and-trade carbon markets such as the EU Emissions Trading System (EU ETS) can have significant implications for sectors, geographies, and companies. However, there are also certain risks associated with carbon pricing.

2.1 GHG regulation and the emergence of carbon markets

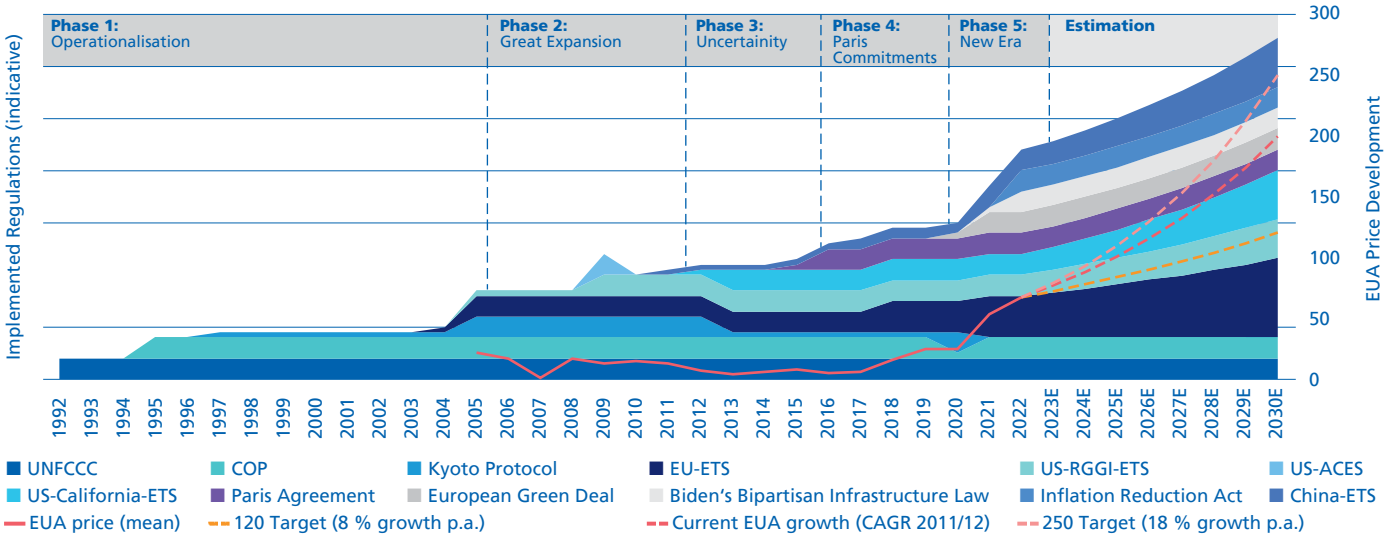
GHG regulation and the subsequent emergence of carbon markets have their roots in the growing awareness of the risks of climate change in the 1990s. The development of carbon markets can generally be divided into five phases (see Exhibit 2):

The underlying concept of carbon markets originated in the 1992 UN Framework Convention on Climate Change (UNFCCC), which proposed and **operationalised** the first GHG mitigation measures. The 1997 Kyoto Protocol then set mandatory binding GHG emission targets and reduction measures for 37 industrialized countries and economies in transition. Since its implementation, it has been criticised for covering only a limited portion of emissions, not being ratified by some of the largest GHG emitters (e.g., China, USA), and for having limited commitments. This led the EU to implement its own climate legislation (EU-15) and the EU ETS, a cornerstone of the EU's climate policy (launched in 2005), which was followed by a **great expansion** of carbon markets. After **increasing uncertainty** in the years 2011-2014, the **Paris Agreement** came to the fore in 2015. In total, 196 parties adopted the legally binding international treaty on climate change. The **new era** of governmental initiatives started in 2019 with the EU Green Deal and the US Inflation Reduction Act, two of the main regulatory policies in this phase.

2.2 Europe is leading in cap-and-trade carbon markets

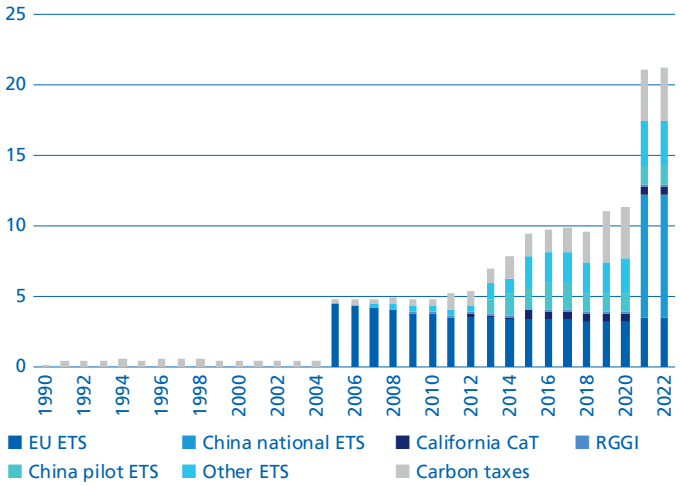
More than 60 compliance and voluntary carbon markets (including taxes) cover about 28% of global GHG. Compliance carbon markets (CCMs), where carbon allowances are traded and regulated by mandatory (sub-)national schemes, cover about 75% of these emissions, while

Exhibit 2:
International Carbon Market Phases



Source: Zürcher Kantonalbank (2022).
Remarks: The EUA (European Union Allowance) price evolution is shown to give an indication on how policies can affect carbon prices.

Exhibit 3:
Global covered emissions by CCMs



2022	Covered Emissions	Share of Total
Global CCM (incl. taxes)	21.3%	75.0%
EU ETS	3.4%	12.0%
China	8.8%	31.0%
Cal. CaT	0.6%	2.1%
RGGI	0.1%	0.5%
China pilot ETS	1.3%	4.7%
Other ETS/CaT	3.3%	11.5%
Carbon taxes	3.7%	13.2%
Global voluntary markets	7.1%	25.0%
Total Carbon Markets	**28.3%**	**100.0%**

Source: World Bank (2022).

voluntary carbon markets account for the remainder.[1] China's national ETS accounts for 31% of global covered emissions, while the EU ETS accounts for approximately 12%. In 2021, the market value of CCMs was estimated at over $270 billion, with the EU ETS accounting for 57% of the value and China only accounting for 16% due to low prices.

It is estimated that global carbon markets reached USD 85bn in trading value in 2021 (up 164% from 2020), 95% of which was traded on the Intercontinental Exchange (ICE). Volumes also increased by approximately 24% year-on-year. **The EU ETS is the major carbon market with an annual trading turnover of 10 times its emissions and is characterised by high liquidity and accounts for ca. 90% of trading value in 2021.**

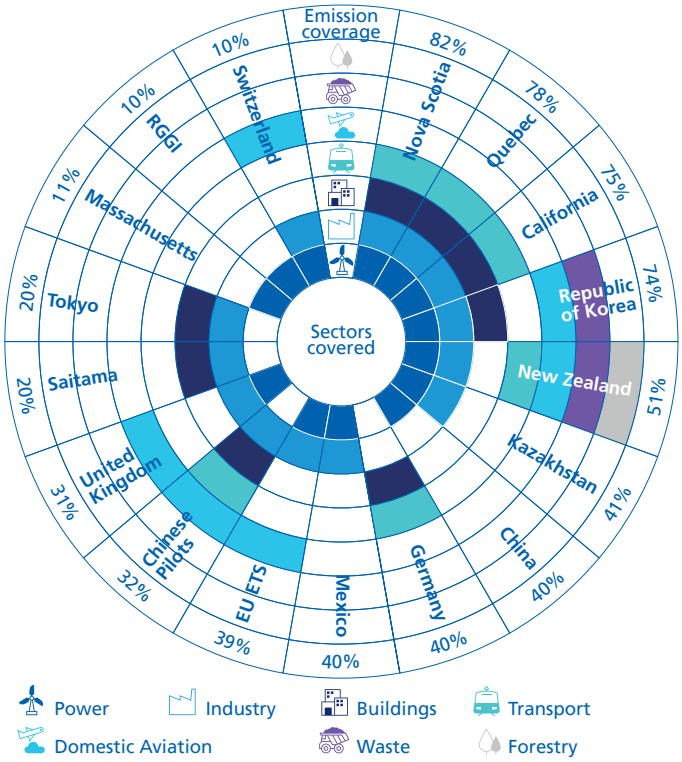
Although carbon markets are still small compared to the multi-billion-dollar oil and gas market, industry experts forecast that global carbon markets will grow drastically by 2050 and potentially surpass oil-markets by 2030.

The geographically most important carbon markets include Europe, North America and China. The EU ETS covered ca. 39% of the total emissions of the European Economic Area in 2020-21, encompassing activities from power generation and manufacturing to aviation. In North America, the systems worth noting are the California "Cap-and-Trade" programme and the Regional Greenhouse Gas Initiative (RGGI), which is a "Cap-and-Invest" programme. Proceeds are used to create local and regional benefits (e.g., jobs, renewable energy). China's national carbon market, which started in 2021, is the largest ETS in terms of covered emissions. The Chinese ETS pursues the objective of effectively reducing its carbon emissions and achieving peak emissions by 2030 and carbon neutrality by 2060.

Exhibit 4 shows a summary of the scope and sectoral coverage of ETSs in 2021, provided by the International Carbon Action Partnership (ICAP), an association of major carbon trading systems.

[1] Voluntary carbon markets have grown substantially but remain pale compared to compliance markets (USD 1bn vs. USD 270bn market value). Nonetheless, these markets are expected to be valued between USD 40-80bn by 2030.

Exhibit 4:
Scope and sectoral coverage of major ETS



Source: ICAP (2021).

Exhibit 4 shows that there is no standardised global effort. However, sectors such as energy and industry are covered in the majority, while other highly polluting sectors (e.g., buildings, transport) are not. It is also evident that the US does not have a national emissions trading system, as it follows a more investment-based approach. Although China and the EU are the largest CO_2 markets, the EU ETS is the most important market due to its maturity. However, Exhibit 4 also shows that there is still great potential for a sectoral expansion of carbon pricing.

2.3 Drivers of carbon market pricing

Despite large differences in carbon markets, pricing drivers generally fall into three categories: fundamental, financial and regulatory. Each category includes a subset of indicators, which are described in the following table:

Table 1:
Drivers of carbon market pricing

Category	Indicators (examples)
Fundamental	The fundamental indicators are mainly determined by supply and demand for the certificates in circulation. For example, the more allowances on the market, the lower the price. Other indicators are temperature- and economy-related carbon emissions. Colder winters can increase heating demand, while an economic downturn can reduce overall emissions. Fuel switching can also affect a country's emissions if coal becomes cheaper compared to gas (cf. the European energy crisis in 2022), resulting in higher emissions.
Financial	Financial indicators relate to the volatility and liquidity of allowances, financialization of carbon markets, and speculation. High volatility combined with low liquidity can lead to price shocks that speculators can exploit. In addition, products that give retail and institutional investors exposure to carbon markets (e.g., through exchange-traded funds) can also have an impact on prices.
Regulatory	Regulatory indicators can increase or decrease the perceived stability of a carbon market. In this regard, carbon-friendly regulations, reforms, or more ambitious targets (e.g., EU Green Deal, RePowerEU, CBAM) can support carbon prices.

Source: Zürcher Kantonalbank (2023), BloombergNEF (2022).

2.4 Carbon prices are more likely to rise than fall

Putting a price tag on carbon is one of the most effective and technology-independent ways to decarbonise an economy. While governmental subsidies and private investments are needed, they are often insufficient due to a lack of coherence, transparency, and standardisation. In the meantime, gradually increasing carbon prices can be expected to accelerate emission reductions in sectors where avoidance costs are low, stimulate new technological innovations, and provide incentives to invest in carbon removal. Since 2016, carbon markets have experienced dramatic price increases, averaging 23% per year depending on the year of introduction, with the highest annual growth in the EU ETS (+41%).

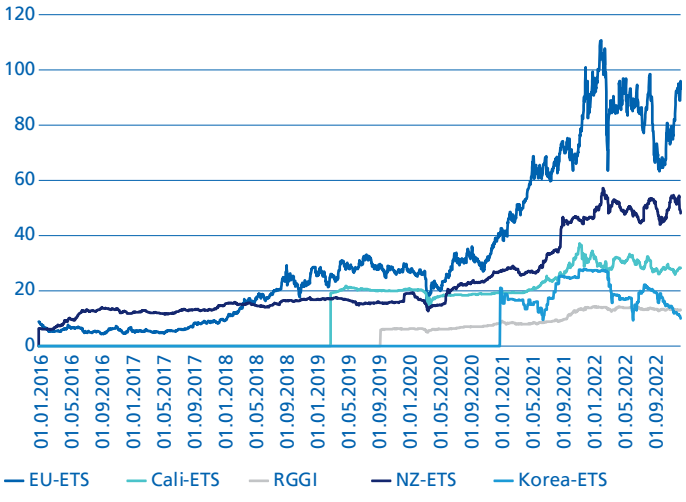
According to the International Energy Agency (IEA), carbon prices need to be introduced in all regions to achieve net-zero emissions by 2050, reaching approximately USD 130 (2030) and USD 250 (2050) per tonne of CO_2. Major developing countries (China, Brazil, Russia and South Africa) will have equivalent prices at USD 90 and 200, respectively. The IEA's carbon price projections consider government measures such as coal phase-out plans, efficiency standards, and renewable energy targets. Without the support of such climate policies, the carbon prices needed to support action based on the marginal cost of mitigation would be significantly higher. Climeworks, a Swiss-based carbon capture company, forecasts that by the mid-2030s the price should be in the range of USD 100-200 per tonne of CO_2. This is in line with what is required in both the <2°C and <1.5°C scenarios of the Intergovernmental Panel on Climate Change (IPCC).

2.5 Evaluating carbon risk through sector affiliation and geography

The key question is: Who will pay these higher carbon prices? The trend of ever increasing societal and regulatory pressure on companies is a first indication. A possible, though quite simplified, way of approximating a company's carbon risk is through its sector affiliation. Clearly the sectors with the highest carbon intensity are generally the most exposed.

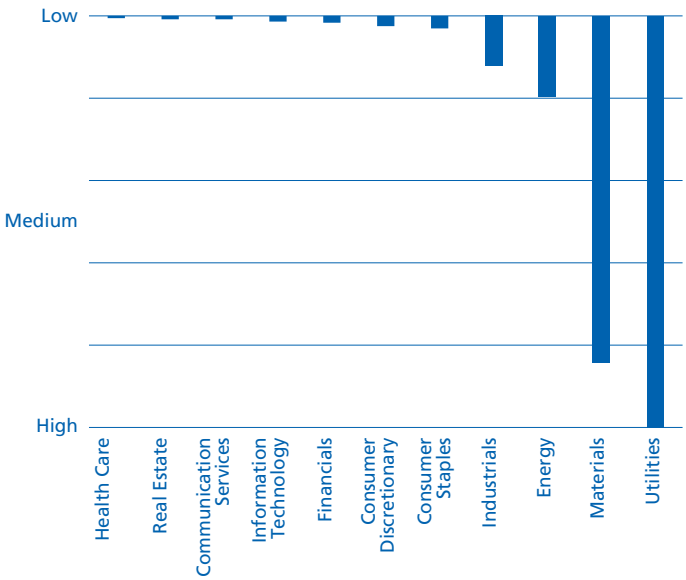
Evidently, the utility, material, energy, and industrial sectors are most exposed to carbon risk due to their carbon-intensive business. Generally, the least exposed sectors are health care, real estate, communication services, information technology and financials, as their business is highly service based (Exhibit 6).

Exhibit 5:
Global Prices in Carbon Markets



Source: Bloomberg (2022).

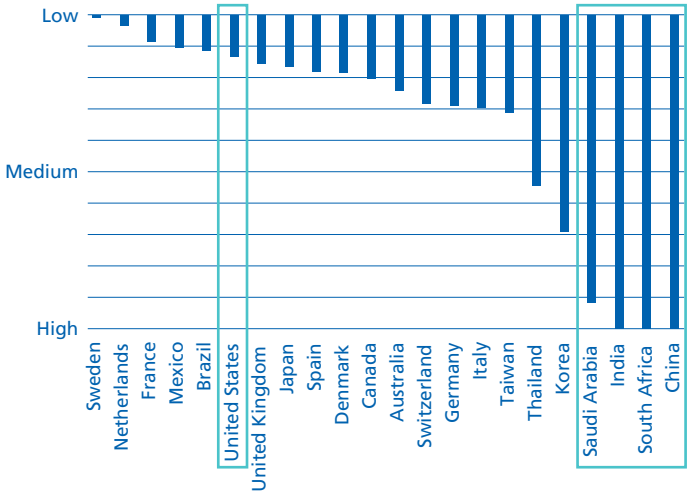
Exhibit 6:
Impact of sector affiliation on carbon risk



Source: Zürcher Kantonalbank (2022).
Remarks: Each sector is represented by the share price impact. Carbon hedging is not considered. Only emissions from scope 1 and 2 are considered.

Considering geography, companies in China, South Africa, India, and Saudi Arabia have on average the highest carbon risk due to their large power, oil, metal, steel, cement, and chemical industries. This contrasts with the US, where the average company is far less affected by carbon risk as the country has a diversified economy with a large service sector that compensates some of the downside risk from other carbon-intensive industries (Exhibit 7).

Exhibit 7:
Most exposed geographies



Source: Zürcher Kantonalbank (2022).
Remarks: Each sector is represented by the average impact. Carbon hedging is not considered. Only emissions from scope 1 and 2 are considered.

2.6 Analysing carbon risk at the company level is key

Although carbon risk can be approximated by a company's sector affiliation, the top-down approach should always be supplemented by a bottom-up analysis. Factors other than sector affiliation and geography can meaningfully influence carbon risk for a company's valuation. The five most important factors are described below:

1. **Overall carbon intensity:** The higher the carbon intensity of a company, measured as the ratio of CO_2 emissions to revenue, the more it is affected by higher carbon costs. A company can directly reduce its intensity by defining a clear reduction strategy and investing in low-carbon assets.

2. **Lock-in-risk:** Companies with older equipment (shorter remaining plant life) are potentially better positioned to replace equipment with low-carbon assets. However, a longer remaining plant life of assets is not necessarily negative if the recently installed assets are less carbon-intensive.

3. **Operating and financial flexibility:** Companies with high operating margins (EBIT) and financial flexibility can absorb rising carbon costs.

4. **Pass-through:** The ability to pass through higher carbon costs and investment costs to reduce carbon intensity is highly dependent on industry dynamics and management execution. For example, utilities that operate fossil-fuelled power generation can usually pass through 100% of the carbon costs via the marginal power pricing system.

5. **Hedging:** Hedging can influence the impact of higher carbon prices on company value. For example, some companies are already hedging their future carbon risk by pre-buying carbon certificates for their future emissions at today's prices and thus hedging against rising prices.

The first three factors can easily be quantified, while the latter two factors require fundamental analysis at the company level. Pass-through and hedging shift carbon risks into the future, but do not directly reduce a company's carbon emissions. Accordingly, carbon hedging only buys companies time to achieve reduction targets in the short term and implement carbon reduction measures in the long term. In the end, it is crucial to conduct a fundamental analysis to fully understand the risks and opportunities of higher carbon prices for a particular company.

2.7 Who will benefit from higher carbon prices?

Higher carbon prices will help accelerate decarbonisation efforts, from abatement to mitigation. These abatement and mitigation efforts will positively drive investments in the following key decarbonising areas:

- **Renewables:** Massively higher demand for wind and solar energy, which represent a scalable and cost-effective form of low-carbon electricity generation. Growth in renewables will be accompanied by investments in the transmission infrastructure, cables and power equipment, as well as energy storage (mainly lithium-ion batteries and pumped hydro).

- **Hydrogen:** Hydrogen is used in various industries (e.g., steel, cement, chemicals). It serves as an energy source, industrial feedstock (e.g., fertilisers), and electricity storage solution. Today, most of the hydrogen produced is derived from fossil fuels and thus not clean. However, clean hydrogen via electrolysis is becoming increasingly competitive due to higher fuel costs (e.g., natural gas) and governmental subsidies (e.g., hydrogen tax credit in the US).

- **Carbon capture and storage (CCS):** CCS is mainly required in areas where decarbonisation is difficult, such as the steel and cement industries. It is expected that around 2,000 plants will be needed by 2040 to reduce carbon emissions of difficult-to-abate industries, compared to around 50 plants today. Higher carbon prices increase the economic attractiveness of CCS.

- **Energy efficiency:** Higher energy efficiency helps to reduce energy consumption and carbon emissions. Higher carbon prices make investments in the energy efficiency of buildings (e.g., heating & cooling, data centres), transportation (e.g., electric vehicles, low-carbon fuels) and industrial manufacturing (e.g., digitalisation and automation) more attractive.

2.8 Key risks

Following commitments under the Paris Agreement to limit global warming to well below 2°C, governments are increasingly imposing a price on carbon, shifting the cost of emissions from society to the source of the emissions. However, there are also certain risks to carbon pricing:

- **Energy cost shocks:** In a "normal" market environment, carbon prices make gas more attractive than coal in certain geographies like the EU. However, the Russian invasion of Ukraine has shown that supply shocks can massively increase the cost of gas and thus make it much more expensive than coal. This supply shock has clearly had a negative impact on energy affordability in Europe and led to a partial weakening of the prior political consensus on climate policy.

- **Carbon-induced inflation:** Transitioning from a fossil-fuel based economy to a net-zero economy can cause imbalances between supply and demand of fossil fuels, ultimately leading to inflation. Those imbalances can be exaggerated by higher carbon prices and taxes, which might reduce short-term political support.

- **Risk of politicization:** Carbon pricing is often politicised. For example, free emission allowances within the EU ETS are still very common to preserve competitiveness (although a phase-out of free emission allowances should start in 2027). Carbon markets can sometimes be used by politicians to achieve short-term goals (e.g., release of additional allowances worth 20bn EUR to alleviate affordability issues within the EU).

3 Conclusion

Further reforms of the EU ETS and the introduction of CBAM are expected to lead to significant carbon risks for certain industries and companies, especially in Europe, in the coming years. Consequently, it is important for investors to understand carbon risks and their impact on company valuations. A sectoral carbon risk assessment must therefore always be complemented by a fundamental analysis to fully capture a company's carbon risks.

Asset Management of Zürcher Kantonalbank is continuously assessing the carbon risks of companies as part of a fundamental analysis and incorporating these into investment decisions. Current developments are closely monitored to be able to comprehensively assess the impact on companies at an early stage. Carbon risks may have a direct negative impact on valuation, while increasingly stringent carbon pricing may create opportunities for companies with clean technologies, such as renewable energy or batteries.