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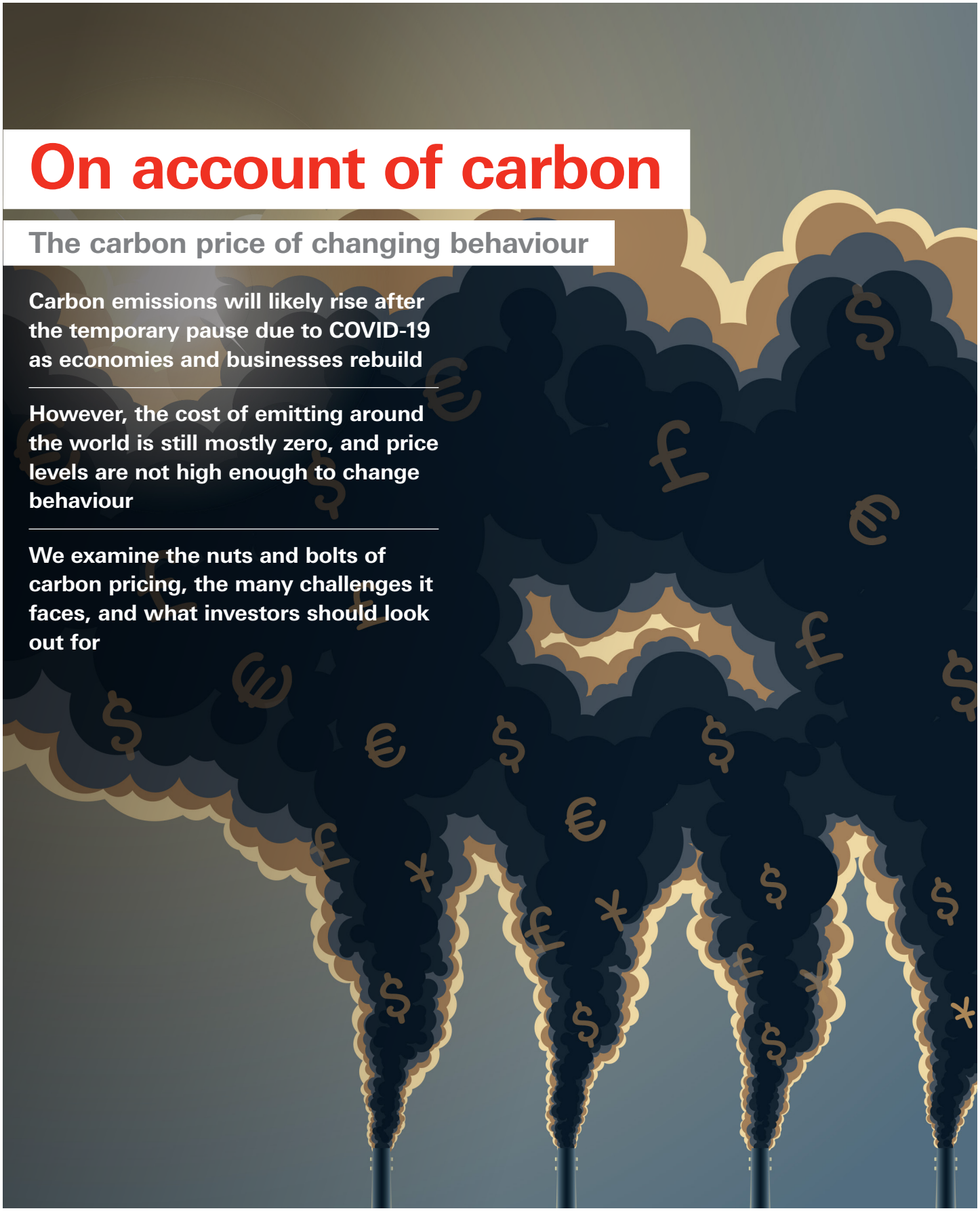
On account of carbon

The carbon price of changing behaviour

Carbon emissions will likely rise after the temporary pause due to COVID-19 as economies and businesses rebuild

However, the cost of emitting around the world is still mostly zero, and price levels are not high enough to change behaviour

We examine the nuts and bolts of carbon pricing, the many challenges it faces, and what investors should look out for



Disclosures & Disclaimer: This report must be read with the disclosures and the analyst certifications in the Disclosure appendix, and with the Disclaimer, which forms part of it.

Executive summary

COVID-19 will (hopefully) pass; climate change will last

We appreciate that COVID-19 is the top issue for governments to deal with during these times. However, after any temporary pause in emissions from the global economic slowdown, we are likely to emit more greenhouse gases than before. Many have argued that pricing carbon emissions is necessary to change behaviour.

The success of carbon pricing has been mixed

Various governments have tried to put a price emissions with varying success. Carbon tax schemes have not meaningfully reduced emissions to date and the price of trading schemes has been volatile and subject to the health of the economy. When carbon taxes or trading schemes do not go to plan, it is usually because emissions are not accurately monitored and verified, or that the pricing is not at a level which incentivises behavioural change.

Climate change continues with devastating impacts

Where we are with the climate: Atmospheric concentrations of global greenhouse gases (GHGs) continue to rise and the consequences of a warming world are already being felt through extreme weather events such as floods, storms, droughts, and bushfires. The latest climate science tells us that emissions need to be reduced significantly and eventually hit ***net zero*** and even ***net negative*** if we are to stave off the most severe consequences of climate change. This requires a rapid shift of direction to that of a much lower carbon trajectory.

What do climate reductions actually mean?

Analysing corporate climate pledges: These come in all shapes and sizes but are not all equal. For example, a **carbon reduction** refers to a reduction in the emissions from an activity but this may be on an *absolute* or a *relative* basis. **Carbon neutral** implies that emissions have been somehow cancelled out or offset. **Carbon zero** means the activity produces negligible emissions. **Carbon negative** employs a technology (usually man-made) that physically removes GHGs from the atmosphere.

Putting a price on carbon to capture external costs

Understanding carbon pricing: Carbon pricing is a mechanism that tries to capture the external costs of GHG emissions such as healthcare, asset or crop damage however these external costs are not easy to quantify. Pricing comes in various forms, depending on market conditions, the developmental state of the economy, the climate commitments of the jurisdiction and the level of support from the businesses and public involved. There are many considerations that determine potential success such as the volume, form and source of emissions, the scope of coverage, price levels and what the revenues are used for.

To tax, trade …

Types of carbon pricing: A **carbon tax** is often considered the simplest way to price carbon and is supposed to be relatively easy to implement. An **emission trading system** usually sets a cap on the volume of future emissions which are then distributed (for free or at a cost), essentially as a "permission to emit". Participants can emit up to a certain volume, however more than the allowed volume requires purchasing extra "permits" or by paying a fine; any leftover permits may be sold to others or saved for use in a future compliance period.

… or even offset

Carbon offset schemes are different because they try to put a price on the ability to reduce emissions (which have basically already occurred). A **carbon credit** is essentially a certificate "awarded" by an authority for an activity which is assumed to have prevented a physical greenhouse gas from reaching the atmosphere. Carbon offsets can be used for both *unofficial* and *official* purposes. There are many issues to consider with credits such as true cancellation, the concept of ***additionality*** (would something happen anyway?), ***climate integrity*** and "are all reductions equal?" Accurate accounting and avoiding double counting is very important.

Not all emissions reductions are created equal

Reducing emissions means emitting less but there are *absolute* and *relative* reductions. An ***absolute*** reduction involves emitting less than before but it is still contributing to an increase in GHGs. A ***relative*** reduction involves emitting less than a benchmark or baseline growth. **Withholding (or zero)** emissions means not putting any GHGs into the atmosphere - zero emissions is possible but generally difficult to achieve over the entire life cycle of an activity. **Removing** emissions means actively reducing the atmospheric concentration of GHGs by either natural or man-made means. However, the key here is to ensure that the removed emissions never reach the atmosphere – even in the future.

Globally, the UN is trying to set up a new system

What about the Paris Agreement? The *Clean Development Mechanism* used to be the mainstay of carbon credits and offsetting although this encountered many issues which seriously dented the credibility of offsetting schemes. The 2015 Paris Agreement tries to revamp carbon pricing through covering climate pledges (Article 6.2) and the establishment a new global carbon market (the *Sustainable Development Mechanism*).

How revenues are spent changes perceptions

How to use revenues? How any derived revenues are utilised also has a bearing on how well the scheme is perceived by the public and participants. We think it helps to avoid perceptions of carbon pricing being "just another tax" or budget increasing measure. In our view, revenues designated for sustainability aims are perceived to be more of a 'necessity to contribute to solving climate change' or other sustainability goals.

Many businesses now use an internal carbon price …

Internal carbon pricing: Companies engaging in carbon intensive industries have been preparing for the eventuality that they would have to become more carbon efficient as well as have to pay to emit. In the future, most or all carbon could be priced and so many companies already employ internal carbon pricing. It is useful to businesses in: *risk management* (potential future liabilities), *decision making* (potential profitability of an investment), and *carbon efficiency* (areas to reduce emissions).

… and more will do so as they embrace TCFD

Not forgetting TCFD: Over a thousand global companies are embracing the recommended climate disclosures set out by the Task Force on Climate-related Financial Disclosures (TCFD). In its supplemental guidance on how to implement the recommendations, the TCFD asks all sectors to "provide their internal carbon prices". In addition to scenario analysis, it means that many more companies will be using internal carbon pricing as a tool going forward.

Demands for offsets should rise because of CORSIA

Aviation and CORSIA: International aviation has agreed to hold net carbon emissions at 2020 levels (i.e. carbon neutral growth from 2020). It will achieve this via the *Carbon Offsetting and Reduction Scheme for International Aviation* (CORSIA), which will mainly use carbon offsets. This will drive up demand for carbon credits even though there are concerns around quality.

Only 15% of global emissions are priced

Carbon pricing around the world: According to the World Bank's latest 'State and Trends of Carbon Pricing' (June) 2019, "almost 46 national and 28 subnational jurisdictions" have or plan to implement some carbon pricing initiative. However, all these schemes collectively only cover around 15% of global GHG emissions. In general, carbon tax schemes are the most common, followed by various forms of trading, and then others such as floor prices etc. We highlight some of the key aspects of major schemes by region.

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The knowns and unknowns

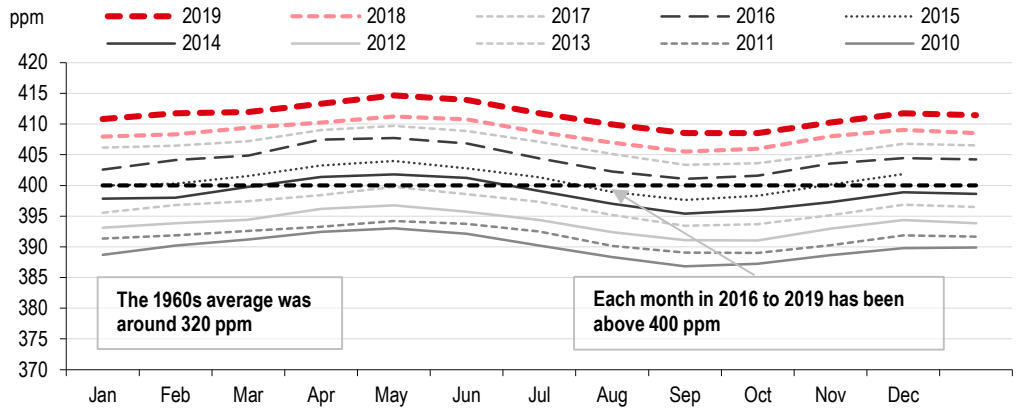
- Global emissions are still rising, after COVID-19, the global economy is likely to emit more greenhouse gases than before
- Carbon pricing has been implemented across many countries with mixed success, but more leading economists are calling for it
- We discuss the various ways to price carbon and the challenges these bring, particularly with carbon credit and offsetting

Where are we with the climate?

GHG emissions => more warming => impacts

As atmospheric concentrations of global greenhouse gases (GHGs) continue to rise (Chart 1), the consequences of a warming world are already being felt through extreme weather events such as floods, storms, droughts, and bushfires. We have covered these events extensively in our research, one recent example is focuses on Australia – *Agriculture, drought, bushfires, and climate change* (14 January 2020).

Chart 1: Atmospheric concentrations of carbon dioxide (CO_2)

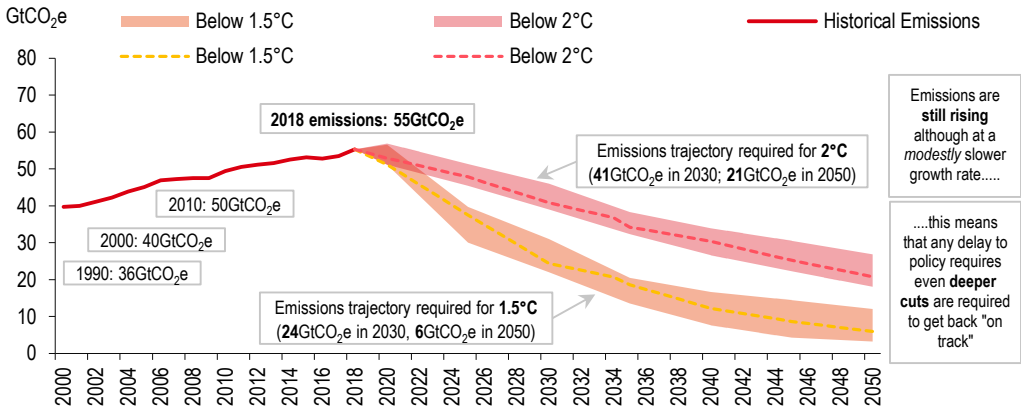


Source: Earth System Research Laboratory (NOAA)

Significant emissions cuts are required to reverse the trend

The latest climate science (from the IPCC, the UN's climate science body) tells us that emissions need to be reduced significantly and eventually hit net zero and even net negative if we are to stave off the most severe consequences of climate change. This requires a rapid shift of direction to that of a much lower carbon trajectory (Chart 2). Most of the world recognises this need to change trajectory although act with varied urgency.

Chart 2: The global emissions trajectory must change significantly downwards



Source: Emission Gap report 2019

Responses have been mixed – pledges should be turned into actual policies

Governments are trying to respond collectively through the annual climate negotiating process under the UN Framework Convention on Climate Change (UNFCCC). The latest round of negotiations took place in December 2019 and did not make significant progress (see *COP25: Intransigence*, 16 December 2019).

Businesses are also responding with a variety of climate pledges. Although this is a start, we argue that these pledges need to be translated into actual corporate policy in a way that changes the course of a company over time – towards the low carbon future. However, before scrutinising a company's implementation, we think it is important to understand what the pledge is aiming to do and how it contributes to reducing climate change. Box 1 looks behind the corporate marketing to distil what a pledge may actually achieve if implemented fully.

Box 1: What's with all the carbon?

Carbon reduction – refers to a reduction in the emissions from an activity, facility, or business, usually in an absolute sense but sometimes loosely used on a relative basis.

- *Question to ask:* are more or less emissions reaching the atmosphere?

Not all carbon reductions are created equally

Carbon neutral – implies that the emissions produced by the activity, facility or business were somehow cancelled out or offset usually by the purchase of carbon credits.

- *Question to ask:* are the emissions of the activity going up or down and do the carbon offsets represent a true carbon reduction over time?

Carbon zero – the general operation of the activity, facility or business produces negligible emissions.

- *Question to ask:* what is the emissions profile over the full life cycle from raw materials to end of life disposal?

Carbon negative – the activity, facility or business employs a technology (usually man-made) that removes GHGs from the atmosphere to such an extent that it removes significantly more than the actual GHGs emitted.

- *Question to ask:* what happens to the GHGs after removal?

The allure of carbon pricing

If it cost money to emit then maybe emissions behaviour would change

There is no doubt that societal and economic advancement over the past few centuries was driven by the ability to release vast amounts of energy – most commonly through the combustion of fossil fuels. However, only in the past few decades have we realised that the resultant build-up of GHGs in the atmosphere is causing rapid, significant and dangerous change to our climate. This has led many academics and economists to advocate for the pricing of these GHG emissions – to drive behaviour towards other activities which achieve similar levels of output or results with less (or without) the GHG emissions.

But implementing this successfully is difficult

A number of governments around the world (national and sub-national) have tried to price emissions with varying success. The overall successes have been very mixed. Carbon tax schemes have not meaningfully reduced emissions to date and the price of trading schemes has been volatile and subject to the health of the economy. When carbon taxes or trading schemes do not go to plan, it is usually because emissions are not accurately monitored and verified, or that the pricing is not at a level which incentivises behavioural change. In theory, these can be fixed with better reporting and adjustments to the pricing levels.

Carbon credits may soon fall back into favour

In our view, carbon credits and the offsetting that it allows is less well understood than taxes and trading, primarily because it is somewhat less structured. In the past, there were many questions raised over the climate integrity of carbon offsetting (especially under the Kyoto Protocol) which led to offset schemes falling out of favour in recent years. However, carbon credits are likely to become more popular over the next few years as net zero becomes more prominent – with the vocal pursuit to limit warming to 1.5°C – and the plan by the global aviation sector to offset its emissions above 2020 levels.

Box 2: Economists' Statement on Carbon Dividends

The below statement appeared in the Wall Street Journal *on 17 January 2019 and was signed by over 3,500 US economists, 4 former Chairs of the Federal Reserve, 27 Nobel Laureates (Economics) and 15 former Chairs of the Council of Economic Advisors*

I. A carbon tax offers the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary. By correcting a well-known market failure, a carbon tax will send a powerful price signal that harnesses the invisible hand of the marketplace to steer economic actors towards a low-carbon future.

II. To avoid debates over the size of government. A consistently rising carbon price will encourage technological innovation and large-scale infrastructure development. It will also accelerate the diffusion of carbon-efficient goods and services.

III. A sufficiently robust and gradually rising carbon tax will replace the need for various carbon regulations that are less efficient. Substituting a price signal for cumbersome regulations will promote economic growth and provide the regulatory certainty companies need for long- term investment in clean-energy alternatives.

IV. To prevent carbon leakage and to protect US competitiveness, a border carbon adjustment system should be established. This system would enhance the competitiveness of American firms that are more energy-efficient than their global competitors. It would also create an incentive for other nations to adopt similar carbon pricing.

V. To maximize the fairness and political viability of a rising carbon tax, all the revenue should be returned directly to US citizens through equal lump-sum rebates. The majority of American families, including the most vulnerable, will benefit financially by receiving more in "carbon dividends" than they pay in increased energy prices.

Carbon pricing is useful to various stakeholders

Carbon pricing seeks to price the externalities of climate change to the benefit of all, but in reality, they affect stakeholders differently.

A signalling mechanism

For governments: Formal carbon pricing is a market mechanism to change behaviour and as such can be used to complement a national (or sub-national) climate target. It can also be an additional source of revenue.

A risk identifier

For businesses: Effective carbon pricing acts as a signalling mechanism – that over the long term, GHG emissions cannot continue at current or historical rates. The scheme and price can reflect the level of determination to lower emissions. Businesses can also use internal carbon prices to evaluate the impact of potential or future carbon prices on their operations. It can also assist in identifying climate risks and opportunities.

> **A well-designed, strong, equitable carbon pricing mechanism offers just the sort of signal to which businesses will respond with new investments in clean technologies**
>
> **LEAD on Carbon Pricing, businesses call for a price on carbon, 2020**

A stress tester

For investors: Carbon pricing mechanisms can be used to assess the adequacy of businesses' climate strategy over the long term. Moreover, the actual price can be used to stress test the impact on the profitability of projects or operations over the near to medium term.

An influencer

For the general public: assuming some of the costs are passed on, carbon pricing acts as a signalling mechanism to influence consumer choices – nudging them towards lower carbon or more sustainable options.

To tax, trade or offset?

- Methods of pricing carbon vary considerably but fall into three main categories – each with its benefits and challenges
- Carbon credits and offsets raise many questions over concepts such as additionality, climate integrity, accounting and transparency
- The Paris Agreement provides for two types of carbon pricing mechanism but the finer details are dividing negotiators

There are external costs associated with emissions …

… but it is difficult to match emissions with effects

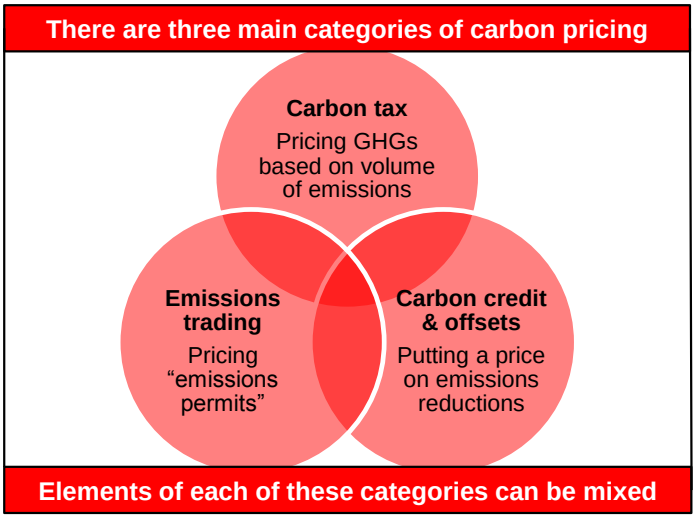
Understanding carbon pricing

Carbon pricing is a mechanism that tries to capture the **external costs** of greenhouse gas (GHG) emissions. These external costs are not easy to quantify and broadly cover costs that the general public may incur, now or later, either directly or indirectly, from (*for example*):

- **Healthcare** – arising from acute and chronic illnesses exacerbated by climate change such as heat waves or drought, or increasing incidences of vector-borne diseases. These indirectly affect worker productivity and increase overall healthcare costs
- **Asset damage or loss** from climate-related weather events (storms, floods) and slow onset events (ocean acidification)
- **Crop damage** from extreme weather, resulting in potential loss of health (nutrition), life or livelihoods and disruption across supply chains

Carbon pricing aims to tie these external costs to sources of emissions with the aim of changing behaviour i.e. reduce emissions. This is difficult to do because the external costs are not matched to the emissions. In other words, it is almost impossible to attribute an incident to a specific GHG emission because they occur at different times in different locations.

Figure 1: Carbon pricing usually comes in three broad forms



Source: HSBC

Each tonne of carbon dioxide is priced – simple …

… capturing this accurately and effectively – difficult

There are many parameters to consider

Putting a price on carbon is simple in theory, but more difficult in practice

Carbon pricing come in various forms (Figure 1), depending on market conditions, the developmental state of the economy, the climate commitments of the jurisdiction and the level of support from the businesses and public involved. In theory, every tonne of carbon dioxide equivalent that is emitted, can be priced somehow, however in reality, there are many complications such as:

- **Volume** - accurately determining how many greenhouse gases have been emitted;
- **Form** – ensuring all different types of GHGs are included and converted into carbon dioxide equivalence (CO_2e) – see Table 1;
- **Source** – calculating the volume from a point source (i.e. a pipe) is relatively easy however calculating from a non-point source (i.e. a farm) is much more difficult;
- **Scope** – which entities to include e.g. businesses vs individuals, large vs small businesses and at what threshold;
- **Price** – the effective cost of the emissions will determine whether behaviour will change but balancing this with politics and economics is not easy
- **Revenue** – the revenue earned from carbon pricing could be directed towards reducing the financial burden of transitioning towards a low-carbon economy as well as preparing for the impacts, however this is not always the case

Table 1: Greenhouse gases – main types and CO_2 equivalence

	Lifetime	GWP_{20}	GWP_{100}	Main Sources	Major sectors affected by reduction
CO_2	No single lifetime can be given for CO_2	1	1	Fossil fuel combustion; Deforestation; Cement production, ferrous metals	Energy (oil, gas), Metals & Mining (coal), Utilities (fossil-fuel fired power generation
CH_4	12.4	84	28	Natural gas production / leakage; coal mining; Agriculture; Landfills	Energy, Utilities (Environmental services), Consumer Staples (food products)
N_2O	121	264	265	Fertilizer application; Fossil fuel and biomass combustion; Industrial processes	Consumer (agricultural products
HFCs	1-270 years (depending on type; mostly short)	506	1-12,400	Refrigerants; air conditioning systems, aerosols	Chemicals (industrial gases), Capital Goods
NF_3	740	-	16,100	Semiconductor manufacturing; panel manufacturing (solar and LCDs), chemical lasers	Electronic industry, photovoltaic industry
SF_6	3,200	-	23,500	Electricity transmission; magnesium production, semiconductor manufacturing	Utilities (transmission & distribution), magnesium production
(PFCs)	50,000	4,880	6,630	Industrial factory runoff, wastewater treatment plant discharges; Aluminium production, semiconductor manufacturing	Metals & Mining (aluminium production), semiconductor manufacturing

Note: F-gases (HCFs, PFCs, SF6, NF3) are man-made gases used in various industrial applications; they are powerful greenhouse gases with global warming effects >23,000 times those of CO_2. For GHG inventory calculations, non-CO_2 gases are often converted into CO_2 equivalent or CO_2e
Source: IPCC Fifth Assessment Report, GHG Protocol

We last looked comprehensively at the issue of carbon pricing in *Keeping it Cool - Global carbon pricing*, 9 September 2015 where we focused mainly on taxing and trading carbon, please see that report for more background. Here we briefly recap carbon taxes and emissions trading.

Carbon Taxes

A carbon tax is often considered the simplest way to price carbon and is supposed to be relatively easy to implement.

Taxes may induce some behavioural change …

- *Advantages:* In theory, any known source of emissions can be taxed. The tax rate can be according to volume, thresholds, sources, type and other variables such as carbon intensity.

… but economic competitiveness is a concern

- *Disadvantages:* In practice, almost all economic (and general) activities generate some emissions. Selecting which activities to tax and which not to tax is politically challenging given the importance of certain economic sectors etc. In addition, accurately determining the volume of emissions (and hence how much to tax) can be very difficult. Carbon leakage is also a potential concern.

Emissions reductions from carbon taxes are not controlled

- *Emissions reductions:* The potential reductions in emissions come from behavioural changes i.e. not wanting to be taxed or seeking to be taxed less, rather than imposing a limit on the volume of emissions.

> **A carbon tax offers the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary**
>
> **Economists' Statement on Carbon Dividends, *Wall Street Journal* (17-Jan 2019)**

Examples of carbon tax schemes include:

Sweden – covers 40% of national emissions via transport and buildings

Singapore – coves 80% of national emissions via industry and power generation

British Columbia, Canada – covers 70% of provincial emissions via almost all sectors

See Table 4 on page 28 for more details.

Emissions trading

Trading the permission to emit GHGs

In an emission trading system or scheme (ETS), a specific jurisdiction such as a country or city, province or even an industry sets a cap on the volume of future emissions over a defined time period. The volume of allowed emissions is distributed (for free or at a cost) amongst participants of the scheme (e.g. controlled entities such as companies or facilities), essentially in the form of an allowance (a "permission to emit"). Participants can emit up to a specified volume, usually at no extra cost, however:

Flexibility in how to comply

- Any **emissions over** the allowed volume requires an extra allowance which must be paid for either by purchasing another participant's "permission" or by paying a fine.
- Any **emissions under** the allowed volume i.e. leftover, may be sold to participants that require them, or in some cases, saved for use in a future compliance period.

Emissions trading schemes are more complicated to set up than carbon taxes.

Allows market forces to find market emission efficiencies

- *Advantages:* In theory, market forces shift emissions towards greater efficiency either through cost or process. Participants have the choice between paying to emit more, or lower emissions.
- *Disadvantages:* The number of allowances made available is very difficult to get right. Too many and the trading price is so low as to not have any meaningful impact on emissions; too few and economic activity is affected as it costs businesses a lot to comply.

Getting allowances right is notoriously difficult …

- *Emissions reductions:* Jurisdictional emissions targets can be implemented through the ETS by lowering the overall cap and penalising those that overshoot.

The key aspect of any ETS is determining the amount of allowances each participant is assigned. This can be done in a number of ways including:

- A free distribution of the **overall emissions cap** amongst participants;
- A free distribution based on **estimate of emissions growth** over a baseline;
- An auction of allowances against a certain level of emissions.

… and key to whether the ETS is effective or not

The amount (or growth) of allowances should be limited or reduced over time in order to lower the overall emissions of the jurisdiction. In theory, participants are incentivised to become more ***carbon efficient*** as it becomes more costly to emit more.

> **In emissions trading, the *price* of traded allowances is a function of the *number* of allowances available.**

Examples of emissions trading schemes

EU – covers 45% of bloc emissions via facilities from a variety of sectors.

California – covers 85% of state emissions via power, industry, transport, buildings

South Korea – covers 70% of national emissions; via mainly power, industry, buildings, waste

See Table 4 on page 28 for more details.

Carbon credit and offset mechanisms

Credits – pricing the ability to reduce emissions

Outside of taxes and trading schemes, carbon credits and offsetting is another method to put a price on carbon. However, these schemes are fundamentally different in that they do not put a price on the *actual GHGs emitted*, instead they try to put a price on the ***ability to reduce*** *emissions*. The emissions have already occurred.

Box 3: What a carbon credit actually is

A carbon credit is not a physical object. A credit is essentially just a certificate "awarded" by an authority when an activity is deemed to have prevented a real tonne of carbon dioxide or equivalent other greenhouse gas from reaching the atmosphere. This could be achieved through avoidance, reduction, sequestration or removal.

In essence, a project which generates *emissions credits* (through various means) can sell these credits to those who wish to "use the credits" (make them count as their own) for a variety of purposes.

Allows a broad range of mitigation activities to potentially become economical

- *Advantages:* Offset mechanisms and associated carbon credits encourage other emissions reducing activities which may ordinarily be outside the scope of emissions trading schemes or carbon taxes. It allows for smaller projects to reap some economic benefit for carbon reduction efforts and hence can also encourage innovation.
- *Disadvantages:* The less formal oversight of many offset programmes brings verification and additionality into question. Comparison across different programmes is also difficult.
- *Emissions reductions:* If the demand and price for offsets (emissions credits) is high, then more projects and more innovation will ensue.

Box 4: Carbon offsets can be used in a number of ways

Carbon offsets can be used for *unofficial* purposes as well as for *official* purposes.

Offsets can contribute towards *net zero* ambitions …

- **Unofficial (voluntarily)** – any entity that wishes to could purchase a number of carbon credits equivalent to its actual GHG emissions and then state that it has *offset* its emissions such that its *net emissions are zero*.
- **Official (compliance)** – some trading or tax mechanisms allow the purchase of carbon credits to count towards allowances or as "permits to emit" since the credits offset the emissions (Note: this is usually up to a specific proportion e.g. 5% or 10%).

… but they do not stop actual emissions of GHGs

However, there are many areas where carbon offsetting can seem to go against the idea of truly reducing emissions. Firstly, it can be perceived to be allowing the continued emission of GHGs in the belief that they can be "cancelled out" with offsets. Other issues include

- the concept of additionality,
- climate integrity and the credibility of the credits generated,
- accounting and the possibility of double counting, and
- the false incentives that can occur.

> **"'Additionality' addresses the issue of whether an activity would have occurred anyway. If so, then it is not usually considered *additional*.**

Additionality – would something have happened anyway?

***Additionality* is open to wide interpretation**

The concept: ***additionality*** describes whether a project actually delivers emissions reductions "in addition to" the status quo or a baseline (business as usual) scenario that either already exists or would have been implemented anyway. i.e. it tries to address the question of "more than" – for example, doing *more than* is required, or doing *more than* normal, or doing *more than* was planned.

The problem: there are some who believe that carbon credits should only be given to projects which are truly additional, however additionality is open to wide interpretation, especially since it relies on a truthful depiction of 'baseline', agreement on what 'would have been', as well as

accurate accounting of GHGs. It is difficult to prove that a project would have / would not have happened anyway. Additionality is a common gripe between countries at the negotiating table as some critics question the climate credentials of certain projects.

Climate integrity – are all reductions equal?

Not all emissions reductions truly benefit the climate directly or immediately

The concept: climate integrity seeks to determine whether an activity is truly beneficial to solving climate change. Leaving aside *adaptation* for now, from a *mitigation* perspective, this essentially means modifying the concentration of GHGs in the atmosphere by:

- **Reducing** emissions – which slows the rate of increase in atmospheric concentration;
- **Withholding** emissions (zero emissions) – which holds the concentration steady by not adding any more GHGs into the atmosphere; or
- **Removing** GHGs from the atmosphere – which reduces their concentration.

Investors should scrutinise what is actually meant by "emissions reductions"

The problem: In general parlance, the phrase "emissions reductions" does not quite distinguish between reducing, withholding and removing as above – the catch all term makes these appear equal when in fact they are not.

> **Some emissions reductions are more equal than others: reducing = *lower*, withholding = *none*, removing = *negative***

Reducing emissions means emitting less than you otherwise would have over a given time period – however we must also distinguish between an *absolute* reduction and a *relative* reduction.

Investors should distinguish between an *absolute* and a *relative* reduction in emissions

- An ***absolute*** *reduction* involves emitting less than before i.e. from $10tCO_2$ to $5tCO_2$ for a 50% decrease. This is commendable but is still contributing to an increase in atmospheric concentrations of GHGs.
- A ***relative*** *reduction* involves emitting less than a benchmark or baseline growth.
  - *Benchmark* – if a factory usually emits $1tCO_2$ per unit output but a new process means it only emits $0.75tCO_2$ per unit, then the relative reduction is 25%. However, if the factory doubles output, then there is an absolute rise in emissions.
  - *Baseline growth* – if a factory expected to emit $100tCO_2$ in a single year, but during the course of the year only emitted $75tCO_2$, then it made a relative reduction of 25%. However, if say, the year before, it emitted $60tCO_2$, then there is an absolute rise in emissions.

Some activities result in no emissions actually reaching the atmosphere

Withholding (or zero) emissions means that an activity is not adding to the emissions account at all. Zero emissions is possible but generally difficult to achieve for any given activity over its entire life cycle. For example, the production of energy by fully renewable power such as solar or wind may produce negligible emissions during the operational phase – however the manufacture and transport of the solar panels or wind turbines still produced emissions. In addition, emissions can still be produced during the end of life phase.

Taking GHGs out of the atmosphere is good …

Removing emissions means you are actively reducing the atmospheric concentration of GHGs by either natural or man-made means. Here, the emissions flow between the activity and the atmosphere (i.e. the emissions account) is truly negative. Whilst good for the climate, the key here is to ensure that the GHG removed from the atmosphere never reach the atmosphere again.

… but will they stay out forever?

For instance, planting trees does remove carbon over the time it takes for the tree to grow and mature, but if the carbon stored in that tree is released at a later date (from decay, burning etc.), then the carbon is still released and overall, the effect has been to *delay* emissions rather than *remove* emissions.

> **Emissions accounting involves keeping a track of GHGs that actually reach the atmosphere, as well as those that do not, may not or should not**

Accounting for reductions

Accurate record keeping is important for carbon pricing

Every activity or entity has a hypothetical emissions account – essentially a ledger balance of how many GHGs were emitted over a given time period. For example, if we emit one tonne of CO_2 then the account shows, +1 tCO_2; if we emit three tonnes then +3tCO_2. For all participants of mandatory tax or trading schemes, keeping an accurate emissions account is important. As carbon disclosure becomes more prevalent globally, more entities are keeping a track of their emissions.

Note: tracking GHG emissions does follow certain accounting protocols which include direct and indirect emissions as well as the conversion factors of different types of GHGs. We do not cover this topic in this report.

Different accounts: Individual businesses and facilities will often keep their own emissions account. However, the global emissions accounting system does not work as a sum-of-the-parts system because the way emissions are recorded differs between entities (e.g. businesses, cities, countries). For example, a company may be able to know how much fossil fuel it has burned over a time period, but countries tend to estimate numbers for the whole economy.

Different accounting systems may not always be comparable

Negative values may be assigned – and may not represent a physical emissions reduction

Credit account: carbon credits from, say, a renewable project take the form of a negative emission value such as (*minus three*) -3tCO_2. *(Note: this does not necessarily mean that the project physically removed 3tCO_2 from the atmosphere.)* This *negative value* can be applied to the company that generated the credit and the country that it was generated in. If however the credits are sold then the negative value should be applied against the new entities account and removed from the originator (and country if applicable). (There is the added complication of vintages i.e. years when credits expire.)

> **Avoiding *double counting* is a key objective of accurate and transparent GHG emissions accounting**

Double counting occurs when the transfer of carbon credits, which have already been applied against the originating entity's emissions account, are then applied again to the new entity, without the corresponding adjustment made to the originating entity and country. In other words, the credits or negative values have been used twice.

False incentives and a false sense of security

Credits can assist with the transition

Besides encouraging innovative projects, carbon credits have a role to play – as a transition – because those entities less able to lower their emissions immediately, can "buy time to do so" whilst complying with various emissions reduction schemes. However, they can also give a false sense of security as some entities continue to emit (more and more) and add to the stock of carbon in the atmosphere – whilst believing that their emissions can be offset. This may decrease the incentive to actually reduce absolute emissions.

Credits should come with robust accreditation

Sometimes, credits are given to projects with dubious climate credentials although standards are improving under scrutiny. For instance, purchasers may believe they are receiving offsets for a forest – but are there contracts in place for when and how the forest may be harvested? Or what if the forest succumbs to fire? Finally, there have been cases where very climate / environmentally unfriendly projects which generate problems are created – just so that the problem can subsequently be solved.

Assurance: There is a wide spectrum of standards for carbon credits and offsetting – with varying quality. In our view, purchasers should conduct extensive research beforehand. Also, investors should ensure the quality of credits at investee companies and that the companies do not use offsetting as an excuse not to reduce emissions over the longer term.

Non-climate environmental integrity

Credits should minimise adverse sustainability effects

Sometimes, a project which may be good for the climate (and have low-to-no emissions) may have negative consequences for the environment or other sustainability criteria. Many of these are indirect consequences which bear little relationship to the climate aspect – for example, non-species forestry planting – but can have wider effects on the local environment and biodiversity. Since no project is perfect, thorough research is required to ensure that carbon offset projects do not cause any serious consequences which may negate its overall sustainability benefit. In our view, this should be done over a life-cycle basis.

For more details on some of these related issues, see *Sustainability Engaged: An investor engagement guide to the UN's SDGs* (15 March 2019)

Carbon pricing and the Paris Agreement

Article 6 of the Paris Agreement covers carbon pricing

Globally, the UNFCCC has used carbon pricing with mixed success. Historically, the Kyoto Protocol and the related Clean Development Mechanism were the mainstay of carbon credits and offsetting although this encountered many issues which seriously dented the credibility of offsetting. Following the adoption of the Paris Agreement in 2015, carbon pricing under the UNFCCC has moved into two related but distinct directions:

1. Article 6.2 – covering nationally determined contributions (climate pledges);
2. Article 6.4 – establishing a new global carbon market (for credits and offsets).

Disagreement over Article 6 was one of the main reasons that the latest round of climate talks failed (see *COP25: Intransigence*, 16 December 2019).

Many countries plan to use carbon pricing …

Box 5: Nationally determined contributions (NDC) are essentially the contribution that each country (Party) will make towards global climate efforts. These NDCs involve both mitigation (reducing emissions) and adaptation (preparing for the impacts). Where carbon pricing is involved, we are primarily concerned with the mitigation aspect.

Note: Around 96 Parties have either set up or plan to set up a carbon pricing mechanism as a means to help them achieve their national emissions reduction targets. However, there is a difference between setting up domestic carbon pricing and using international carbon pricing under the Paris Agreement (Article 6).

… some will help towards domestic emissions reductions

Around half of all the climate pledges (NDCs) that have been submitted towards the Paris Agreement discuss carbon pricing. The vast majority mean that they will set up some form of carbon pricing regime domestically i.e. are planning to or will consider the use of carbon pricing as a tool to meet their commitments.

… others will buy carbon credits from other countries

International effort sharing using carbon pricing

In general, some Parties may find it easier to meet mitigation targets than others. Since not all Parties may be able to meet their reduction targets through domestic means alone, Parties are thus allowed to use the emissions reductions (credits) from other countries (i.e. by other Parties) to count towards their own account – especially when it comes to meeting their own NDCs. This is effectively a Party-to-Party bilateral exchange of carbon credits.

ITMOs: This bilateral carbon credit system is covered by Article 6.2 of the Paris Agreement and intends to use what are known as ***internationally transferred mitigation outcomes or ITMOs.*** The principle is simple – mitigated emissions are deducted from one Party (the seller of credits) and added to the other Party (the purchaser of credits). However, in reality, there needs to be a very robust and transparent accounting system in place (acceptable to all) that establishes:

The international transfer of emissions must be robust

- **Climate integrity** – which means emissions are actually being saved;
- **Transparency** – which means the receiving Party actually knows that they are getting;
- **Governance** – which means everything works smoothly and fairly.

Establishing this accounting system has encountered multiple problems at UNFCCC negotiations, leaving Article 6.2 one of the few outstanding parts of the rulebook – the operational guidelines of the Paris Agreement – to be settled. Even after two consecutive years (COP24 and COP25) of complicated negotiations, a host of issues still need to be ironed out. These issues are similar to the common problems of carbon credits as described above. For ITMOs in particular, these are:

Establishing the guidelines to do this have proved challenging

- **Definitions** – what counts as an ITMO;
- **Governance and responsibilities** – which body will oversee the process;
- **Transfers** – what mechanism will be employed to track the transfers;
- **Adjustments** – how will these be made, where and how;
- **Timeframes** – what timeframes would be allowed, e.g. single-year or multi-year;
- **Use** – what ITMOs can be used for, i.e. will there be a restriction on the activities or even the overall mitigation that can be "offset" using ITMO.

Some countries have specifically mentioned using these international credits as a means to achieve NDC targets (Table 2).

Table 2: Countries that may potentially use ITMOs to meet their NDC targets

Party	Relevant part from country NDC statement
Canada	Canada may use **international mechanisms** to achieve its target, subject to robust systems that deliver real and verified emissions reductions.
Japan	Japan aims at reducing 50-100 MtCO2e/year through the **Joint Crediting Mechanism**.
Liechtenstein	Liechtenstein assumes to achieve **emission reductions abroad which may be accounted towards its reduction target** in 2030.
Monaco	Monaco plans to use **international emission reductions**, because domestic emission reductions are 'insufficient' to meet the end goal.
New Zealand	New Zealand's NDC will remain provisional pending confirmation of access to carbon markets. New Zealand calls for unrestricted **access to global carbon markets** that enable trading and use of a wide variety of units that meet reasonable standards and guidelines.
Norway	Norway plans to use **international credits only if** it cannot secure a collective agreement with the EU.
South Korea	Korea will partly use **carbon credits from international market mechanisms** to achieve its 2030 mitigation target.
Switzerland	Switzerland will realize its NDC mainly domestically and will **partly use carbon credits from international mechanisms**.

Source: States and Trends of carbon 2019, Individual country NDCs/INDCs

There could be a unified carbon pricing scheme across the world …

A new global carbon mechanism

The Paris Agreement also intends to establish "a mechanism to contribute to the mitigation of GHG emissions and support sustainable development" covered under Article 6.4. This mechanism is essentially a global carbon market and is often referred to as the "Sustainable Development Mechanism" (in theory, it is supposed to replace the ill-fated "Clean Development Mechanism"). This mechanism has four aims, to:

1. **Promote** GHG mitigation
2. **Incentivise** GHG mitigation by public and private entities
3. **Contribute** to emissions reduction (to the host Party)
4. **Deliver** on overall global emissions mitigation

… although agreeing the rules is complicated …

Again, the same issues arise when trying to formulate a set of rules that work for everyone (those who might need to buy and those who might generate credits). For example, the definitions to be used within the mechanism; the supervision and governance aspects; which activities to include; and how to ensure there is no double counting.

Given the increasing momentum surrounding the net zero emissions targets of 1.5°C, we think incentivising mitigation (2nd aim above) will become more important. There is the recognition that getting the mechanism right and allowing a flourishing global market to develop should

… but the benefits could be wide ranging and far reaching

1. encourage the **innovative development of projects** which may contribute to overall emissions reduction through carbon credit,
2. encourage **more entities to set more ambitious targets** i.e. absolute emissions reductions or net zero,
3. advance the **development of technologies** that would allow for more carbon zero or carbon negative activities in the future.

Other carbon nuts and bolts

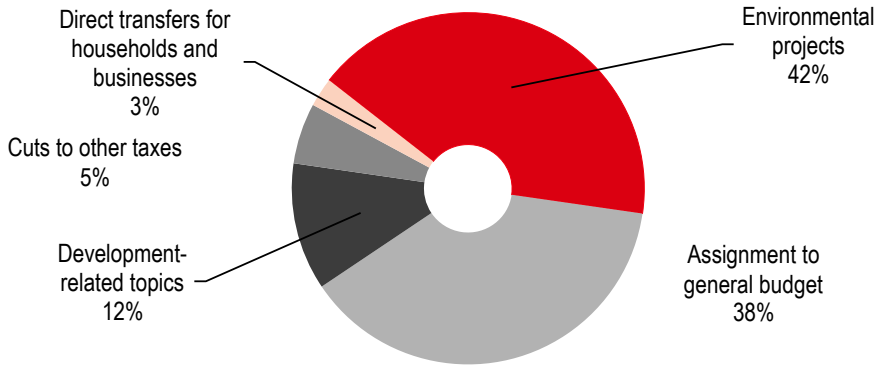
- The perception of carbon pricing can be improved if the revenues are used for sustainability purposes such as mitigation
- The use of internal carbon pricing is gaining momentum and we expect many more companies to prepare as TCFD takes hold
- The use of carbon offsets will grow rapidly from 2021 as international aviation starts to buy approved credits to maintain emissions levels

How to spend it – revenues from carbon pricing

Carbon revenue spending can alter the perception of the pricing mechanism …

Perceptions: Besides the intricate design of any carbon pricing scheme, we think that how any derived revenues are utilised also has a bearing on how well the scheme is perceived by the public and participants. For example, if the revenues collected go towards a general budget then the scheme could be perceived as "just another tax" or budget increasing measure for that particular jurisdiction. However, if the revenues are earmarked or designated for sustainability aims, then the perception is more one of 'necessity to contribute to solving climate change' or other sustainability goals.

Chart 3: Use of revenue generated from carbon pricing in 2017-18



Source: World Bank

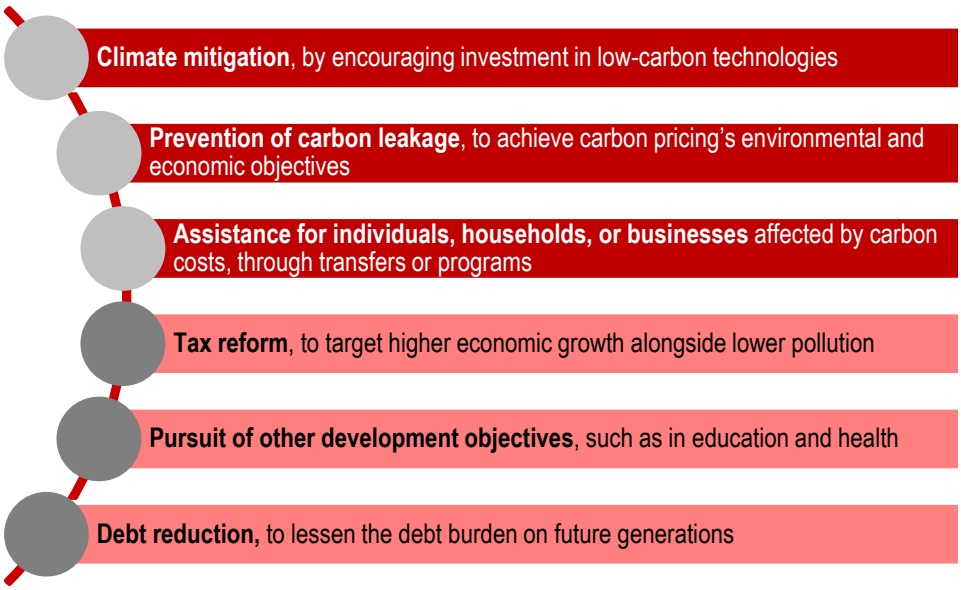
… around two-fifths go to environmental projects

The World Bank has analysed how various jurisdictions currently use revenues derived from carbon pricing. The latest technical note from August 2019 shows two-fifths go towards environmental projects (Chart 3), however just under two-fifths are also assigned to the general budget. Although the World Bank analysis recognises carbon pricing "as an important source of government revenue", in our opinion, this does not directly address the perception issue. We think this has a bearing on how successful various schemes have been.

Outside of the government budget, the earmarking of revenues comes alongside more complicated rules and regulations. The World Bank identifies six main categories of "spending options for carbon revenue" – we split this further into climate and other (Figure 2).

In our view, spending carbon pricing revenues on climate issues makes sense

Figure 2: We think earmarking revenues improves the perception of carbon pricing



Source: World Bank

In reality, revenue use is often mixed

In many cases, the use of revenues is mixed: for tax reform, to support industry competitiveness as well as for emission reduction projects or other development objectives – all balanced within political and economic objectives. It is not always possible to separate the use of revenues out completely. In addition, all potential uses come with benefits as well as limitations – and these may or may not have climate change in mind.

Table 3: We think using revenues for climate-related purposes would improve the success of carbon pricing

Revenue use	Climate focus?	Benefits (according to World Bank)	Limitations (according to World Bank)	HSBC Comment
Climate mitigation	Yes, domestically and globally	Can increase effectiveness of carbon price by addressing market failure; Can further reduce emissions in uncovered sectors; Can lead to greater public acceptance of carbon pricing	Can have high administrative costs relative to alternative revenue use options if existing allocation mechanisms are not in place	Could also be used towards adaptation of physical and social infrastructure in preparation for higher temperatures and extreme events
Prevention of carbon leakage	Yes, domestically and globally	Reduces the risk of emissions increases in uncovered jurisdictions; Mitigates the negative impact on affected businesses in the short term; Has the potential to increase stakeholder support	Requires identifying sectors for compensation, which can be difficult; Requires careful design to reduce the risk of undermining climate objectives	Tries to ensure that the emissions do not flow outside whilst at the same time attempting to maintain the competitiveness of affected businesses
Assistance for individuals, households or businesses	Yes, domestically	Can compensate affected individuals, households, or workers; Can have low administrative costs, if allocation structures already exist	Depending on design, can be less visible than alternative options if delivered through existing transfer systems, and therefore may have less public support	We think this could be effective if delivered directly to those either affected by the carbon price (low-income households) or indeed those potentially more affected by the impacts of climate change

Source: World Bank, HSBC

In general, we believe that the potential success (from a climate perspective) of any carbon pricing scheme would be improved if the revenues raised went back into solving climate change.

Pretending to price it – Internal Carbon Pricing

Carbon pricing is going to become more prevalent …

Cause and effect: The causes of climate change have become better understood over the past decades and the UN climate science body, the IPCC, stated in its 2013 report (AR5) that "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century". Companies engaging in carbon intensive industries have been preparing for the eventuality that they would have to become more carbon efficient as well as have to pay to use up more of the global carbon budget i.e. pay to emit.

… but some companies want to be more prepare

Currently not every jurisdiction prices carbon – at all or effectively. There is a growing expectation that this will change in the future. Either all (or most) carbon will be priced, and the price of that carbon will increase. This is why many companies employ **internal carbon pricing**.

Internal carbon pricing is a tool employed by an entity to put a price on the greenhouse gases that it emits now or in the future, in anticipation that they may be charged to emit or that this charge may increase over time.

There are three broad reasons for using an internal carbon price:

Internal carbon pricing can assist users in different ways

1. **Risk management** – to assess potential (future) liabilities / costs in relation to emissions for a project, asset or activity;
2. **Decision making** – to determine the potential profitability of an investment, project or line of business;
3. **Carbon efficiency** – to identify operational areas to reduce emissions and lower risks.

Knowing entity emissions beforehand is essential …

GHG inventory: However, before doing any of the above, businesses need to know what their emissions are and how much they emit – this is known as a greenhouse gas inventory. GHG inventories usually cover the different types of GHGs and are converted to tonnes of carbon dioxide equivalent (tCO_2e) – see Table 1 on page 9. Once businesses have a reasonably accurate inventory, they can run scenarios of how much their emissions might cost them if the emissions were priced at various levels.

…then using this emissions profile for risk management …

Risk management: Whether a jurisdiction has already begun pricing carbon or not, there is always the possibility that

1. it could introduce pricing in the future,
2. it could include other sectors that may not be priced currently, and
3. it could increase the price in the future.

Businesses can use a variety of (internal carbon) pricing scenarios to assess potential costs and possibly provision accordingly if deemed necessary. The latest disclosures to CDP by companies around the world suggest that around 700 companies are already doing this – with well over 900 additional companies planning to do so (Chart 4).

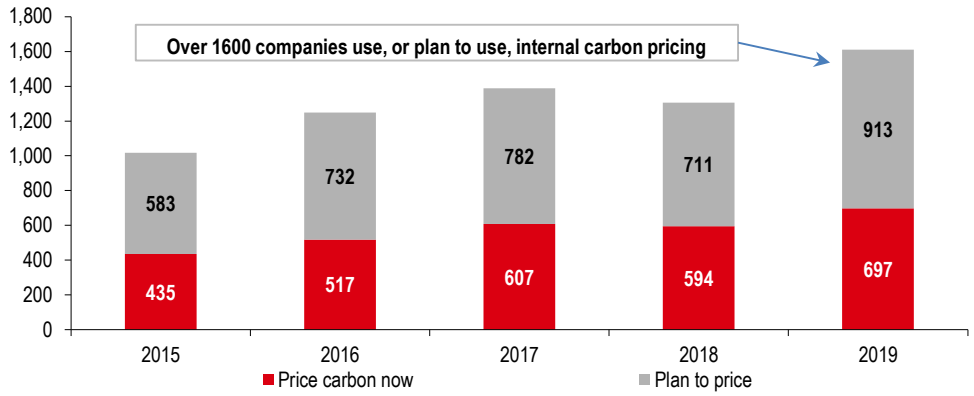
… to make better decisions about the future …

Decision making: Similar to risk management above, more businesses – particularly those engaged in carbon intensive industries – are using internal carbon pricing before allocating capital, as part of the rate of return assessment. Many of these assets are long-lived and, in some cases, more costly to access, explore or set up than other options, hence carbon pricing scenarios can determine the profitability capital allocation i.e. inform the decision making.

… or to remove excess / unnecessary carbon from the entire value chain

Carbon efficiency: The process of determining a GHG inventory allows businesses to know the relative carbon intensity of different parts of a business. For example, its energy use per building, its transportation modes, the various stages of its supply chain, different parts of the manufacturing process or perhaps how its storage systems work. The overall carbon intensity of the business, facility or supply chain could be lowered i.e. made more *carbon efficient*, if changes are made (where possible) to high carbon intensive areas. Some examples may include electrification or changing storage options.

Chart 4: Use of internal carbon pricing is growing



Source: CDP, 2020

Some companies operate entire trading schemes internally

Internal schemes: Some companies go further than just pricing scenarios. Some companies operate an entire internal carbon pricing mechanism whereby different businesses participate in an ETS or tax-based scheme internally – trading with other facilities or being challenged to lower emissions costs. This can help towards lowering the overall emissions of the whole company.

Box 6: Examples of companies that use internal carbon pricing

BASF (chemicals) uses two different types of internal carbon pricing. The first is a *shadow carbon price* to assess the economic efficiency of existing facilities and investment projects across different regions and timeframes; the price is reviewed annually. The second is a *social cost of carbon* to calculate the damage costs for commercial activities along the entire value chain – from the supply chain via company sites to customer industries.

Danone (food and dairy) sets a static carbon price in its capital expenditures approval process to redirect investment towards lower carbon solutions, clean technologies, renewable energy, and other projects that may contribute to emissions reductions. The price is reviewed periodically but not annually.

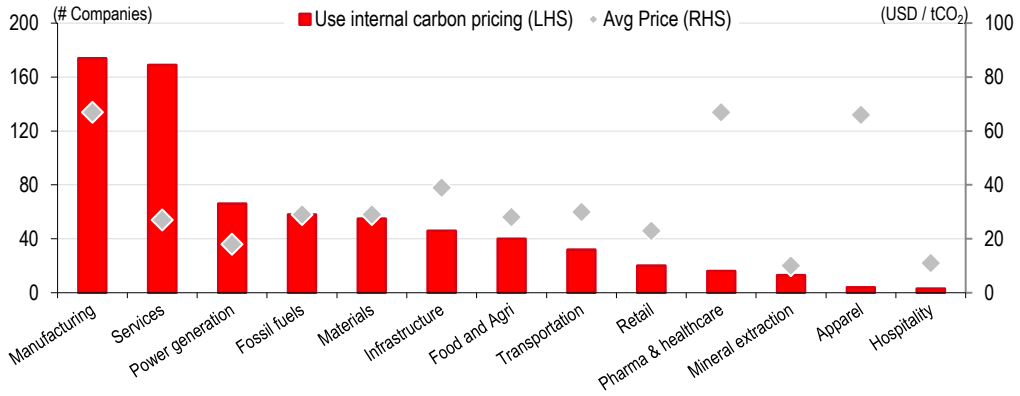
Acciona (energy) uses a shadow carbon price for its medium to long term projects in order to drive investments in technology and lower carbon production processes. The price evolves over time and is intended to mitigate future risks as more activities are included into official carbon pricing schemes.

Microsoft (ICT) uses an internal incremental carbon fee on emissions from its operations. Individual business groups pay for their use of offices, software development labs, air travel, data centres, etc. Funds collected from the fees are pooled into a central fund which is then used for internal efficiency initiatives and carbon offset projects.

DGB Financial Group, Korea (financials) uses internal carbon pricing to take into account the relative cost of mitigation actions to help the company meet its reduction goals. The pricing system is also used to make operational decisions.

BP (oil & gas) set up an internal trading scheme in 1997. Each business unit (Exploration and Production; Refining and Marketing; Gas, Power and Renewables; and Chemicals.) participates on a task force which reports to the Climate Steering Group (executive level body that sets BP's climate strategy). It is responsible for setting the rules for its trading scheme, allocating permits and ensuring compliance.

Chart 5: Use of internal carbon pricing between various sectors



Note: As per data reported by 697 companies to CDP in 2019
Source: CDP 2020

Ramping up with TCFD

Global use of internal carbon pricing is likely to increase

More and more companies are embracing the recommended climate disclosures set out by the Task Force on Climate-related Financial Disclosures (TCFD). Since its launch in June 2017, over a thousand global companies have declared support for the recommendations (see Box 7). In its supplemental guidance on how to implement the recommendations, the TCFD asks all sectors to "provide their internal carbon prices". In addition to scenario analysis, it means that many more companies will be using internal carbon pricing as a tool going forward.

Box 7: What is TCFD?

The uptake of TCFD has been strong

The Financial Stability Board (FSB) set up the Task Force on Climate-related Financial Disclosures (TCFD) in December 2015 at COP21 (the climate negotiations where the Paris Agreement was adopted). In June 2017, the TCFD set out a broad disclosure framework applicable across all organisations, designed to provide climate-related information which can be used to make meaningful business and investment decisions.

Its recommendations fall into four main categories of: **Governance, Strategy, Risk Management, Metrics and Targets**. Since 2017, not only have more companies begun disclosing under TCFD, but more organisations – regulators, stock exchanges, investor coalitions – have indicated that they will move towards TCFD guidelines in the future. For more details, see *May the (Task) Force be with you*, 30 June 2017.

Other entities are also embracing internal carbon pricing

Besides businesses, internal carbon pricing is also useful elsewhere and is increasingly being used by national governments, financial institutions, investors.

Other entities may use internal prices for different reasons …

Governments may use internal pricing in decision making – over fiscal budgets, infrastructure projects, overseas aid and development. For example, in the US, many federal agencies "use estimates of the social cost of carbon to value the climate impacts of rulemakings". The US Environmental Protection Agency (EPA) defines this social cost as a measure "of the long-term damage done by a ton of CO_2".

> **An increasing number of firms and investors are advocating for carbon pricing policies from government, and some are applying an internal carbon price to guide investment in advance of government policy to that effect**
>
> **Emissions Trading in Practice, World Bank Group (2016)**

… risk assessment at financial institutions …

Financial institutions are using internal carbon pricing in risk assessments. Scenarios of future carbon prices can assist in lending decisions. For example, at what point does a loan become profitable or unprofitable with a change in carbon price. The price can be used to ascertain credit risk (which clients might run into cash flow issues) as well as exposure to liabilities in insurance, for instance.

… valuations and engagement by investors

Investors tend to use internal carbon pricing mainly in two ways. The first is valuations and stress testing models (of companies and portfolios) for changes in the cost of emissions – this is a key reason that disclosures a la TCFD is increasing. Secondly, investors can use this information as a means of engagement – to discuss climate strategy, readiness, exposure etc. with the companies they invest in.

Participants and sectors

The participation of sectors depends on aims and economic configuration

The details of carbon pricing schemes vary widely and have a strong bearing on whether the scheme contributes effectively to its goals. One very important aspect to get right is choosing the appropriate participants. This will be very different by jurisdiction depending on its aims (as above) and its economic configuration.

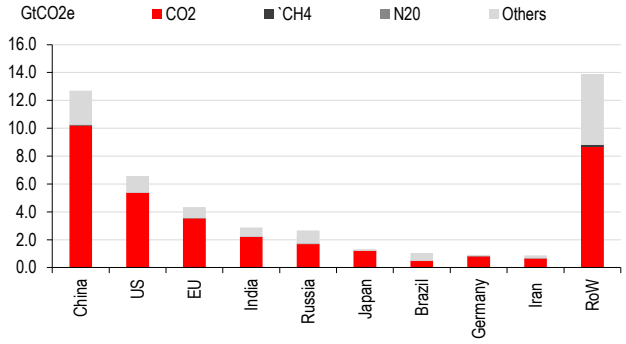
- **Aims** – these vary in weight with jurisdictional emissions reduction, political and public awareness, government revenues, other developmental priorities
- **Economic configuration** – varies by energy, transport, average size of company, agriculture etc.

Note: The World Bank has guidance for governments on how to implement carbon pricing schemes – we do not go into the details here.

Some sectors are dominant emitters of specific GHGs

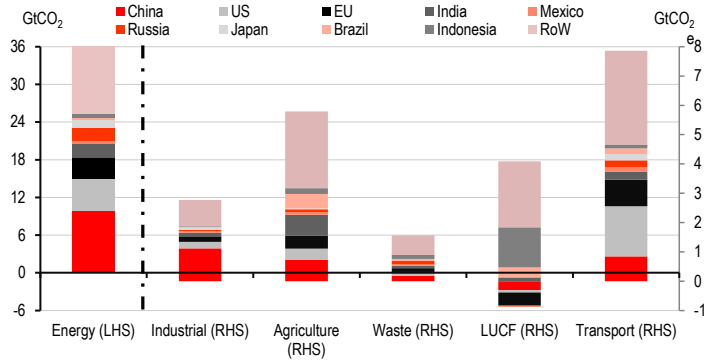
Considerations for investors: we think it is important to consider the gases and sectors covered by any pricing scheme. Carbon dioxide is the most prevalent greenhouse gas globally (Charts 6 and 7) however there is growing concern that emissions of other gases are rising steeply. Different GHGs matter more or less to different sectors. For example, for fossil fuels, CO_2 is the most important gas however for electricity transmission, it is arguably sulphur hexafluoride (SF_6); for methane (CH_4), it is the waste sector but also the agriculture sector and specifically ruminant livestock and rice farming.

Chart 6: Sources of GHG by gas and country (2016)



Source: PRIMAP database

Chart 7: Sources of GHG by sector and country (2016)



Source: World Resource Institute CAIT database (LUCF is land-use change and forestry)

As companies disclose more and more climate information, we believe investors should scrutinise these disclosures for clues about trends in *volume* and *inclusion*.

Company disclosure may offer clues about future inclusion into carbon pricing

Volume of GHGs – which companies may evolve such that the volume of their emissions breaches a participation threshold hence could incur costs, or indeed falls (through efficiency or process change) below certain thresholds thus reducing a liability or having the ability to sell allowances/credits in trading schemes.

Inclusion – as carbon pricing schemes advance globally, alongside better GHG inventories, it is likely that more types of greenhouse gases will be priced. In our view, investors should be aware that certain business activities and certain business divisions could come under inclusion in the future. This could be either a liability or a potential asset for companies.

The curious case of Aviation and CORSIA

Aviation is a special case

Aviation, which accounts for around 2% of global *GHG* emissions (or 2.4% of CO_2 emissions) globally deserves a special mention for two reasons. *Note: the total radiative forcing (i.e. actual contribution to the warming effect) from aviation is higher at around 3-5% as it includes contrails and other pollutants.*

1. International aviation is not covered by the Paris Agreement
2. International aviation will implement an offsetting scheme from 2021

Box 8: International aviation

International (civil) aviation is accounts for around two-thirds of total aviation emissions but is not covered by the Paris Agreement. Domestic aviation emissions, such as from a flight from Edinburgh to London, are covered by domestic climate pledges under the Paris Agreement, whereas a flight from London to New York falls under the jurisdiction of the International Civil Aviation Organization (ICAO), a specialised agency under the UN. ICAO expects international aviation to grow at roughly 5% per year (*note: these assumptions were before COVID-19)*.

CORSIA

Aviation will soon operate a large offsetting scheme …

In 2016, after increasing pressure to deal with emissions from the sector, ICAO agreed to hold net carbon emissions from international aviation at 2020 levels (i.e. carbon neutral growth from 2020). It will achieve this via the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which will mainly use carbon offsets to address emissions above 2020 levels. For more details, see *Flying into a new climate* (13 October 2016).

… which will drive up demand for carbon credits

Increased demand for carbon credits: CORSIA means that the aviation sector will likely become large buyers of carbon offsets in the near future as airlines seek to offset emissions over and above 2020 levels. In addition, a number of airlines such as the IAG Group, Etihad, Qantas and Delta have announced plans to become net zero in the future.

Maintaining quality: ICAO has tried to avoid "greenwashing" and has instigated measures to improve the accuracy of airline emissions. However, there has been concern that a mass buying of carbon credits by the sector could result in (a combination of) the following:

There have been concerns over greenwashing …

- Old credits being used for offsets
- Credits of dubious climate integrity being used for offsets
- An influx of projects given accreditation by national governments without due diligence

In March 2019, ICAO released eligibility criteria for the carbon credits to be used within CORSIA (CORSIA Emissions Units). Box 9 describes the criteria, we note that it tries to address many of the issues we describe above.

… which ICAO has tried to deal with by implementing specific criteria for credits

Box 9: CORSIA Emissions Units

"Offset credit programs should deliver credits that represent emissions reductions, avoidance, or sequestration that:

1. Are additional.
2. Are based on realistic and credible baseline.
3. Are quantified, monitored, reported and verified.
4. Have a clear and transparent chain of custody.
5. Represent permanent emission reductions.
6. Assess and mitigate against potential increase in emissions elsewhere.
7. Are only counted once towards a mitigation obligation.
8. Do no net harm."

(Source: ICAO document, CORSIA Emissions Unit Eligibility Criteria, March 2019)

Currently, six programmes have been approved for use

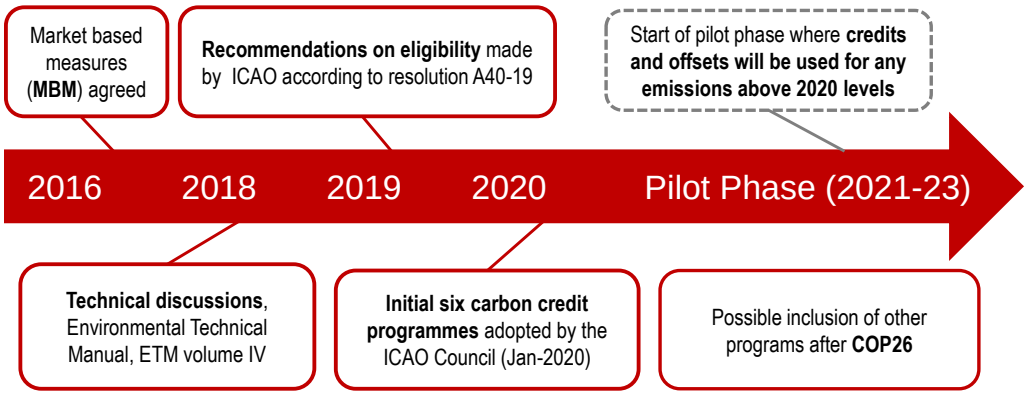
Not a free-for-all: Based on these criteria, in March 2020, the ICAO Council approved the recommendations made by ICAO's Technical Advisory Body on which carbon credits may be eligible for airlines to use (during the first pilot phase). Importantly, "emissions units are issued to activities which commenced as of 1 January 2016, and in respect of emissions reductions occurring through 31 December 2020" which means that *only newer credits* could be used. In addition, airlines may only use carbon credits from six approved programmes:

- American Carbon Registry
- China GHG Voluntary Emission Reduction Program

- Clean Development Mechanism
- Climate Action Reserve
- The Gold Standard
- Verified Carbon Standard

ICAO will consider the potential for more programmes to be included after COP26 and the (expected) conclusion of the rulebook on the Paris Agreement (see Page 15).

Chart 8: The implementation of CORSIA has taken some time



Source: ICAO, HSBC

Choosing creditable offsetting schemes is challenging

In our view, the experience of ICAO in implementing CORSIA highlights some of the difficulties in ensuring the full integrity of carbon credit and offset schemes. There are still many that are dissatisfied with CORSIA's offset choices. As the pilot phase for CORSIA begins next year, we think investors should scrutinise the disclosures made by airlines with respect to emissions, offsets, and overall climate strategy.

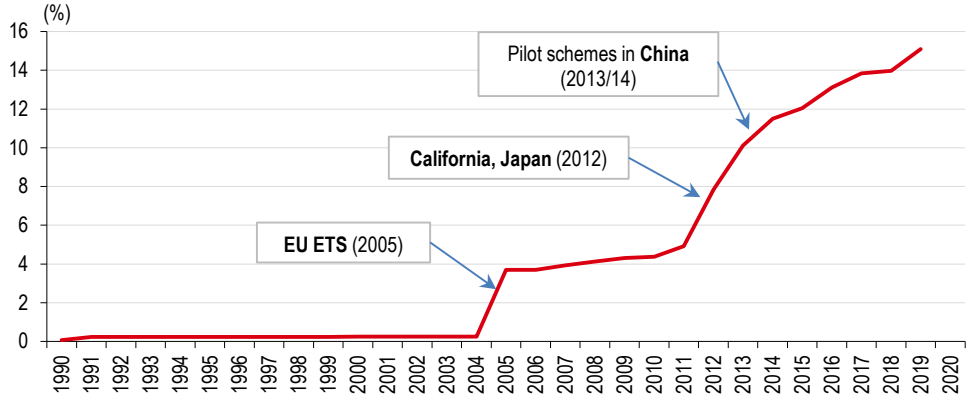
Global carbon pricing

- Only 15% of global GHGs are covered by a carbon price …
- … but price levels are not yet high enough to nudge behaviour
- We expect new schemes to learn from the mistakes of others

Carbon pricing around the world

According to the World Bank's latest State and Trends of Carbon Pricing (June) 2019, "almost 46 national and 28 subnational jurisdictions" have or plan to implement some carbon pricing initiative. However, all these schemes collectively only cover around 15% of global GHG emissions (Chart 9). This leaves a lot of room for more pricing schemes in the future.

Chart 9: The share of global emissions covered by carbon price has been rising



Note: Only ETS (Emissions Trading Systems) or carbon tax are considered on this graph. Emissions are given as a share of global GHG emissions in 2012. Annual changes in global, regional, national, and subnational GHG emissions are not shown in the graph
Source: World Bank

In looking at the climate pledges towards Paris Agreement, some 96 Parties are considering using carbon pricing. Although these 96 Parties represent 55% of global GHG emissions, it does not necessarily mean that all the emissions from a particular jurisdiction are or will be covered by a carbon price. Besides emissions coverage, questions remain over whether the price is high enough to change behaviour.

> **Price levels may not be adequate in, most of the places to drive a transformational change**
>
> **State and Trends of Carbon Pricing 2019, World Bank**

Table 4 shows some of the major carbon pricing schemes around the world. There is wide variation in the proportion of jurisdictional emissions coverage: ranging from 10% in South Africa up to 85% in California. There can be many reasons for this – the most common being either specific sector inclusion or exclusion, and the threshold for participation. For example, in many schemes, only entities that emit over a certain level (say, 25,000 tCO_2e/year) participate, which means that smaller entities do not have their carbon emissions priced (yet).

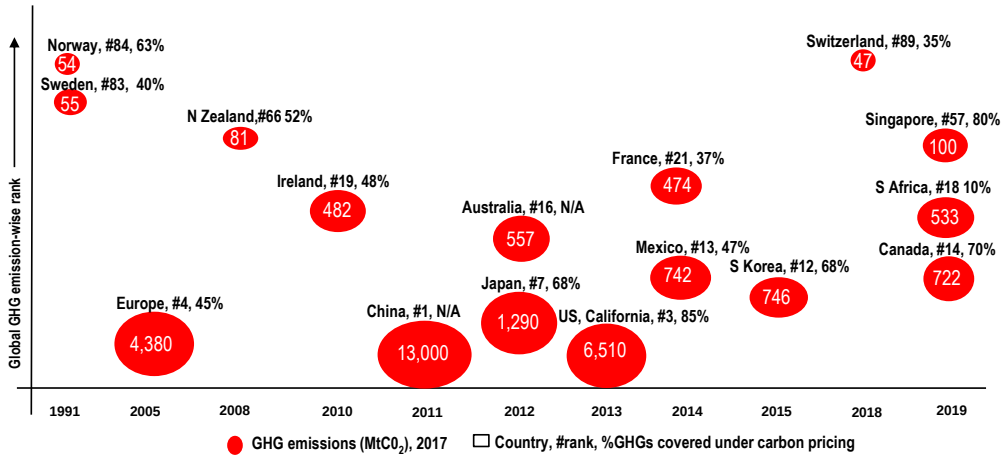
Table 4: Major carbon pricing mechanisms across the globe

Country or region	Start year	$/tCO₂ (2019)	GHG coverage (2018) Mtons CO_2	%	Sectors covered
Carbon tax					
Chile	2017	5	47	39	Energy, agriculture, waste, industrial processes
Colombia	2017	5	42	40	Energy, industry, agriculture, forestry and other land use
Denmark	1992	26	22	40	Transport, industry, agriculture and fisheries, electricity
Finland	1990	65	25	38	Industry, transport and buildings
France	2014	50	176	37	Industry, buildings and transport
Ireland	2010	22	31	48	Agriculture, transport, energy
Japan	2012	3	999	68	All sectors incl. fossil fuels
Mexico	2014	1-3	307	47	All sectors, fossil fuels (e.g. natural gas) producers and importers
Norway	1991	59	40	63	All sectors incl. fossil fuels
Portugal	2015	14	21	29	Transport, industry, agriculture
South Africa	2019	10	360	10	Industry, power gen, buildings, transport
Sweden	1991	127	26	40	Transport and buildings
Switzerland	2008	96	18	35	Road transport, industry, residential and commercial sector
Emission Trading System					
California, US	2012	16	378	85	Power, industry (incl. processes), transport, buildings
China	2020	na	3232		Power and industry (incl. buildings, aviation and transport in some of them)
EU	2005	25	2132	45	Power, industry (incl. processes) and aviation
Korea	2015	22	453	68	Power, industry, buildings, public, aviation and waste
New Zealand	2008	17	40	52	Agriculture, Energy (excl. transport), road transport, industry, waste
Regional Greenhouse Gas Initiative (RGGI)*	2009	5	94	21	Transport, Electric power, Industry, commercial and residential sector
Carbon Price floors					
Canada	2016	15	na	70	Transport, household and industrial sector
UK	2013	24	136	24	Power generation

*RGGI is a market-based programme in 10 states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont) in the eastern part of the United States
Source: IMF (as of April 2019)

In general, carbon tax schemes are the most common, followed by various forms of trading, and then others such as floor prices etc. Below, we highlight some of the key aspects of major schemes, by region.

Figure 3: Overview of key carbon pricing schemes, by emitter



Note: Y-axis denotes rank, i.e., China is the #1 emitter, Switzerland is #89
Source: PRIMAP, HSBC

Europe

EU Emission Trading System (EU ETS)

Basics: The EU ETS was launched in 2005 and is currently in the third phase (2013-2020). It covers around **45% of the EU's GHG emissions**. It is essentially a 'cap and trade' system principle of the carbon pricing.

Table 5: Key features of EU ETS across trading

	Phase 1 (2005-07)	Phase 2 (2008-12)	Phase 3 (2013-20)
Geography	EU 27	EU27 + Norway, Iceland, Liechtenstein	EU27 + Norway, Iceland, Liechtenstein, Croatia (1-Jan-13)
Sectors	Power stations and other combustion plants ≥ 20MW, Oil refineries, Coke ovens , Iron and steel plants, Cement clinker, Glass, Lime, Bricks, Ceramics, Pulp, Paper and board	Same as phase 1 plus Aviation (from 2012)	Same as phase 1 plus Aluminium, Petrochemicals, Aviation (1-Jan-14), Ammonia, Nitric, adipic and glyoxylic, acid production, CO_2 capture, transport in pipelines and geological storage of CO_2
GHGs	CO_2	CO_2, N_2O emissions via opt-in	CO_2, N_2O, PFC from aluminium production
Cap	2,058 million tCO_2	1,859 million tCO_2	2,084 $MtCO_2$ in 2013, decreasing linearly by 38 $MtCO_2$ per year
Eligible trading units	EUAs	EUAs, CERs, ERUs Not eligible: Credits from forestry, and large hydropower projects.	EUAs, CERs, ERUs Not eligible: CERs and ERUs from forestry, HFC, N_2O or large hydropower projects. Note: CERs from projects registered after 2012 must be from Least Developed Countries
Free allocation	6,321.4 $MtCO_2eq$	9,998.5 $MtCO_2eq$	6,516.5 $MtCO_2eq$
Allowances auctioned/sold	8.5 $MtCO_2eq$	442.3 $MtCO_2eq$	4,941.2 $MtCO_2eq$
Verified emissions	6,214.6 $MtCO_2eq$	9,709.5 $MtCO_2eq$	10,712.0 $MtCO_2eq$

Source: EU ETS Handbook (as of 3 July 2019)

Cap: The cap is based on overall reduction targets but member states distribute allowances based on the EU-wide cap. The volume of allowances are reduced by 1.74% each year.

Allocation: is done both freely and via auction.

a. *Free allocation* – permits are distributed by a set of specified rules known as Community Implementing Measures (CIMs).

b. *Auctioning* is conducted on a common auction platform (EEX) in collaboration with EU, Poland and Germany. (In the UK, ICE futures holds the auctions)

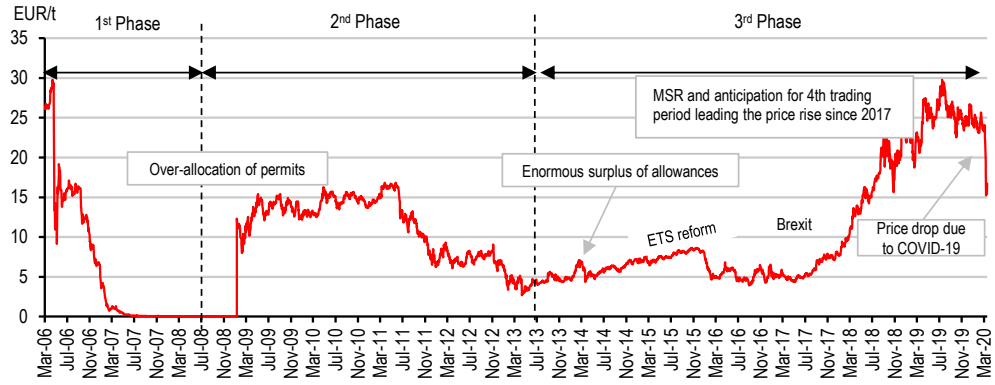
From Phase IV (2021-2030), the share of allowances to be auctioned will increase under the scheme rather than allocating free allowances. Changes to be made to the EU ETS in Phase IV include:

- increase annual emissions cuts to 2.2%
- Reconsideration of free allocation to various sectors
- Various funding mechanisms for smooth transitioning of energy intensive sectors to low-carbon intensive technologies.

Coverage: Energy intensive facilities from sectors such as power stations, oil refineries, offshore platforms, iron and steel, cement and lime, paper, glass, ceramics, chemical plants and also intra-Europe aviation. The scheme aims captures emissions in relation to where they occur – rather than where a company is incorporated.

Price: The EU ETS struggled with a surplus of allowances after the 2008 financial crisis as production and emissions fell, meaning most participants did not use their full quota. A Market Stability Reserve (MSR) was implemented in January 2019 to manage the surplus by adjusting the supply of allowances. Essentially, if the price is too low, more allowances will be placed in the reserve; if the price is too high, more allowances will be released from the reserve.

Chart 10: The price of allowances on the EU ETS has not always been incentivising



Note: data as of 26 March 2020
Source: Refinitiv Datastream, EEX

***A note on COVID-19**: There is uncertainty how European businesses will fare during and after the pandemic. Many businesses may miss their production estimates and hence release few emissions. Whilst technically better for the climate, it does mean that there could be a large surplus in allowances unless the MSR can act quickly to maintain price stability. We think any stimulus package should consider the climate and environmental impacts as well.*

Switzerland – carbon tax *(+ EU ETS)*

Basics: Switzerland introduced a CO_2 levy in 20018, on combustible fossil fuels in the production of heat, light, electricity (essentially all fossil heating and process fuels such as coal, petroleum coke, natural gas and heating oil). However, there are exemptions for facilities that commit to stringent emissions reductions. Switzerland also operates a voluntary "cap and trade" but, as of 1 January 2020, its cap and trade system linked up with the EU ETS (after a decade of negotiations). Hence Swiss companies that participate in these trading schemes are also exempted from the levy.

Price and revenues: The levy has been CHF96 per tonne CO_2 (USD98) since 2018. Annual revenues are around CHF1.2 billion (USD1.25bn). Two-thirds of the revenue generated from the levy is "redistributed to the public and the business community" independent of consumption i.e. each citizen receives the same distribution. This is done through health insurers and the OASI (Old-age and Survivor's Insurance) compensation offices. About one third (up to a maximum of CHF450mn) is directed towards a programme to advance energy-efficient or renewable technologies. Around CHF25m is invested in a technology fund.

Sweden – carbon tax *(+ EU ETS)*

Sweden's carbon tax was introduced in 1991 alongside a pre-existing energy tax at a rate of SEK250 (USD25). This has increased over the years and is now around SEK1180 (USD116) per tonne of carbon emitted. In 1991, as the carbon tax was brought in, marginal income tax was lowered. All segments in the economy must pay the carbon tax except those businesses which participate in the EU ETS.

Norway – carbon tax *(+ EU ETS)*

Norway began its carbon tax scheme in 1991. It set up an emissions trading scheme in 2005 which joined the EU ETS (Phase II) in 2008. Around four-fifths of all Norway's emissions are regulated either through the tax or the EU ETS. The rates of carbon tax are variable depending on the sector however the focus is on CO_2.

Ireland – carbon tax *(+ EU ETS)*

Besides EU ETS participation, Ireland also operates a nationwide carbon tax which was introduced in 2010. It applies to certain fuels such as kerosene, natural gas and liquefied petroleum gas. Rates of carbon tax vary by fuel type. Since 2014, the rate has been EUR20 per tonne of CO_2 emitted by the fuel. The 2020 Irish Budget indicated the intention to increase the tax.

Box 10: Fuel tax in France

In late 2018, France announced an increase in fuel tax from January 2019 in order to address climate change. However, there were concerns that the higher tax would disproportionately affect those living in rural areas (without public transport access), especially those on middle-to-low income. As a result, there were major protests across the country (which expanded to other issues and lasted several months). The fuel tax increase was eventually suspended.

North America

Canada – carbon tax and cap and trade

Basics: The provinces of Quebec and Alberta began to carbon pricing in 2007, followed by British Columbia in 2008. In 2016, the Canadian Government asked all its provinces and territories to implement carbon pricing. As a result, Canada has different systems in place per region. There is also a country-wide pricing scheme which applies to "in provinces and territories that requested it or did not have a carbon pollution pricing system that meets the federal benchmark stringency requirements". *(Note: the country-wide scheme is currently being challenged by some provinces in the Supreme Court of Canada. For more details, see Canada's climate challenge*, *21 June 2019.)*

Fuel charge: From 1 April 2019, there is a federal charge on fossil fuels based on tonnes of CO_2e. It started at CAD19/t in 2019 and will rise by CAD10 per year to reach CAD50 in 2022.

OPBS: For specific larger industries, there is a trading system known as the Output-Based Pricing System (OBPS). This is based on the carbon intensity of production specific to each industry. Facilities which exceed the limit (which is based carbon intensity standards and a level of production) will have to pay a fee (which is the same level as the fuel charge above) or submit a compliance unit (i.e. buy a permit from another participant that did not exceed the limit). Participants may also "bank" (i.e. keep) underused units for future compliance.

California – cap and trade

Basics: California launched its cap and trade programme in 2013, with the aim of returning to 1990 emissions levels by 2020 and being 40% below 1990 levels by 2030. It covers 85% of the state's total GHG emissions. It is implemented and enforced by the California Air Resources Board. It started out covering large industrial facilities (>25,000tCO_2e) and power generation; other fuels such as natural gas and transport distribution were included in 2015. Around 450 entities participate in the scheme which covers the six main types of GHG.

Cap and allocation: The initial 2013 cap was set at 2% below 2012 emission levels with annual declines through to 2020. Allocations methods depend on the sectors – broadly speaking, electricity and gas mostly free; others moving towards more auctions with upper limits. Banking (holding on for future compliance) is allowed; offsets (with conditions) may be used up to certain levels depending on the phase.

Quebec link up: In 2007, a climate trading programme known as the Western Climate Initiative was set up among a number of US states. Through the years, a number of states left for various reasons (political and otherwise). California linked its trading programme with Quebec in 2014; Ontario joined in 2018. All allowances from any of the linked up regions may be used and freely traded by any participants.

Note: The US Department of Justice is suing California for its attempt to include Quebec in its regional carbon trading scheme. The lawsuit was filed on the basis that international pacts can be agreed to only by the federal government. Some environmental law experts believe that the state's cap and trade system was carefully crafted so as not to violate federal authority. The deal with Quebec is structured as a recognition of pollution credits between governments, without the binding enforcement mechanisms that would rise to the level of an international treaty. However it is important to note that in 2012 the American Bar Association (per Bloomberg) noted that the type of international cooperation required by a cross-border cap and trade system may nevertheless overstep constitutional limits on subnational players venturing into foreign affairs. The litigation threatens California's seven-year-old carbon trading market.

The Regional Greenhouse Gas Initiative (RGGI) – cap and trade

This cooperative approach was set up in 2009 by ten US states (mainly on the US East Coast) to reduce emissions form the power generation sector. Any fossil fuel-powered electric generation facility with a capacity of 25MW or above must participate. Allocation is done by quarterly auctions with a three-year compliance period. The overall cap for the initiative is set annually and declines each year. The cap has declined almost 70% since 2009. Participating states are free to use the auction revenues as they choose but many have opted to improve energy efficiency.

Asia Pacific

China – emissions trading

Pilot ETS: In 2011, China approved seven jurisdictions to trial carbon emissions trading: Beijing, Shanghai, Tianjin, Chongqing, and Shenzhen, as well as Hubei and Guangdong provinces. These were launched in 2013-14 essentially to see what worked and did not for Chinese businesses.

Table 6: China's original seven pilot emissions trading schemes

Province	Start year	GHG covered ($MtCO_2$)	Sectors involved
Beijing	2013	188	Industry, power, transport and building
Chongqing	2014	243	Industry and power
Fujian	2016	333	Industry, power and aviation
Guangdong	2013	611	Industry, power and domestic aviation
Hubei	2014	463	Industry and power
Shanghai	2013	298	Industry, power, transport and building
Shenzhen	2013	153	Industry, power, transport and building

Source: World Bank, Carbon pricing dashboard

In December 2016, Fujian Province launched an ETS and Sichuan Province launched a platform for trading carbon offsets (CCER or Chinese Certified Emissions Reductions). The learning from these pilot schemes was supposed to inform a National ETS which was supposed to launch in 2017.

National ETS: Details of the national plan were released by China's National Development and Reform Council (NDRC) in 2016. It was originally supposed to cover eight key sectors of the economy: power generation, non-ferrous metals, chemicals, iron and steel, petrochemicals, building materials, aviation, and pulp & paper (see *Carbon is Forever,* 29 March 2017). However, in December 2017, only a very soft ETS was launched with participation from the power generation

and heat sector. The muted launch was widely reported to be because of the difficulty obtaining accurate greenhouse gas inventory data from Chinese facilities. The pilot schemes are still in operation. The World Bank expects China to re-launch its National ETS in 2020.

Carbon tax: China's Ministry of Finance issued a paper in February 2013 which floated notions of a carbon tax as part of wider environmental tax reforms. However, the issue was not further commented on officially until 2016 when a number of officials from the Ministry of Finance and the NDRC began making public remarks on carbon tax, now as part of resource tax reform. We are not aware of further public remarks since then.

Japan – carbon tax and emissions trading

ETS: Japan had a voluntary emissions trading scheme from 2005 to 2012 (now ended) however only around 80 firms participated covering only 1% of national emissions. **Tokyo** launched a trading scheme in 2010 which covered 400 facilities or around a fifth of the city's emissions. **Saitama** prefecture launched its cap and trade programme in 2011 covering around 600 buildings and factories that used more than a certain threshold of energy in oil equivalent.

Carbon tax: Japan introduced a tax for climate change mitigation in 2012. The tax is based on the carbon content of each fossil fuel (mainly coal, oil and petroleum products, gas products). Tax revenues earned from this climate tax are used for energy efficiency and other emissions mitigation purposes such as low carbon technologies as well as financial assistance for local governments to promote renewable energy.

Singapore – carbon tax

Singapore's carbon tax came into force in 2019, a mere two years after the first announcement during the budget of February 2017. It covers all facilities with GHG emissions of 25KtCO_2e or more and is designed to tackle emissions at source. The tax has been set at SGD5/tCO_2e (USD3.7) for the 2019-23 period and may increase to SGD10-15/tCO_2e (USD7.3-11) by 2030 after a review in 2023. The covered facilities together account for about 80% of the country's total GHG emissions. Revenues from the tax will be used to further reduce emissions.

South Korea – ETS

Measure then trade: In 2011, companies that emitted more than 125,000 tonnes of carbon had to monitor their emissions through a target management system. In 2015, Korea launched a formal ETS. There are various thresholds of participation for specific installations and companies. It currently covers over 600 companies which emit approximately two-thirds of Korean emissions. The allocation of allowances is still largely free due to fierce opposition from Korean business

Box 11: Australia – Carbon Pricing Mechanism

Australian introduced a carbon pricing mechanism in July 2012 although it faced strong opposition from the resources industry. For three years, covered entities were to pay AUD23/tCO_2. In 2015, the system was *supposed* to convert into an emissions trading scheme. However, after a bitterly fought election in September 2013, the ruling Labor Party lost to the Coalition which campaigned on a pledge to repeal the tax. The Coalition government the tax and the entire scheme in July 2014.

New Zealand – ETS

Basics: The New Zealand emissions trading scheme launched in 2008 and was designed to cover all economy-wide emissions however after a series of amendments, just over half of the country's GHG emissions are covered. The ETS covers power and heat generation, transport, industrial processes, forestry and waste. Agriculture is the major sector (just under half of emissions) not covered although these entities must still report their emissions.

Improvements: An amendment bill was introduced in October 2019 and is still in the works. The changes include a phasing down of allowance allocations to industry in a bid to encourage the sector to make its processes more carbon efficient; the removal of old compliance units (from the Kyoto Protocol); and a new penalty system.

Mexico and South Africa

Mexico – carbon tax (and ETS)

Mexico launched a carbon tax in 2014 and covers a variety of fossil fuels (but not natural gas). It is essentially a tax on first fuel producers and importers and covers around two-fifths 40% of national emissions. Mexico launched a Carbon Market Exercise in late 2016 which is a simulation for domestic companies to get used to the way carbon markets work and provided the government useful information for implementing the system. After a number of false starts, Mexico will launch a test programme for emissions trading this year lasting until the end of 2022.

South Africa – carbon tax

Basics: South Africa began to tax carbon in 1 June 2019 after almost nine years of discussion and debate. First proposed in 2010 but with several delays (most notably a postponed 2015 commencement), the National Assembly passed the Carbon Tax Bill in February 2019. The first phase of the tax will until the end of December 2022. The initial rate is ZAR120 / tCO_2e (USD8.30) on carbon dioxide as well as other greenhouse gases such as methane and nitrous oxide.

Coverage: Carbon intensive sectors such as electricity and heat production, transportation, minerals, chemicals, metals are included. They are given an allowance of free emissions ranging between 60-70%, with an additional 5-10% covered by offsets. The agriculture sector is given 100% free allowances. However, the generous tax free allowances reduce the effective rate to ZAR6-48 (USD0.42-3.32). The tax rate and allowances will be reviewed before the start of the second phase (2023-30).

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Our ratings are re-calibrated against these bands at the time of any 'material change' (initiation or resumption of coverage, change in target price or estimates).

Upside/Downside is the percentage difference between the target price and the share price.

Prior to this date, HSBC's rating structure was applied on the following basis:

For each stock we set a required rate of return calculated from the cost of equity for that stock's domestic or, as appropriate, regional market established by our strategy team. The target price for a stock represented the value the analyst expected the stock to reach over our performance horizon. The performance horizon was 12 months. For a stock to be classified as Overweight, the potential return, which equals the percentage difference between the current share price and the target price, including the forecast dividend yield when indicated, had to exceed the required return by at least 5 percentage points over the succeeding 12 months (or 10 percentage points for a stock classified as Volatile*). For a stock to be classified as Underweight, the stock was expected to underperform its required return by at least 5 percentage points over the succeeding 12 months (or 10 percentage points for a stock classified as Volatile*). Stocks between these bands were classified as Neutral.

*A stock was classified as volatile if its historical volatility had exceeded 40%, if the stock had been listed for less than 12 months (unless it was in an industry or sector where volatility is low) or if the analyst expected significant volatility. However, stocks which we did not consider volatile may in fact also have behaved in such a way. Historical volatility was defined as the past month's average of the daily 365-day moving average volatilities. In order to avoid misleadingly frequent changes in rating, however, volatility had to move 2.5 percentage points past the 40% benchmark in either direction for a stock's status to change.

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