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Carbon pricing:

a priceless instrument

for the green transition



Rising carbon prices increase viability of low carbon technologies

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Carbon reduction strategies will be a key focus for many businesses this year. But challenges await, as both mandatory and voluntary carbon markets are far from perfect. In Europe, current carbon price levels support the business case for green technologies like Carbon Capture and Storage (CCS), unsubsidised solar PV systems and wind energy



Carbon pricing: a priceless solution to the tragedy of the commons

A healthy and sustainable climate is a common good that requires everyone to do their part. Yet so often, companies pursue their own short-term gains at an ultimate cost to the many, a problem in economics known as the ['tragedy of the commons'](#).

This is a particularly pressing concern for carbon emissions. In most cases, the emitting company does not pay in full for the damage it causes, like air pollution, or the physical impact of climate change. In economic terms, the cost of carbon emissions to society is higher than the private cost to the polluter, which all but guarantees higher emission levels than the [climate can sustain](#).

The solution is simple, in theory. By putting a price on carbon equal to its social cost, emissions are likely to be reduced to levels that the earth can sustain. That's a solution [corporate leaders](#) and policymakers are increasingly relying on in their race to a net-zero economy, as it provides them with a tool to reduce emissions in a cost-effective way, as seen in [Europe](#) and [China](#).

This article provides a quick guide to carbon pricing for corporate decision-makers who will have to address this issue head-on in the coming years.

Mandatory carbon markets are increasingly a topic for corporate decision-makers in manufacturing and the energy sector...

Governments around the world are starting to price carbon by imposing mandatory carbon markets on energy-intensive sectors, notably the power sector and manufacturing such as steel, cement, plastic and petrochemical industries. According to the [World Bank](#), the number of carbon pricing schemes around the globe increased from 19 in 2010 to 64 today.

In theory, these carbon pricing schemes are effective for two reasons. First, they are mandatory, with governments forcing the targeted industries and companies to comply. Second, the emissions reduction target is met by design. The yearly emissions cap is decreased over time in line with the targeted level for emissions in the future.

Carbon pricing schemes are also efficient, as the market decides the mechanism for reducing emissions. Companies will first apply the most cost-efficient measures, such as cheap energy efficiency technologies (think of insulation, led lighting or recycling) and behavioural change.

More costly technologies are employed when the reduction targets cannot be met with the cheapest options. As the overall emissions cap is reduced over time to limit carbon emissions, the carbon price rises. And with higher carbon prices, the business case for low carbon technologies becomes more viable.

Europe's carbon price tripled in 2021 to €90

European carbon price in mandatory EU ETS market in euro per ton carbon

European carbon price in mandatory EU ETS market in euro per ton carbon



Source: ING Research based on Refinitiv

In Europe for example, the business case to [capture and store carbon \(CCS\)](#) is becoming feasible at current carbon prices, above €80 per ton of CO₂, particularly in carbon-intensive manufacturing clusters where governments and grid operators build the infrastructure to transport carbon.

Carbon pricing favours emission reduction strategies with low abatement costs

Indicative carbon abatement costs in euro per ton CO2 in Europe*

Power sector**	Manufacturing	Built environment	Road transport	Agriculture and land use
Very low cost emission reduction technologies (below 50 euro/ton)				
<ul style="list-style-type: none"> Large scale solar plants in open fields CCS on coal power plants 	<ul style="list-style-type: none"> Recycling Energy efficiency improvements 	<ul style="list-style-type: none"> Behavioral change Foil for radiators Weatherstrips to prevent draft Energy efficient appliances LED lighting Large scale rooftop solar energy on commercial buildings 	<ul style="list-style-type: none"> Behavioral change (lower speed) Improved aerodynamics Right tyre pressure Increase emission standards for truck manufacturers 	<ul style="list-style-type: none"> Prevention of deforestation Increase ground water level in meadows to lower peat emissions Led lighting in greenhouses Replace gas- by geothermal heating in greenhouses
Low cost emission reduction technologies (50-100 euro/ton)				
<ul style="list-style-type: none"> Substitute coal for gas CCS on gas fired power plants Mandatory closures of coal fired power plants Onshore wind energy 	<ul style="list-style-type: none"> Substitute coal for gas CCS steel and cement factories CCS production hydrogen and ammonia CCS refineries 	<ul style="list-style-type: none"> Optimisation of existing heating and cooling systems (optimal adjustment) Heat recovery in commercial buildings 	<ul style="list-style-type: none"> Increase emission standards for car manufacturers 	<ul style="list-style-type: none"> Increase carbon absorption of land e.g. with olivine sand Advanced land fertilisation (injection instead of manure spreading) Reforestation
High cost emission reduction technologies (100-150 euro/ton)				
<ul style="list-style-type: none"> Biomass power plant Offshore wind energy 	<ul style="list-style-type: none"> CCS waste incineration plants CCS biomass (negative emissions) Biomass Wind energy Solar energy 	<ul style="list-style-type: none"> Rooftop solar panels on houses 	<ul style="list-style-type: none"> Electric vehicles 	<ul style="list-style-type: none"> Biomass heating Change diet of animals so they emit less methane
Very high cost emission reduction technologies (>150 euro/ton)				
<ul style="list-style-type: none"> Bio gas Synthetic fuels like hydrogen 	<ul style="list-style-type: none"> Bio gas Synthetic fuels like hydrogen CCS: direct air capture 	<ul style="list-style-type: none"> Renovation / insulation Rooftop solar Heat pumps Geothermal heat District heating Wind energy Green gas 	<ul style="list-style-type: none"> Blending biofuels 	<ul style="list-style-type: none"> Bio gas from manure fermentation

*Abatement costs are indicative as they are highly dependent on the specifics of a project. Table indicates whether strategies are cheaper or more expensive compared to each other. **In 'normal' energy markets with gas, coal and power prices around long term average.

Source: ING Research based on PBL, Aurora, CE Delft and SEO

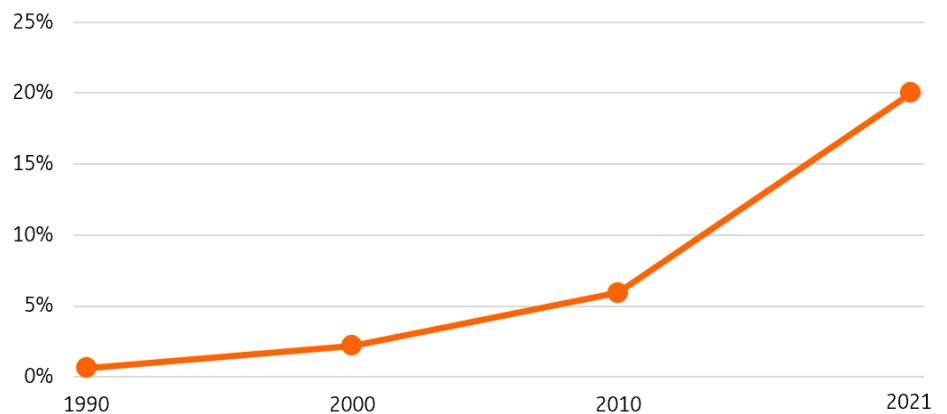
The [European Commission](#) is exploring ways to extend mandatory carbon pricing to other sectors such as shipping, road transportation and buildings. If it follows up with action, carbon pricing will also become relevant for corporate decision-makers in sectors like shipping, road transportation and real estate. Note however that the abatement costs (the cost of removing undesirable byproducts created during production) for many technologies in these sectors are generally much higher compared to manufacturing and the power sector.

...and carbon markets need to be strengthened to reach the Paris Climate Goals

21.5% of global greenhouse gas emissions were covered by carbon pricing instruments in 2021, according to the World Bank's carbon pricing monitor. That represents a significant increase from 2020, when only 15.1% of global emissions were covered.

One fifth of global greenhouse gas emissions are currently covered by mandatory carbon pricing

Share of global emissions covered by mandatory carbon taxes and emissions trading schemes



Source: ING Research based on World Bank and DNB

However, just under 4% of these emissions are priced within the €35-70 range per ton of CO₂ that is currently needed to meet the 2°C temperature goal of the Paris Agreement. No emissions in carbon pricing schemes are priced around €130-140 per ton of CO₂ that the World Bank considers to be in line with the 1.5°C target.

So, the vast majority of global greenhouse gas emissions (almost 80%) is not priced at all. And the carbon price is usually too low to bring emissions in line with the climate goals. Corporate decision-makers should anticipate an increase in carbon pricing if policymakers stick to the Paris Climate Goals.

Carbon border taxes could become an issue in competition with foreign companies

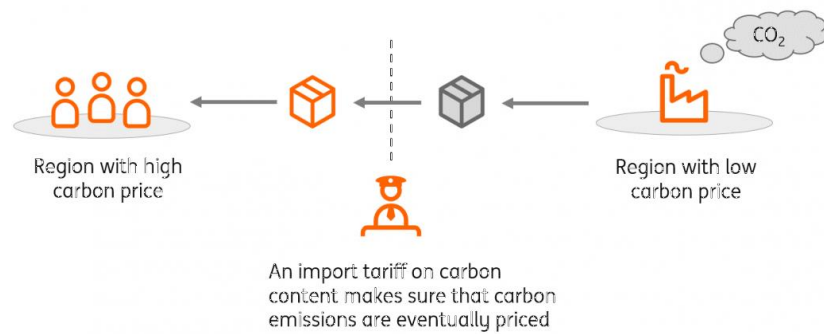
Mandatory carbon markets are local by definition as governments cannot act outside their jurisdictions. There is no global carbon market as a result.

Jurisdictions across the globe have their own carbon pricing mechanisms that result in different carbon price levels. For example, carbon prices currently stand at around €90/ton in the EU, about €72/ton in the UK, about €28/ton in California and around €6/ton in China.

Different prices levels create incentives for corporate decision-makers to relocate carbon-intensive activities towards regions with no or low carbon prices. It also works the other way round, providing incentives to keep existing activities in those regions. In both cases, carbon-intensive products are then imported back into the jurisdictions with higher carbon prices, a process called carbon leakage.

Hence the need for Carbon Border Adjustment Mechanisms (CBAM, a proposition by the [EU Commission](#)) to ensure a level playing field between major production and trade regions such as the European Union, the US and Asia (notably China and India). Of course, there wouldn't be a need for border adjustments if all major production regions in the world priced emissions locally and more or less at the same price.

A carbon border adjustment mechanism prices carbon emissions equally across the globe



Source: ING Research

The [CBAM](#) is a tariff on imports in line with the embedded carbon content of the product, which has not been taxed in the country where the good is produced. It ensures that the carbon emissions are eventually priced.

It also provides governments in producing countries with an incentive to increase carbon prices, as the CBAM would allow them to reap the tax benefits of the carbon policies themselves rather than allowing other countries to benefit from import taxes. That could bring about much-needed global coordination between countries to align climate policies and carbon prices. In the meantime, corporate decision-makers might include CBAM in their competition and pricing strategies.

Voluntary carbon offsetting schemes could be on the agenda...

Currently, most mandatory carbon pricing schemes apply to the power sector and manufacturing. Still, with increasing pledges to net-zero strategies, a growing number of companies are looking for ways to reduce or offset their emissions, whether or not they are already subject to mandatory schemes. They can do so in voluntary carbon markets.

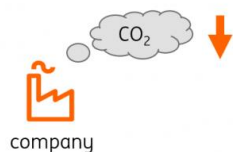
Voluntary carbon markets (in short VCMs) are initiatives that facilitate trade in emission units, called carbon credits, generated from emission reduction activities. Companies can participate in a VCM either individually or as part of an industry-wide scheme, such as the CORSIA.

Two ways to incentivise companies to lower carbon emissions

Mandatory versus voluntary carbon markets

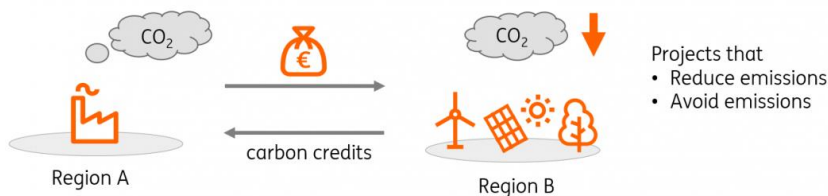
Mandatory carbon markets

Incentivise companies to lower their emissions as they have to pay a carbon price



Voluntary carbon markets

Provide companies a tool to voluntarily offset their emissions elsewhere



Source: ING Research

VCMs are often initiated by non-governmental bodies, as opposed to mandatory carbon markets that are set up by governments. VCMs often involve multiple countries. Usually one country has much lower abatement costs than the other country. Hence, VCMs provide a way to offset emissions in regions with the lowest abatement costs and direct green investment from richer to poorer regions.

Main differences between mandatory and voluntary carbon markets

Differences on goals, instruments and economics

	Mandatory carbon markets	Voluntary carbon markets
Goal and instrument		
Aim	Reducing carbon emissions. Each participant is attributed allowances which they can then trade to meet their carbon budget	Offsetting carbon emissions by preventing or reducing emissions elsewhere
Regulator	Government	No regulator. Independent standard-setters certify projects
Region	Within the jurisdiction	Often outside the jurisdiction
Scope	Mostly energy-intensive sectors (power sector and manufacturing)	Broad range of projects in all kinds of sectors
Instrument	Carbon allowances	Carbon credits
Climate impact	Uniform: every allowance taken out of the market saves a ton of carbon	Different: credits could mean a reduction but also a prevention of carbon emissions)

Economics

Effectiveness	Emissions reduction target is guaranteed by the overall cap	Problems with quality of credits and double counting
Efficiency	Target is met at the lowest costs (with the cheapest technologies within your company).	Emission reduction and/or avoidance happens in regions with the lowest costs (cheapest projects outside your company)
Moral hazard	No: it pays off to lower emissions if you are subject to a mandatory scheme	Yes: will companies reduce their own emissions forcefully if they can 'simply' offset their emissions?
Current market size	~10 gigaton CO2 globally	~0.2 gigaton CO2 globally

Source: ING Research

Carbon credits can be grouped into two categories dependent on the type of offsetting project that generates the credits:

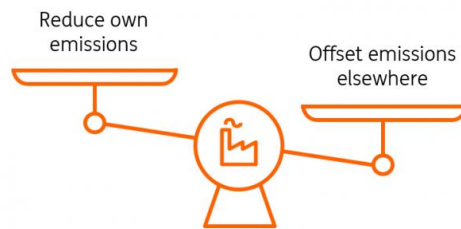
- 1 Avoidance projects avoid emitting greenhouse gasses. Projects to prevent deforestation are a case in point; they don't reduce emission levels but they prevent net emissions from rising as felled trees can no longer capture carbon.
- 2 Removal projects aim to actually reduce current emission levels.

So the quality of carbon credits differs in VCM. Removal projects tend to trade at a [premium to avoidance credits](#). Corporate decision-makers need to take this into account as not all carbon credits are considered effective and credible emission reduction strategies by shareholders, like NGOs, or employees.

One possible drawback from VCMs is that companies may behave less responsibly towards climate change if they can simply offset their emissions instead of having to reduce emissions themselves the hard way ([moral hazard](#)). Mandatory carbon markets simply force companies to lower their emissions or to pay a fine for it in terms of the carbon price.

Will companies voluntarily reduce emissions if they have the option to offset elsewhere?

Moral hazard dilemma in voluntary carbon markets



Source: ING Research

...now that COP26 reconnects mandatory and voluntary carbon markets

In the past, under the Kyoto protocol, there was a link between mandatory and voluntary carbon markets. In Europe for example, owners of power plants and factories in heavy industries could convert offsetting credits (Certified Emission Reductions, CERs) to carbon allowances in the EU Emissions Trading System.

This link was [removed](#) due to long-standing double-counting concerns about the quality of offsetting projects, mismanagement of projects, double-counting of credits and even fraud.

After years of negotiations, in the autumn of 2021, [COP26](#) agreed on a rulebook to eliminate most of these issues, referred to as Article 6 of the treaty. This is a little known, and technically complex, set of rules to strengthen VCMs. [Hence we dedicate a separate article to it.](#)

If implemented well, Article 6 could re-establish the conversion of offsetting credits to carbon allowances, putting both on the agenda of corporate decision-makers.

Voluntary carbon markets are changing for the better

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After years of wavering, voluntary carbon offsetting schemes are likely to be back on the agenda of corporate decision-makers. Here's a reminder of what corporate leaders need to know before considering whether to use them or not



Why carbon offsetting makes sense for corporate decision makers

Currently, most mandatory carbon pricing schemes, like the EU Emissions Trading System, apply to the power sector and manufacturing. We unravelled the economics of these schemes and why they matter for corporate decision-makers here.

But many companies are not part of mandatory carbon pricing schemes, like retailers, wholesalers, contractors, carriers, farmers. They too want to make their businesses more sustainable, and an increasing number is committing to net-zero emission strategies.

In some of these industries, particularly outside the power sector and manufacturing, the cost of reducing emissions with today's technologies might be prohibitively expensive or impossible.

That's precisely where offsetting schemes could play a role in achieving a company's voluntary climate objective: neutralising residual emissions that are still deemed unavoidable today until a technological alternative becomes available on the market. In the absence of mandatory carbon schemes, they can participate in voluntary carbon markets. These voluntary carbon markets have recently attracted a growing number of entrants such as oil companies alongside companies like [Alphabet](#) or [Disney](#), which have been using carbon offsetting for many years.

How voluntary carbon markets work

So, voluntary carbon markets allow corporate leaders to offset carbon emissions that can only be reduced at a high cost or to offset unavoidable emissions. It works by purchasing carbon credits aimed at averting greenhouse gas emissions or permanently removing them from the atmosphere – typically by planting trees, the most popular type of offset project.

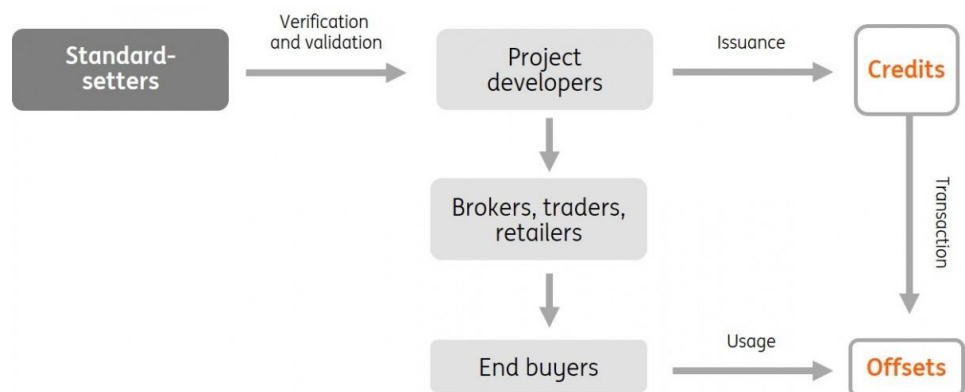
Such offsetting schemes are 'voluntary' and unregulated, unlike 'compliance' markets such as the EU's Emission Trading System (ETS), with legal obligations and public interventions to push prices up.

[Voluntary carbon credits](#), which are also referred to as offsets, are financial tools issued by project developers that avert or remove GHG emissions from the atmosphere. Each offset must demonstrate that one ton of CO₂ (or equivalent GHG) has been averted or removed from the atmosphere.

For a carbon reduction project to generate credits, it needs to respect a set of criteria certified by independent standard-setters like [Gold Standard](#) or Verified Carbon Standards ([Verra](#)). Once the credits are generated, they can be either traded over the counter or used towards a corporate climate target. The price of a credit is originally determined by the cost of the offsetting project, and to a large extent, by supply and demand.

Four types of participants make up voluntary carbon markets

Schematic overview of voluntary carbon market



Source: ING Research based on S&P Global Platts

Credibility is the key challenge

Concerns over the quality and the integrity of carbon offsetting schemes have plagued them since their early days, some 20 years ago following the [Kyoto Protocol](#).

Critics often argue that offsets [do not deliver the environmental benefits they promise](#) and that the unregulated and fragmented markets offer companies a [licence to pollute](#). They may, in theory, create a false incentive for companies to believe they can continue with their current business model.

But they also have the potential to bring capital flows into the global south where it is [crucially needed](#). Carbon credits could also be additional tools for companies to offset more emissions than they have historically created, provided that credible offsetting projects of high quality are used.

Another critical question is whether offset-generating renewable energy projects truly depend on [carbon finance](#). Indeed, one of the most important criteria required by the major certification bodies of offsets (so-called 'standards' like Verra or Gold Standard) is that of 'additionality'.

The concept of 'additionality' is a crucial criterion for the credibility of offsets. It is the assurance that the reduction in emissions resulting from a project is additional to what would have occurred if it had not gone ahead. Financial additionality is key for the credibility of offsets, meaning that an offsetting project could not have gone ahead without the extra revenues resulting from the sale of carbon credits.

Permanence is another key criterion to ensure that offsetting activities, such as tree planting, will last in perpetuity. Recent forest fires in the [American west](#), burning vast expanses of protected forest which were part of carbon offset projects have illustrated the challenge of ensuring such criterion (once a tree burns, it releases all the carbon it captured back into the atmosphere).

Two dynamics are driving growth in voluntary carbon markets

Despite criticism for failing to deliver the climate benefits promised, some [reports](#) suggest that global demand could rise by 15 times by 2030 and 100 times by 2050. Growth is mainly driven by airlines through the sector-wide [CORSIA](#) market, by companies especially in hard to abate sectors, and by governments. The latter could use offsetting strategies to reach [NDC targets](#), either by buying credits themselves or requiring corporate leaders to do so on behalf of their companies.

However, voluntary carbon markets are still marginal right now, covering less than 1% of global greenhouse gasses in 2020, though the market momentum cannot be ignored, with the volume of offsets sold rising above \$1bn for the first time in 2021. Two dynamics are likely to follow:

- First, civil society led initiatives are working on guidance to inform companies on when and how carbon credits can be used as part of credible corporate climate commitments.

In a nutshell, they should only be used to compensate for a small volume of residual pollution that cannot be eliminated otherwise. The Science-Based Targets initiative ([SBTi](#)), the global green gold standard for businesses, now allows companies to factor in carbon offsets as part of their transition journey to net-zero – but only after science-based goals covering the next five to ten years have been adopted and once groups have slashed 90% of their emissions. The [IFRS Foundation](#) is also working on providing guidance for the treatment of offset credits in corporate financial and non-financial statements.

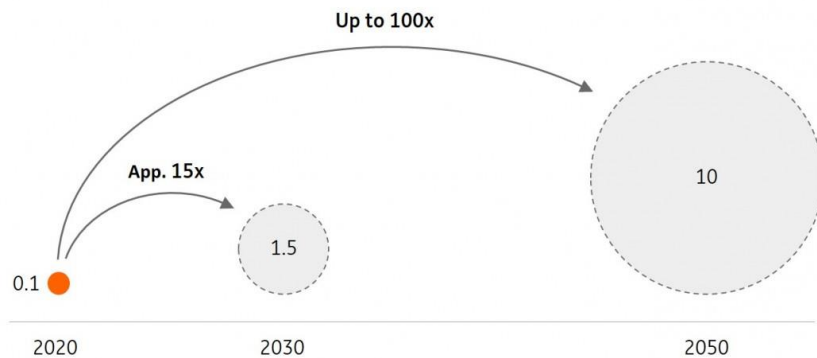
- The second dynamic aims to secure the quality of offset credits and to expand their quantity.

The Taskforce on Scaling Voluntary Carbon Markets ([TSVCM](#)), headed by former Bank of England Governor Mark Carney, thrashed out a set of core underlying features that carbon credits should adhere to, called the core carbon principles, in an attempt to harmonise carbon certifications. The five core principles are additionality, permanence, exclusive claim, overestimation and the provision of additional co-benefits in line with the UN's Sustainable Development Goals.

The next steps should be about developing standardised contracts and trading infrastructure to help overcome known shortcomings like low liquidity, scarce financing and limited data availability. A series of newcomers, like [asset managers](#), could offer the liquidity and [transparency](#) markets crucially need.

Global demand for voluntary offsets is expected to boom

Voluntary demand for carbon credits, gigatons of CO₂ per year



Source: ING Research, expected figures are approximated from McKinsey scenarios

Article 6 of the Paris Agreement is likely to boost government-to-government carbon transactions

Article 6 of the Paris Agreement has made it possible for countries to purchase emissions reduction abroad and use this towards their own targets, as long as a set of rules are respected. It also agrees that entities other than governments could do so (which includes voluntary carbon markets). After six years of negotiations, this was finally agreed in the [very last hours of the COP26 in Glasgow](#).

The text sets a framework to ensure that any emissions reduction units generated by projects abroad may only be used towards a country's nationally-determined contributions (NDC) if there are corresponding adjustments in place. In other words, when an emissions reduction unit is sold abroad, the host country (where the project takes place) must cancel out the impact on its own carbon inventories accordingly to mirror the transfer.

This solution was one of the stickiest points of the negotiation, but it avoids one emissions reduction unit being counted by two countries. Practically, it means that only credits which are adjusted for under Article 6 can be used towards another country's NDC, which guarantees credibility.

Article 6 in the spotlight

[Article 6.2](#) provides an accounting framework for international cooperation, such as linking the Emissions Trading Systems of two or more countries. It also allows for the bilateral transfer of carbon credits between countries and other entities (so-called Internationally Transferred Mitigation Outcomes, 'ITMO').

[Article 6.4](#) establishes a centralised UN mechanism (successor of the [Clean Development Mechanism](#) from the Kyoto Protocol) to certify tradable credits from emissions reductions generated through offset projects.

For example, an investor in country X could fund solar panels in country Z to replace electricity generated by a coal plant. Emissions are reduced, country Z benefits from the clean energy and, as long as the emissions reductions exceed country Z's Paris target, the investor can sell the credit to country X to use towards its Paris target.

Corporate leaders, mind you for greenwashing

However, Article 6 does not make corresponding adjustments mandatory for all voluntary market initiatives. It provides a framework where both would be allowed but doesn't say what they can be used for. Importantly for corporate decision-makers, it means that voluntary offsets without corresponding adjustments can still be used by

companies claiming carbon neutrality, keeping the door open for greenwashing (eco-friendly marketing spin).

In the past, companies like [Volkswagen](#) and [Shell](#) have been accused of reporting their carbon emissions incorrectly and being too heavily reliant on offsetting strategies. It is clear that NGO's like [Greenpeace](#) are no fans of carbon offsets.

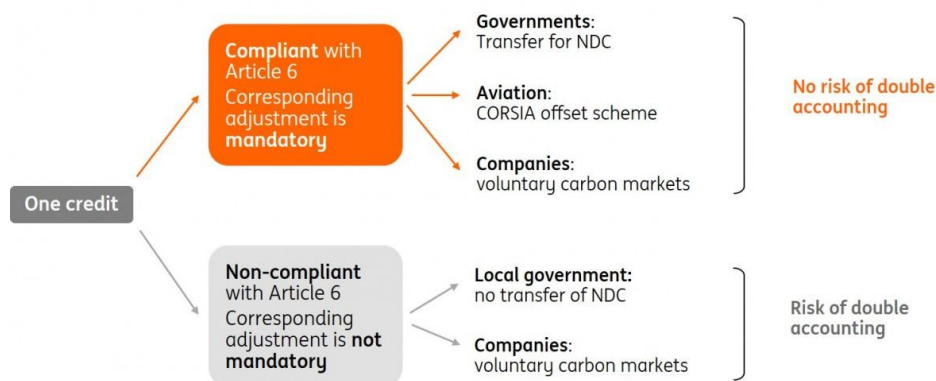
The big question coming out of the COP26 in Glasgow is to what extent private voluntary carbon markets comply with the new Article 6 framework.

Ultimately, companies will have the freedom to use offsets towards carbon neutrality claims that do or do not have a corresponding adjustment. Additional guidelines from civil society initiatives and regulators are therefore needed.

The reputational risk that comes with it is already an incentive to focus more on offsets involving a corresponding adjustment. Plus, the Article 6 framework may further encourage improvements of third-party standard setters like Gold Standard or Verra to require corresponding adjustments in voluntary markets, leading to a greater level of credibility.

But it might not be enough. Reputational risk will not drive change on its own. With a large number of voluntary market standard-setters of various quality and little institutional oversight, offsetting schemes could continue to be perceived as the wild west – leaving some room for additional guidelines and more stringent standards.

Corresponding adjustments are mandatory under the Article 6 framework, but not for all offset credits



Source: ING Research

Price of carbon credits is still inconsistent with the economics of carbon reduction

Companies buying carbon credit in voluntary markets can already choose credits stemming from avoidance or removal projects through nature-based or tech-based solutions.

The latter category tends to trade at a premium to avoidance projects as the investment level to reduce emissions is generally higher. Demand for these projects from sustainable companies or investors is also generally higher as they are more powerful tools than avoidance projects.

Right now, credits can be bought with or without a corresponding adjustment. The two types of credit result in another price differential for voluntary market participants, based on whether an offset credit implies a corresponding adjustment (sold at a premium) or not.

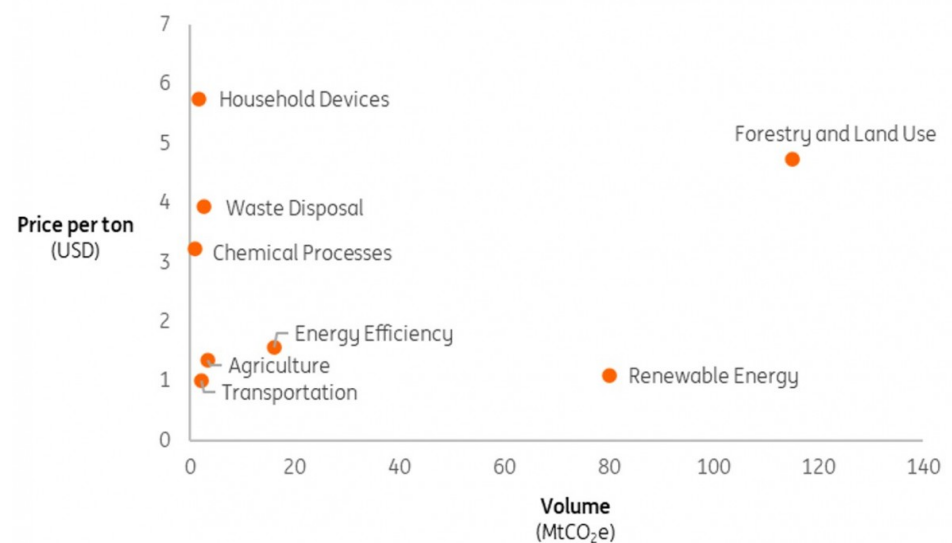
We show in the graph below that the volume and average price of offsets already vary significantly per category of projects due to differences in quality. Forestry and land use projects and renewable energy projects are by far the most popular categories for offsetting. With land use projects trading at prices five times higher than renewable energy projects.

Note that qualities and options also vary within each project category. Unfortunately, due to the lack of transparency in voluntary carbon markets, price spreads data within each category are hard to get hold of.

The result is that most of the offset credits are available for less than €5 – much cheaper than the cost to reduce a ton of carbon with current technologies. In Europe, those costs are represented by the carbon price in the EU ETS, which currently stands at around €90/tCO₂. This is much lower than the global price of carbon needed to be consistent with the temperature goals of the Paris Agreement, [which should be between €100-€150 per ton CO₂ by 2030](#).

Prices and demand for offsets differ widely between project categories

Average price and volume of carbon offsets per project category in 2020, MtCO₂e



Source: ING Research based on Ecosystems Marketplace

Concluding remarks

From the current market dynamics and latest developments at COP26, we conclude that the lines are changing within the offsetting world, putting carbon credits on the agenda of corporate decision-makers:

- Voluntary carbon offsetting makes sense as a last resort to neutralise a company's residual emissions until a technological alternative becomes available on the market or becomes financially viable.
- Public and private initiatives are flourishing to scale up voluntary carbon markets. They bring more credibility and liquidity to offsetting schemes – two characteristics particularly praised by private actors. There is still a lot of room to improve transparency and data availability.
- The new Article 6 framework could further improve the credibility of voluntary markets.
- It is misleading to believe that voluntary carbon markets are the solution to the climate crisis. Corporate decision-makers need to avoid accusations of

greenwashing. Even if offset credits become more credible with corresponding adjustments, prices are likely to remain much lower compared to mandatory carbon markets that are focused on reducing companies' [emission levels](#).

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