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Argus White Paper:

German industrial emissions

Europe's heavy industry is under pressure to cut its emissions. The greenhouse gas output of EU industry has barely fallen since 2013 - a trend that has not gone unnoticed by policymakers.

In a bid to accelerate emissions cuts in sectors such as steel, chemicals and cement, the EU is considering the introduction of a carbon border tax. This could see industrial sectors lose their free allocation of allowances under the the EU emissions trading system (ETS), in exchange for protection against cheaper imports. Further reforms to the European carbon market may also be on the way, which could hike carbon costs for industry.

Germany makes up a fifth of EU ETS industrial emissions, putting it on the front lines of these changes. So how are the country's largest-emitting sectors planning to decarbonise and what carbon pricing policies would they support?

German industry backs EU CO2 border tax

The EU emissions trading system (ETS) is failing to shield industry from carbon leakage, and the EU should introduce carbon border measures to help European firms compete internationally, some of Germany's largest industrial companies have said.

Calls for an EU-wide carbon border tax have increased in recent months, after European commission president-elect Ursula von der Leyen pledged to introduce legislation proposing the idea in her first 100 days of office. She begins her five-year term in November.

A carbon border tax would impose a levy on imports into the EU from non-EU countries, so that the imported product is subject to CO2 costs comparable with if it had been made in Europe, where its emissions would have been covered by the EU ETS.

The price of an EU ETS permit, which allows a company to emit one tonne of CO2, has more than tripled since the start of 2018. The EU gives free ETS allowances to industry to attempt to avoid carbon leakage, which occurs when firms relocate to non-EU regions to avoid paying ETS costs.

But this system is not working, according to industrial firms.

"If you want to keep industry in Europe, additional carbon leakage measures have to be implemented. That could be a carbon border adjustment," HeidelbergCement's EU public affairs director Rob van der Meer said.

EU cement-makers say they are struggling to compete with firms in countries such as Turkey and Egypt, which have lower production costs, partly because they do not face the EU's CO2 costs. It is also relatively cheap to ship cement and clinker to Europe from countries further afield, such as China, which accounts for more than half of the world's cement production.

These challenges will become more acute from 2021, when the EU will tighten the amount of free permits it gives to industry.

"This will become even more evident in phase four of the EU ETS [2021-30], when the free allocation changes," HeidelbergCement Berlin liaison office head Christoph Reissfelder said.

German chemicals firm BASF also called for carbon border measures to help EU firms stay competitive.

Emissions

illuminating the markets

"We need a competitive CO2 price globally, but until then we need compensation on the border, otherwise our products will be so expensive that we will not be able to sell them on the global market," BASF head of energy and climate policy Claus Beckmann said.

One way to implement border measures would be to define carbon benchmarks for product groups, and apply these to all imports, regardless of which country the product comes from. Applying the tax to products, rather than specific countries, could help ensure it complies with World Trade Organisation rules, Beckmann said.

'Second best'

German industry associations also back EU carbon border measures, but said an international ETS would be a more efficient way to support decarbonisation in their sectors.

Higher EU ETS costs are "really reducing our international competitiveness in a very difficult international environment", German steel association Wirtschaftsvereinigung Stahl executive director Martin Theuringer said, pointing to challenges including global steel overcapacity, market dumping and risks arising from the US-China trade war.

The EU can tackle carbon leakage by giving industry more free ETS permits, or by compensating firms for their electricity costs if higher carbon prices cause power prices to rise, he said.

"But if all this fails, then of course we have to think about developing new instruments to integrate other countries' supplies into our carbon pricing system, and that is basically a border adjustment," he said.

EU carbon border measures are likely to become necessary, according to German industry, mining and chemical trade union IG BCE's head of energy and economic policy, Ralf Bartels. But they "will always be second best to an international emissions trading system", he added.

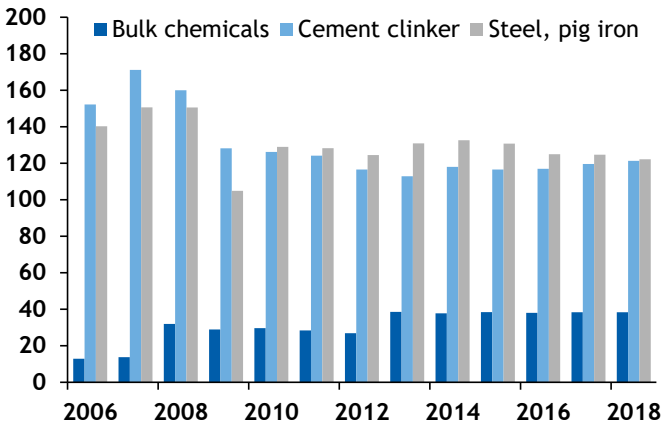
A carbon border tax is not without risks. One concern is the threat of retaliatory measures from other countries, according to Heiko Reese, head of metal workers' union IG Metall's office in Dusseldorf.

And a product-based tax could be hard to implement in the chemicals sector, as calculating and applying a carbon duty to thousands of different products would be a practical challenge, the German chemical industry association's head of energy and climate, Jorg Rothermel, said.

Industrial emissions

Europe's heavy industry will face increasing pressure to cut its emissions in the coming years — especially if the EU sets an economy-wide target to reach net zero emissions by 2050, which would probably require all sectors to cut emissions by at least 95pc.

EU ETS emissions for selected sectors *mn t CO_2*



Emissions from EU industry have barely fallen since 2013, while the EU power sector has cut its emissions by 17pc over the same period.

Some industrial sectors have performed better than others. ETS emissions from steel production were 122.2mn t CO2 equivalent (CO2e) last year, down by 7pc compared with 2013. But emissions from cement production increased by 7pc over the same period to 121.3mn t CO2e in 2018 (*see chart*).

Environmental groups say that the EU's decision to give industry free allowances has reduced the incentive for these sectors to cut CO2 emissions. The cement sector received roughly 64mn more free permits in 2013-18 than its EU ETS emissions over the period — although this accounts only for emissions from cement production, and not from the sector's fuel combustion to generate power.

There are also technological challenges to reducing emissions in industry, with no quick fix to decarbonising some CO2-intensive industrial processes, while the power sector can make large CO2 savings by switching from coal to gas-fired power generation.

Many of the technologies that industrial sectors are betting on — such as using hydrogen instead of coal to produce low-carbon steel — have not yet reached commercial scale. These technologies require large investments in order to reach commercialisation, and could increase the cost of steel production by 20-30pc. EU steel firms say they need public funding to help them bear these costs and remain competitive.

CO2 border tax would 'replace' EU ETS free allocation

The EU's plan to introduce a CO2 border tax would likely see the bloc phase out free allocation for industry in the EU emissions trading system (ETS), carbon market observers have said.

European Commission president-elect Ursula von der Leyen, who takes office in November, has pledged to introduce an EU-wide carbon border tax — a move she says would "ensure our companies can compete on a level playing field".

A border tax would apply a levy to goods coming into the EU, so that the price of imports from non-EU countries included a CO2 cost equivalent to the EU's. The idea is to avoid carbon leakage, the risk that EU companies would relocate to other regions to avoid paying carbon taxes.

Market observers said an EU carbon border tax would likely replace, rather than exist alongside, free allocation for industry in the EU ETS. The EU currently gives free ETS allowances to industrial sectors deemed at risk of carbon leakage, to reduce their CO2 costs.

"My working assumption is that border-adjustment taxes would have to be phased in over time given their complexity and as a result that free allocations would also have to be phased out over time," bank BNP Paribas' head of sustainability research Mark Lewis said.

Double protection

Introducing carbon border measures alongside EU ETS free allocation would risk "doubling up" on policies to shield industry from carbon leakage, climate change think-tank Sandbag said.

"Free allocation is generally inconsistent with a carbon border tax, not least because World Trade Organisation [WTO] law does not allow double protectionism," Sandbag analyst Dave Jones said.

Non-governmental organisation Carbon Market Watch (CMW) warned that having both measures in place would reduce the incentive for firms to cut their emissions.

"If free pollution permits were kept in place while introducing carbon border taxes, European industry would have no incentive to clean up its act," CMW policy director Sam Van den plas said.

Environmental groups say EU ETS free allocation has taken the pressure off industrial firms to cut CO2. Emissions from EU industry stood at 587mn t of CO2 equivalent last year — roughly unchanged from 2013.

High-carbon industries like steel and cement will face increased pressure to cut CO2 in the coming years, as von der Leyen rolls out her flagship "European green deal" policy — a package of measures aimed at reducing EU emissions to net zero by 2050.

Reaching net zero will require large CO2 cuts across all sectors. A border tax, by helping companies stay competitive while they decarbonise, could help address the concerns of critics who say the EU's climate ambitions will place a burden on industry and put jobs at risk.

The measure has the support of some of Europe's largest industrial companies, which say they are already struggling with carbon leakage because of the steep rise in EU ETS prices since 2018. Luxembourg-based steelmaker ArcelorMittal describes border measures as "an effective and fair way to ensure every country plays its part in reducing global CO2 emissions."

Decarbonisation plans

2018 EU ETS emissions	*Key source of emissions*	*Key decarbonisation technologies*	*Challenges*
Steel			
122.2mn t CO2 (from pig iron and steel production) 7pc of total ETS stationary emissions	To make pig iron, iron ore and coke – a product made from coking coal – are heated together in a blast furnace. The coke absorbs oxygen from the iron ore and produces CO2.	The coke in this process can be replaced by hydrogen. This results in water, rather than CO2, being produced. It also removes the need to turn coal into coke – another CO2-intensive process.	Producing the hydrogen would require large amounts of low-CO2 electricity. The high cost of low-carbon hydrogen means this method is not commercially viable.
Cement			
121.3mn t CO2 (from cement clinker production) 7pc of ETS stationary emissions	To produce clinker, limestone is heated in a kiln to above 800°C, causing the CO2 in the stone to be released. This process accounts for two-thirds of emissions from cementmaking.	In the absence of alternative methods of clinker production, industry groups are betting on carbon capture technology. Switching to electric kilns could also dent emissions.	CCS remains expensive – costs for projects in the cement sector range from €92-172/t of CO2. Firms say using electric kilns would massively increase their power demand, making their products too expensive to be competitive.
Chemicals			
38.36mn t CO2 (from bulk chemicals production) 2pc of ETS stationary emissions	Hydrogen production from natural gas (methane) is the most emissions-intensive process in the sector. Most production processes are energy intensive, with their emissions dependent on what fuel is used to produce that energy.	Switching to hydrogen made from low-carbon electricity could cut emissions from some chemicals by 100pc. Using biomass, rather than fossil fuels, as a feedstock for chemicals such as methanol and ethylene could also cut CO2.	Green hydrogen is 3-4 times more expensive than hydrogen produced from methane. Biomass-based chemicals production is more energy-intensive, and feedstock availability is a challenge.

'Diplomatic quagmire'

Von der Leyen has so far given no specifics on how an EU carbon border tax would work — aside from telling her nominee for EU economy commissioner, Paolo Gentiloni, that the measure must be compliant with WTO rules.

The complexity of setting CO2 tariff levels across a range of subsectors, and agreeing those levels with other countries, could become a "diplomatic quagmire" for the EU, Mark Lewis said.

But he added that the bloc's position as a large market, which other countries want access to, should give it leverage in these talks. "I think it is ultimately both technically and politically possible to implement border-equalisation taxes," he said.

Implementing the policy will be easier in some sectors than others. Europe's chemicals firms manufacture thousands of different products — applying a specific carbon duty to each one would be a practical challenge, industry representatives warn.

Another practical hurdle is that an EU-wide CO2 border tax would require unanimous support from member states. To get around this, von der Leyen wants the EU to move from unanimity to qualified majority voting on tax and energy matters.

Ultimately, a CO2 border tax is a fallback solution, seen as second best to having a global carbon price.

"In an ideal world, all countries would charge for emitting CO2, but given this won't happen for a while, the prospect of a carbon border tax is an exciting solution to this problem," Jones said.

The EU hopes border measures would incentivise non-EU countries to introduce tougher climate policies, so they can import products into the EU market without having to pay the tax. This would have the dual advantage of driving global CO2 cuts, and positioning the EU as an international leader on climate change.

Cement industry urges no more EU ETS reforms

Europe's cement industry has urged the EU not to make further changes to its emissions trading system (ETS) to provide investment certainty for the sector.

The EU agreed a package of EU ETS reforms last year, designed to tighten the supply of allowances and support prices in the market's next trading phase (2021-30).

The changes sent carbon prices soaring, more than tripling from €8/t of CO2 equivalent (CO2e) at the start of 2018 to €25/t CO2e at the end of the year. EU ETS prices became more volatile and liquidity in the allowance market rose sharply, as compliance buyers scrambled to buy permits, and investor money flooded into the market.

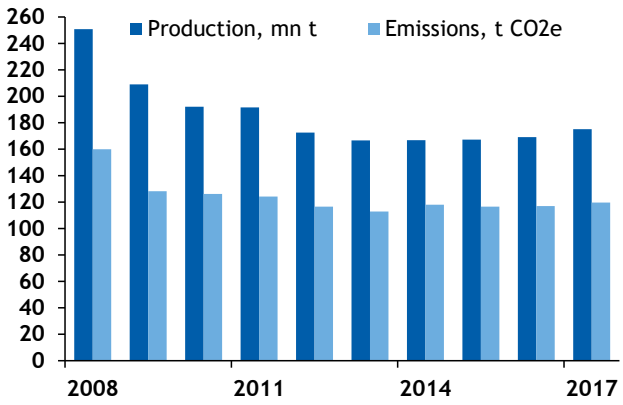
But the EU is already considering further carbon market reforms, as the bloc strives to cut its CO2 emissions and contribute to the goals of the Paris climate agreement.

European Commission president-elect Ursula von der Leyen wants the EU to set a tougher emissions reduction target for 2030 and reach net zero emissions by 2050 — targets she says may require changes to the EU ETS legislation during the 2020s.

The cement industry has urged policy makers to leave the carbon market alone. Changes to the carbon market rules in recent years have undercut cement firms' ability to invest in low-carbon technologies, according to cement industry association Cembureau. Cement firms work on investment cycles lasting 25-30 years — meaning that investment decisions taken today will decide the sector's emissions in 2050.

"Cembureau is not in favour of further reforms to the ETS. The current ETS, as adopted for the next trading period, provides for a clear regulatory framework that should be implemented before a further review of the regime is conducted," Cembureau chief executive Koen Coppenholle said.

EU cement production, cement clinker ETS emissions



Parts of the EU ETS reform package have not yet been finalised, including benchmarks that will calculate how many free permits industrial emitters receive in the 2020s, and the rules on compensation for indirect CO2 costs. And the EU should not review the ETS before these measures have been confirmed, Coppenholle said.

"We would be happy if there would be no fundamental changes to the phase four framework, so that we have legal certainty over the next ETS phase. It is about predictability," German cement association VDZ's head of political and economic affairs Manuel Mohr said. Germany is the EU's largest cement-producing country.

Technologies to cut emissions from cement production have long lead times and high costs. VDZ expects carbon capture and storage (CCS) to play the biggest role in decarbonising cement production, but does not expect widespread commercial deployment of CCS until 2030. Other options, such as extracting recycled cement from waste concrete, or swapping clinker — the binding agent in cement — for low-carbon alternatives, exist only as pilot projects or are too expensive to be widely adopted.

Firms can only make such investments if "reasonable returns are assured and EU companies can compete fairly with counterparts outside the EU," Coppenholle said.

Tougher emissions targets

From the EU's point of view, EU ETS reforms will probably be necessary in the next decade to meet the bloc's climate policy aims.

Von der Leyen wants to set a target for the EU's 2030 emissions to be 55pc below 1990 levels. The current 2030 target is for a 40pc emissions cut.

In its current form, the carbon market is not compatible with this goal. The EU ETS sets a cap on the total amount of emissions that can be produced by the roughly 11,000 installations covered by the scheme. The cap is reduced over time so that emissions fall — the current rules mean that ETS emissions in 2030 will be 43pc below 2005 levels.

According to French bank BNP Paribas, the rate at which the ETS cap is reduced each year would need to more than double, to hit von der Leyen's planned 2030 target.

Impact of current reforms

Sharp gains in EU ETS prices since the start of 2018 caught some industrial companies by surprise, as the cost of their carbon compliance obligations has more than trebled.

The price gains were driven mainly by the centrepiece of the EU ETS reforms package — a new market stability reserve (MSR) mechanism, which in 2019 began sucking spare allowances out of the market and placing them in a reserve.

But despite the spike in carbon costs, EU ETS emissions from cement production increased last year.

EU-28 cement production increased every year in 2014-17, hitting a six-year high of 175.1mn t in 2017, the latest year for which data are available (*see chart*). Production is still comfortably lower than it was before the 2008 financial crisis, which saw EU cement output drop by roughly a third.

EU ETS emissions from cement production were 121.3mn t CO2e last year, roughly 7pc higher than at the start of the current EU ETS phase in 2013.

Companies in high-emissions industries such as cement, steel and chemicals production receive free carbon credits from the EU to help shield them from carbon leakage. The cement sector received roughly 64mn more free permits in 2013-18 than its EU ETS emissions over the period — although this accounts only for emissions from cement production, and not from the sector's fuel combustion to generate power.

German industry seeks CCS opportunities

Industrial companies are eyeing opportunities for carbon capture and storage (CCS) projects in Germany, where the technology has failed to take off because of factors including strong public opposition.

CCS has been seen as politically untouchable in Germany, given public disapproval of onshore CO2 storage sites, and opposition from environmental groups, which say that the technology could be used to extend the life of coal power plants.

Germany has no large-scale CCS facilities in the pipeline. The country's only commercial-scale CCS project — a demonstration facility at Vattenfall's Janschwalde lignite-fired power plant — was shelved in 2011 because of a lack of political support.

The technology remains "highly controversial", chancellor Angela Merkel said in May.

But there are signs that the CCS debate is being revived.

Germany's climate cabinet unveiled a package of measures last week to put the country on track to meet its emissions reduction targets. The plan included CCS and carbon capture and usage as options to decarbonise industry.

The EU also wants to adopt a target to reach net zero emissions by 2050 — a move that Germany supports. Meeting this aim will be very difficult without CCS.

"There is a different discussion now, in the sense that CCS might be the last option to get rid of CO2 which is not avoidable with technologies," German chemicals firm BASF's head of energy and climate policy Claus Beckmann said.

German policymakers appear more willing now to address public concerns about CCS that have "hindered its uptake" to date, Global CCS Institute advocacy manager Guloren Turan said.

The economy ministry and environmental group WWF Deutschland were among the speakers at a CCS conference in Oslo earlier this month — a sign that their attitudes to the technology are thawing, some observers said.

Industrial CCS

The CCS debate in Germany has tended to focus on the technology's use in coal power plants, raising criticism from environmental groups which say that this would extend the lifespan of these plants and crowd out new renewables generation.

But some observers see a chance to shift the focus to CCS in industry, now that the government has agreed to close the country's coal-fuelled power generation by 2038.

The coal exit presents a "new window of opportunity to discuss [CCS] again in a more neutral context," the German cement association's head of political and economic affairs Manuel Mohr said.

The cement sector is betting on CCS to decarbonise industrial processes for which low-carbon alternatives do not yet exist, such as converting limestone into clinker, which accounts for more than half of the emissions from cement production.

CCS promises a less disruptive way of cutting emissions for cementmakers than finding new methods of production. With CCS, companies could continue using the same industrial processes but capture and store the CO2 they produce, resulting in zero emissions.

"Carbon capture will play the largest role when it comes to decarbonising our sector in the long run," Mohr said.

Subsea storage

Projects to store CO2 offshore, rather than onshore in Germany, could also make CCS more palatable to voters.

Onshore CCS remains "not very popular" in Germany, but subsea storage has less public opposition, German research institute the Wuppertal Institut's vice-president Manfred Fischedick said.

Some European countries are already storing CO2 in subsea sites. Norway has been using natural gas fields to store CO2 since the 1990s, and its government plans to launch a full chain of CCS infrastructure — Europe's first — based around a North Sea reservoir. This could enable CO2 emissions from other countries to be transported to Norway and permanently stored.

High costs

Even if the public warms to the idea, the cost of CCS remains prohibitively high.

The cost of capturing and storing a tonne of CO2 in the cement sector can stretch to €175/t CO2. At these costs, the EU carbon price is nowhere near high enough to persuade industrial companies to invest in CCS, instead of buying carbon credits that allow them to continue emitting. The cost of an EU carbon credit has ranged from roughly €18-€30/t CO2 in 2019.

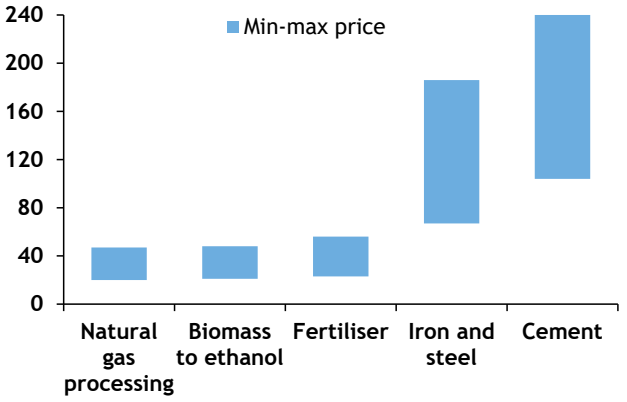
Industrial firms say they need more support from governments to develop CCS, particularly to scale up pilot projects to commercial scale.

A project testing technology to separate CO2 during cement production at HeidelbergCement's plant in Lixhe, Belgium, has received €12mn in EU grants, alongside €9mn in private funding. The next stage of that project, to test whether the separated CO2 can be captured or used in another industrial process, is dependent on more public support, the firm said.

EU funding programmes have so far failed to get large-scale CCS projects off the ground. And some national governments have cancelled funding for projects at short notice, rattling investors.

A new EU fund to support technologies including CCS will open to applications next year. The "innovation fund", which is currently valued at around €11.5bn, will give money to CCS projects in the early stages of development, a move the EU hopes will avoid the pitfalls of previous funding mechanisms.

First-of-a-kind CCS project costs $/t CO_2$



An older EU fund, designed to give money to projects only when they had started operating, did not lead to any CCS projects being built.

Observers in Germany say the government must also establish a regulatory framework for CCS, to kick-start investments. A lack of regulatory certainty "prevents companies from investing" in the technology, WWF Deutschland said.

EU fund to help make CCS cost competitive

The EU plans to use an €11.6bn pot of funding to help close the gap between the EU emissions trading system (ETS) price and the cost of carbon capture and storage (CCS) projects.

The EU innovation fund will offer subsidies to CCS projects in the 2020s, with the fund made up of the proceeds of the sale of 450mn EU ETS allowances. Based on the average EU ETS price in September, it would contain roughly €11.6bn.

This will be the EU's "main funding source for CCS", according to outgoing climate commissioner Miguel Arias Canete.

Projects can apply for innovation fund subsidies to cover up to 60pc of the difference between the cost of an EU ETS allowance — which enables a company to emit a tonne of CO2 — and the cost of capturing a tonne of CO2 using CCS technology.

Carbon capture technology is seen as vital if the EU wants to reduce its greenhouse gas (GHG) emissions to net zero by 2050 — a target endorsed by European Commission president-elect Ursula von der Leyen.

To reach this goal, the EU would need to reduce the majority of its emissions, and offset the remainder using CO2-absorbing forests or emissions removal technologies.

CCS will be "one of the most important" tools the EU uses to offset its emissions," Canete said.

The innovation fund "should help kick-start the next wave of CCS projects in Europe", Global CCS Institute advocacy manager Guloren Turan said.

High costs

CCS projects have struggled to get off the ground in Europe because of the technology's high costs and a lack of successful subsidy programmes.

Of the 19 large-scale CCS facilities in operation globally, only two are in Europe.

EU carbon prices have tripled since 2018, but are still not high enough to persuade industrial companies to invest in CCS to capture emissions, instead of buying ETS permits that allow them to continue emitting.

The cost of capturing and storing a tonne of CO2 in the cement sector can run as high as €175/t CO2. By comparison, the EU ETS front year contract's closing price in September ranged from €24.71/-€27.03/t CO2.

CCS costs are significantly lower in other sectors — first-time projects cost up to €25/t CO2 in the natural gas processing industry. But EU carbon prices have been highly volatile over the past few years, and have struggled to provide a consistent price signal to support long-term investments in CCS.

Northern Lights project

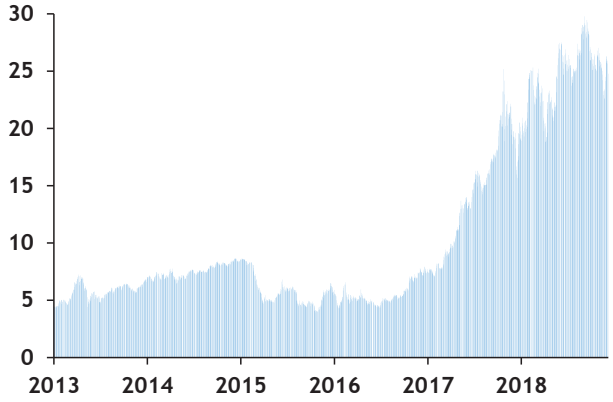
Norwegian state-controlled Equinor has signed preliminary agreements with seven firms to develop a project to store CO2 emissions under the North Sea.

The development of the CO2 storage site will help the Norwegian government decide whether to pursue its Northern Lights project, a state-funded effort to set up a chain of CCS infrastructure in Norway.

If successful, this could enable CO2 emissions from around Europe to be transported to Norway and permanently stored in a sub-sea reservoir.

The world's largest steelmaker, ArcelorMittal, Finnish state-owned energy company Fortum Oyj and Germany-based HeidelbergCement are among the firms to have signed initial deals to work with Equinor on the CO2 storage project. Equinor, Shell and Total will co-fund the project, and aim to take a final investment decision on it next year.

Front year EU ETS price since 2013 *€/t CO_2e*



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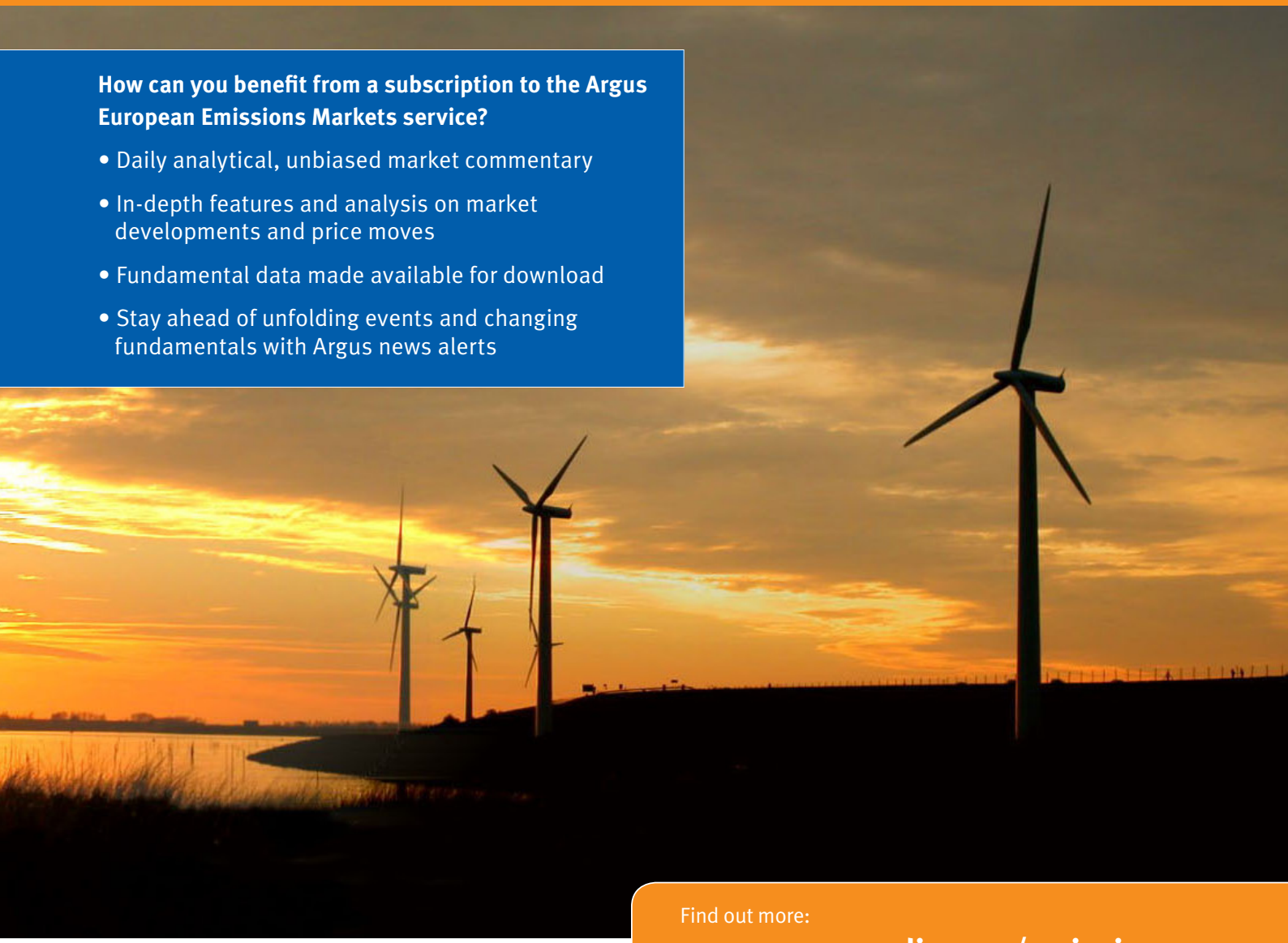

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