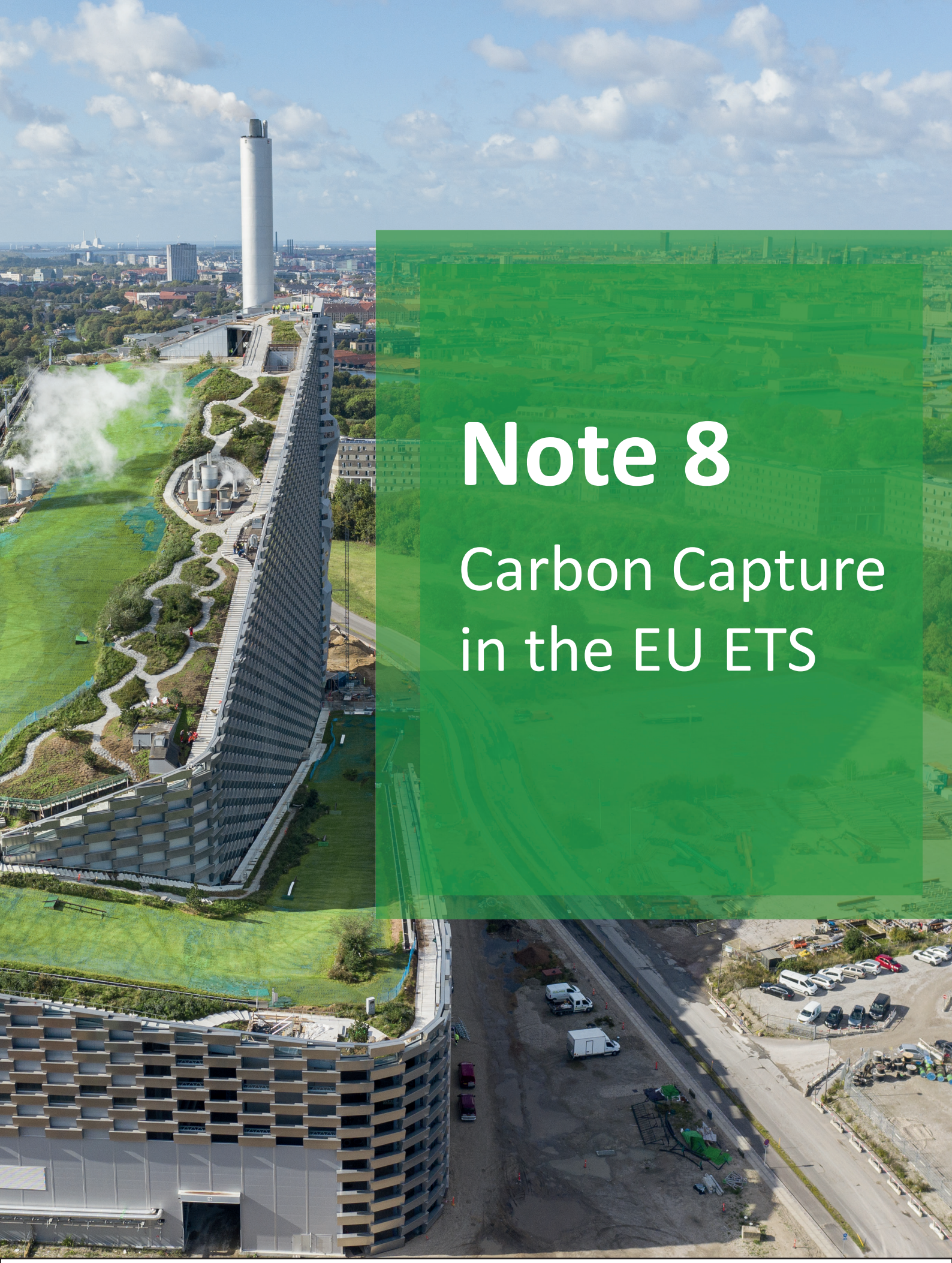

Note 8

Carbon Capture in the EU ETS

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Carbon Capture in the EU ETS

1. Summary

This note examines carbon capture in relation to the EU Emissions Trading System (ETS). After a general introduction to the EU ETS in, the note describes how the ETS can contribute to spreading carbon capture in waste incineration, power plants and industry in the form it has today. At the same time, it is important to be aware that certain elements of the EU ETS can be a barrier to investment in carbon capture. Finally, the note discusses how changes to the EU ETS can have an impact on carbon capture in the future.

2. Introduction to the EU ETS

The EU Emissions Trading System (EU ETS) was introduced to put a cap on the total amount of carbon dioxide (CO2) emitted in certain sectors of the European economy and then create a market for emissions allowances (EUAs). It currently operates in 31 European countries (the EU 28 plus Iceland, Liechtenstein and Norway) although future UK participation in the EU ETS remains uncertain post-Brexit.

Introduced in 2003 and revised in 2009 and 2017, the EU ETS covers approximately 45% of the EU's total greenhouse gas (GHG) emissions. In 2018, the EU ETS covered approximately 14,000 installations across Europe, including more than 11,000 power stations and manufacturing facilities.

Since 2005, total emissions covered by the EU ETS have fallen by around 700 $MTCO_2$ (see Figure 1) – equivalent to around 86 million passenger cars (approximately 30% of the total number of cars in circulation in the EU) not being driven for one year. Whilst this may sound like success, the EU ETS has failed to deliver the scale and pace of emissions reductions needed to deliver on EU's climate objectives, particularly since the ratification of the Paris Agreement.

Over the past decade, the EU ETS has been characterised by a low carbon price primarily resulting from a surplus in the availability of emissions allowances. In 2013, the European Commission found that there was an excess of more than 2.1 billion emissions allowances and, as a result, during the 6-year period between 2012 and 2018, the price of emitting 1 tonne of CO_2 did not exceed €9. The low carbon price and a policy of giving emissions allowances to industry for free ("free allocation") has meant that, for many industries, the CO_2 emissions price signal has been too low to justify investing to reduce emissions. The EU ETS price started, however, rising in Q4 2018, and has stabilised at around 25 €. While this has had some effects on general output from selected industry sectors, it is still too low to motivate investments in CCS in any one installation.

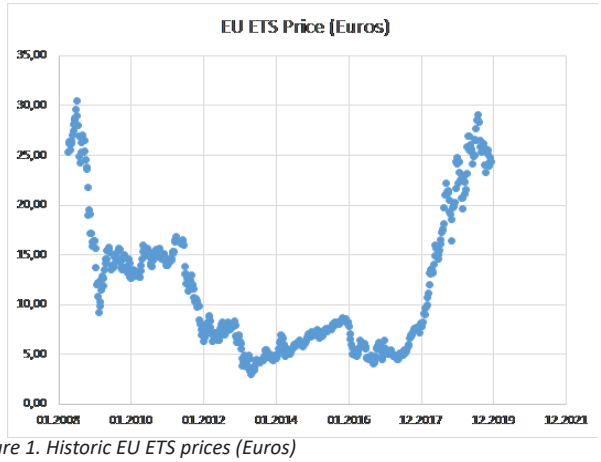

Figure 1. Historic EU ETS prices (Euros)

The surplus in emissions allowances over the last decade has been caused by a multitude of issues, including structural deficiencies of the EU ETS and a decline in economic activity resulting from the 2008 economic crisis. In an attempt to "fix" the EU ETS, a range of measures have been introduced to address the surplus of allowances. These measures include:

- **Backloading** – a short-term measure to postpone the auctioning of 900 million allowances until 2019/2020;
- The **Market Stability Reserve** (MSR) – a longer-term reform, which will see the backloaded allowances and any other surplus allowances transferred to the MSR instead of being released for auction;
- **Phase 4 reforms** to the EU ETS – agreed in 2017, the most-recent raft of reforms included an agreement to increase the Linear Reduction Factor (the percentage reduction in the total number of available allowances) to 2.2% from 2021 onwards.

It is widely expected that the recent reforms to the EU ETS will lead to a steady increase in the CO_2 price over the coming decade.

Further information on the EU ETS and its various reforms can be found on the European Commission website[1].

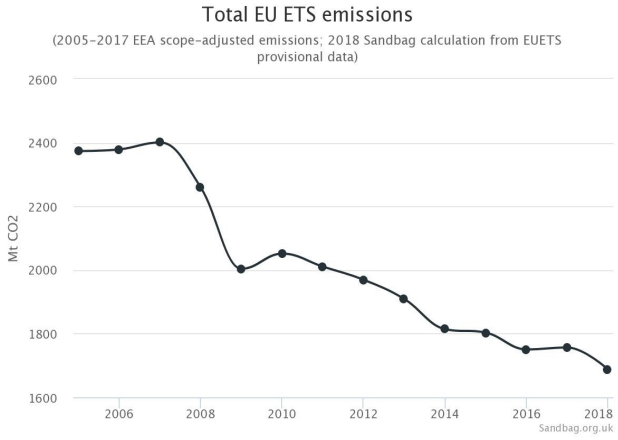

Figure 2. Total EU ETS Emissions, 2005 – 2018 (Sandbag, 2019)

[1] https://ec.europa.eu/clima/policies/ets_en

2.1 EU ETS Innovation Fund

A key facet of the EU ETS in its early stages was the New Entrant Reserve fund (NER300), so called because 300 ETS allowances were set aside and auctioned off, to create a fund for innovative renewable energy and Carbon Capture and Storage (CCS) projects. Due to its stringent and prescriptive eligibility criteria, the NER300 was notoriously difficult to access and, as a result, it was widely considered a failure.

Following reforms to the ETS ahead of Phase 4 (2021 – 2030) the NER300 was replaced with a new "Innovation Fund" and redesigned with the aim of making the funds more accessible and impactful. The Innovation Fund remains available to CCS and innovative renewable energy projects alongside newly included small scale and industry projects, as well as "environmentally safe" CCU projects.
A Delegated Act providing the modalities of the Innovation Fund was adopted by the European Parliament and the European Council in June 2019. The Commission hopes to open a first call in 2020 with a view to the first disbursements being made in 2021/22.

3.0 Carbon Capture in the EU ETS

3.1 Carbon Capture and Storage (CCS)

CCS is covered under the EU ETS in a variety of ways. Firstly, it can be applied to a range of different economic activities covered by Annex 1 of the ETS Directive, including power stations and industrial/manufacturing facilities and – in some instances – waste-to-energy plants (see Box 1). In this instance, operators under the ETS may invest in carbon capture as a mechanism for reducing their direct emissions, thereby reducing their ETS liabilities. However, in order to ensure that investments in CCS under the ETS deliver genuine and permanent emissions reductions, CO^2 pipelines and geological CO_2 stores are considered separately and independently as installations under the EU ETS. This means that when CO_2 is captured at an emissions site, its transportation and storage must be fully metred and the ETS liability must pass down the CCS chain.

3.2 Carbon Capture and Utilisation (CCU)

Until recently, CCU in no form has been credited under the ETS Directive. Whilst CO_2 can be captured under the ETS Directive, the resulting CO_2 has to be transferred to a permanent geological storage site in order for the emissions reductions to be credited to the emitter. This is because many forms of CCU merely postpone emissions for a short period of time, and therefore do not deliver permanent abatement or direct emissions reductions.

Following a European Court of Justice ruling in 2017, [Schaefer Kalk][2] , there has been discussion among industry and legal experts regarding the accounting of CO_2 that leaves one emitting point source but is subsequently utilised by the same or another company to make a product. Whilst the full implications of the Schaefer Kalk ruling are not yet known, it is possible that further forms of CCU will, in future, be credited similarly under the ETS. This could have considerable consequences for the role of the ETS in climate policy. If, like calcium carbonate precipitation, other forms of CCU that do not lead to permanently avoided emissions once the CCU product is used then the future credibility of the ETS is likely to be called into question.

4.0 The Future of Carbon Capture in the EU ETS

4.1 EU ETS Barriers Preventing Investments in Carbon Capture

When it comes to geologically stored CO_2, the scientific consensus is that likelihood of leakage as well as the consequences to environment and human health are very small. This consensus is based on decades of experience

Box 1: Energy-from-Waste under the EU ETS and Implications for Carbon Capture

(Extract from Carbon Limits; Anders Pederstad, Torleif Haugland and Francois Sammut. EU ETS og avfallsforbrenning (2017))

Waste incineration is explicitly excluded from the EU ETS system. The main arguments to keep waste incineration outside the EU ETS (eg as argued by the Confederation of European Waste-to-Energy Plants, CEWEP) have been that the quota system will have no effect because plant owners cannot change fuel and to only a small extent can affect fuel composition and energy efficiency. Measuring the proportion of fossil CO_2 in waste and reporting based on standard values is by some considered as too uncertain[2].

Waste incineration in so-called "co-incineration plants" is however considered to be subject to EU ETS quotas according to the EU Emissions Trading Directive, and four plants in Norway that burn waste and supply heat for industrial purposes are included in the EU ETS obligations in Norway.

Sweden is the only country in Europe to interpret the ETS directive as requiring inclusion of waste incineration. The Danish authorities have correspondingly chosen to incorporate waste incineration plants in the EU ETS through so-called "opt-in" [Article 24 of the ETS Directive]. The Norwegian parliamentary statement 41/2017 confirms that Norwegian authorities also consider the inclusion of emissions from waste incineration plant in the EU ETS to be an alternative to introduction of a (Norwegian) CO_2 tax on emissions from waste incineration.

[2] It should be noted that it is possible to use the carbon isotope 14C to determine the relative contribution (or mixing ratio) of fossil fuel oxidation to the total carbon dioxide. For example, recent measurements of 14C suggest a bio-share of slightly above 50 per cent at Klemetsrud waste-to-energy plant in Oslo.

with full-scale CO2 storage as well as testing, modelling and general knowledge about the properties of CO2 and how it interacts with e.g. sandstone or in saline aquifers. However, one cannot expect the general public to be know the details of CO2 chemistry and storage geology. This uncertainty can make liability and leakage issues more of an issue than it is in reality.Low risks of leakage notwithstanding, the requirement to surrender ETS allowances in the event of a leak from a CO_2 store has long been considered to be the key barrier preventing investment in CCS. This is not because operators disagree with the 'polluter pays' principle, but because the liability is effectively unquantifiable and therefore most likely uninsurable (Etteh, 2011).

The combination of the ETS Directive and CCS Directive means that the operator of a CO_2 store must purchase and surrender ETS allowances at the market price at the time of leakage. This means that if a leak occurs in year 20 after CO_2 injection, for example, the operator of the store will have to buy allowances at the market price at that point. If we are successful in tackling climate change and the CO_2 price plays a key role in that endeavour, then one would expect the CO_2 price in 20 years' time to be significantly higher than it is today. Given the uncertainty surrounding the future CO_2 price, this becomes a risk to a CO_2 storage operator.

In addition to the financial risk posed by this liability, three other linked factors might compound the difficulties for potential CO_2 storage operators:

1. Most emitters, e.g. steel or cement companies, have no expertise in managing subsurface projects involving either extraction from, or injection into, geological structures. This means they typically lack the experience, knowledge and skills to assess and manage the risks (technically and financially) of a potential CO_2 leak in the future. This issue would, however, be largely resolved in the scenario outlined in point 2 below.

2. In most cases, it is likely (in part due to the above competencies of different companies) that the three parts of the CCS chain (capture, transport and storage) will be operated by different types of company rather than one single company. Under this scenario, and depending on the business model for any given CCS project, each operator needs to ensure that its revenues can be protected and that any risks are shared across the full chain. This so-called 'cross-chain risk' has led to the different operators in prospective projects each increasing their own risk premiums, therefore dramatically increasing the cost of a project. This was particularly the case under the UK's previous CCS Competition (CCSA, 2016).

3. The CCS Directive puts a requirement on CO_2 storage operators to put in place up-front, highly-liquid financial securities to cover the costs of a potential leakage. Guidance Document 4 associated with the CCS Directive adds further detail here and has been interpreted by Member States and potential storage operators in such a way that most projects have, in effect, been required to provide cash-equivalent financial securities before injection can begin. For companies without a big balance sheet, this hurdle has often proved to be an insurmountable barrier to investment without Member State support.

4.2 Opportunities for Carbon Capture Projects under the EU ETS

As CO_2 prices rise on the back of recent reforms to the ETS, and 'free allocation' of EUAs to heavy industry begins to phase out, carbon capture projects will begin to look more attractive to owner-operators of industrial facilities. However, high CO_2 prices alone will not necessarily make CCS projects investable. This is because it is not just a matter of it becoming cheaper to store than emit CO_2, a project has to fit strategically for the companies involved, be investable, and fit in well with the investment cycles of the emitting facility. For these reasons, it is highly unlikely that the private finance sector (e.g. banks) would consider as investable a CCS project business case based on the ETS alone. In effect, this means that additional sources of funding, government subsidies or additional revenue protections, are going to be necessary for the early CCS projects in Europe. This will particularly be the case for early infrastructure (CO_2 transport and storage) projects, which may face a greater degree of uncertainty around the volumes of CO_2 they will receive.For more discussion regarding business models, see note 9a.

To help unlock investment in CCS projects, The Bellona Foundation and the Zero Emissions Platform (ZEP) have previously advocated for a 'Market Maker' approach to early projects, whereby investments in CO_2 transport and storage Infrastructure are underpinned by the public sector through direct investment and/or appropriately structured regulation.

Publicly-backed infrastructure can help to mitigate investment risks for the private sector, stimulate CCS by creating an investment model, and enable emissions intensive industries to address future increases in the cost of emitting CO_2 by providing access to the infrastructure they need to decarbonise. The Market Maker would compensate for a lack of market for CO_2 storage, by developing CCS infrastructure and then contracting with industrial emitters for the delivery of CO_2. Emitters would be required to pay a transport and storage fee that covers the costs of the infrastructure and a small element of capital repayment, which is then used to refinance the Market Maker.

[3] For more on liability, see e.g. Etteh, N., 2011, Carbon capture and storage: Liability implications, University of Dundee.

Over time the Market Maker could then be privatised or disbanded as a commercial market for CO_2 storage develops.

The key opportunity for CCS projects under the ETS – whether 'Market Maker' projects or otherwise – is under the Innovation Fund. The Innovation Fund will provide approximately €10 billion worth of funding for CCS, CCU, innovative renewable energy projects and innovative low-carbon technologies and processes in energy intensive industries. The first call under the Innovation Fund will open in 2020 and projects in any sectors listed under Annex 1 of the ETS Directive are likely to be eligible.

4.3 Changes to the EU ETS and Potential Impacts on the Future of Carbon Capture

The ETS Directive revisions agreed in 2017 in theory cover the whole fourth phase of the EU ETS, running from 2021 to 2030. However, key opportunities for further reform exist in the form of the 2021 review of the Market Stability Reserve and a 2023 review of the EU ETS in the context of the Paris Agreement stocktake. Since the previous ETS revision, climate change has continued to rise up the political agenda and society is increasingly calling on political leaders to deliver ambitious policies that can limit global warming to 1.5 Degrees. As a result, it is highly likely that the opportunities for reform in 2021 and 2023 will lead to further changes to bolster the ETS.

The following mooted reforms could impact the future of carbon capture under the ETS:

• An increase in the Linear Reduction Factor (LRF) – Analysis indicates that the current 2.2% LRF is set to deliver about 70% emissions reduction in ETS sectors by 2050. Meanwhile, the EU institutions are expected to adopt a policy of climate neutrality by 2050 in either late 2019 or early 2020. This would arguably require the ETS to deliver net zero emissions by 2050 or potentially earlier, necessitating an increase in the LRF. This change would be

Role for Cities as…	Potential Opportunities (linked to EU ETS)	Potential Risks (linked to EU ETS)
Owner-operators of Waste-to-Energy facilities	• CO2 liabilities can be managed by retrofitting CC to WtE facilities. CCU may offer near-term economic opportunities whilst CCS can offer permanent emissions reductions.	•Future inclusion of WtE in the ETS may actually reduce ability to finance a CCS project
Owner-operators of district energy networks	• ETS price rises help to drive production of low carbon solutions (using CCS) for district energy • Cities purchasing low carbon hydrogen creates market pull and helps to support investment in CCS • Projects potentially eligible for funding under the Innovation Fund	• Future inclusion of biomass CO2 in the ETS as equivalent to fossil CO2 and no potential reward for capturing biogenic CO2 • Price increases in the EU ETS can reduce ability to finance a CCS project by reducing free cash flow from operations
Owners of (or investors in) CO2 infrastructure	• Cities could act as Market Makers for CCS infrastructure, helping to unlock private investment and creating infrastructure to help future-proof industrial facilities located in the city region. • Projects would be eligible for funding under the Innovation Fund, the Connecting Europe Facility or similar.	• Technical difficulties related to sharing of transport and storage infrastructure and corresponding leakage liability risk management solutions
Major purchasers of industrial products such as steel and cement	•High C O2 prices alone unlikely enough for industry to invest in CCS. Cities procuring low carbon products could create market pull to help accelerate shift towards low carbon industry. • Cities procuring low carbon products can help secure new investment in energy intensive industries and to retain jobs in industrial regions.	• Price increases in the EU ETS will reduce operating margins which can reduce ability to finance a CCS project by reducing free cash flow from operations
Transport planners for low emission vehicle infrastructure	• ETS price rises stimulate production of low carbon hydrogen for transport and indirectly investment in CCS	

expected to increase the CO_2 price, which may make the economics of CCS projects more attractive to investors.

• Extending the 24% Market Stability Reserve (MSR) removal rate and increasing the MSR upper threshold – An extension of the temporary 24% removal rate of the MSR beyond 2023 would help to further address the surplus of allowances available for auction, as would an increase in the 833 million tonnes upper limit on the size of the MSR. One would expect these changes to increase the CO_2 price.

•A market for negative emissions – Currently, the ETS has no mechanism for recognising or rewarding negative emissions. This means facilities such as biomass power stations or waste-to-energy plant burning biogenic waste would not receive any additional credit should they store the CO_2. European Commission analysis of pathways for its Long Term Emissions Reduction Strategy suggests that negative emissions technologies are likely to have an important role in achieving climate neutrality or net zero emissions, meaning new policies and incentives are likely to be needed to bring forward investments. The European Commission is currently considering how best to achieve this change under the ETS.

5.0 Conclusions – Cities, Carbon Capture and the EU ETS

Awareness of how the EU ETS operates and how it impacts on CCS and CCU projects is important for cities to understand. Whether directly or indirectly, the ETS Directive will impact the business case and investability of CCS and CCU projects in Europe, with resulting implications on the achievability of emissions reductions in hard-to-abate sectors, including negative emissions. This is of critical importance for cities with ambitions to achieve carbon neutrality in the coming decades. It is also of high importance as some of the cities themselves are owner of the plants. For example, Helsinki is the sole owner of Helen Ltd which runs all the city's Combined Heat and Power (CHP) facilities. Cities such as Oslo and Stockholm are owners or co-owners of CHP and Waste-to-Energy (WtE) plants.

Note 9a discusses potential business models for cities relating to CCS. The table below illustrates the risks and opportunities relating to these various business models under the EU ETS.

References

Case C-460/15, *Schaefer Kalk GmbH & Co. KG v Bundesrepublik Deutschland.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A62015CJ0460

Etteh, N., (2011). *Carbon capture and storage: Liability implications,* University of Dundee.

CCSA Report: Lessons Learned - Lessons and Evidence Derived from UK CCS Programmes, 2008 – 2015

The CCSA has published a new report on "Lessons Learned – Lessons and Evidence Derived from UK CCS Programmes, 2008 – 2015". 2016. Online publication. *Particularly focused on the recent CCS Competition, which was cancelled in November 2015, the report sets out 36 key lessons for industry and policy makers.* http://www.ccsassociation.org/library/reports-and-publications/

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