EU Emissions Trading System

Rethinking Decarbonisation Incentives – Policy Case Studies

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This case study has been developed for the UK's Energy Systems Catapult under the Rethinking Decarbonisation Incentives project, aiming to draw lessons from international experience of policies to improve the framework of economic drivers for decarbonisation in the UK.

The EU Emissions Trading System (EU ETS) has long been a core part of UK and EU climate policy. It was designed to create a multisector market-based decarbonisation signal and has been progressively revised to harmonise the treatment of operators in different participating sectors and countries. It's had its challenges though, not least in how to maintain a strong decarbonisation incentive given the turbulent economic conditions of the last decade. Concerns over the impacts of the carbon price on the competitiveness of industries have been a major factor in the system design and in turn the nature of the decarbonisation investment signal. It remains a strong model for decarbonisation policy and in the coming years and decades will be further linked to other similar systems and international mechanisms for carbon reduction.

From the UK perspective, the EU ETS will remain important. The UK may continue to participate in the system post Brexit, or link to it. In any case, climate policies will continue to affect competing industries within the UK and the EU. In this case study the main issues determining the robustness of the EU ETS incentive signal are examined. Also, the EU ETS policy development experience provides insights into key decisions related to establishing a multi sector uniform decarbonisation incentive, which have much broader applicability.

Key findings

- The extent to which carbon pricing policies can deliver a consistent decarbonisation incentive across many sectors will depend on their suitability to be covered by a uniform framework. The scope of the EU was determined on the basis of environmental effectiveness, economic efficiency, administrative feasibility and the existence or suitability of alternative policies and measures.
- Emissions trading caps should be set with consideration as to what savings can be achieved in other sectors. The EU ETS third phase cap was set such that the marginal cost of meeting EU targets would be the same for traded and non-traded sectors.
- Free allocation of emissions allowances can help mitigate carbon leakage concerns. However, if the allocation mechanism adjusts future allowances in response to future changes in emissions then the strength of the decarbonisation signal is reduced.
- Free allocation to counter carbon leakage should be based on robust technical assessments of each sector or subsectors exposure to international competition. The EU ETS applies criteria based on carbon costs and trade intensity.
- Carbon market linking can help decarbonisation targets to be met at lowest cost. It also harmonises carbon pricing signals across jurisdictions. Strong harmonisation between linked systems is important and the EU and Swiss authorities have agreed a set of mandatory criteria in their ETS linking agreement.

Abbreviations

BEIS	Department for Business, Energy and Industrial Strategy
CCA	Climate Change Agreements
CCL	Climate Change Levy
CDM	Clean Development Mechanism
CIMs	Community-wide Implementing Measures
EEA	European Economic Area
ETS	Emissions Trading System
EUAs	European Union Allowances
EU ETS	European Union Emissions Trading System
GHG	Greenhouse Gas
IPPC	Integrated Pollution Prevention and Control
JI	Joint Implementation
MRV	Monitoring, reporting and verification

Nomenclature

tCO_2e	Tonnes of Carbon Dioxide Equivalent

Policy overview

Background

The EU Emissions Trading System (EU ETS) is a core pillar of the EU's climate change mitigation policy. It was established in 2005 and is now implemented in 28 EU Member States and three non-EU countries (Iceland, Lichtenstein and Norway) It is the world's largest carbon market covering around 45% of the EU total GHG emissions. Representing a substantial share of the global emission trading market, the EU ETS often serves as a model for the development of emission trading systems around the world, many of which intend to be linked to it in the future (Climate Action, 2016). The EU ETS was introduced via the EU ETS directive of 2003 (Directive 2003/87/EC), subsequently amended.

Coverage

The emissions profile in the EU in 2014 is shown in Figure 1 (note that net land-use change and forestry emissions are excluded). The EU ETS covers approximately 45% of EU emissions. Participation in the EU ETS is mandatory for installations in certain industries, power generation and operators of other larger combustion plant. Since 2012 it also covers commercial aviation for airlines operating within or between EU ETS countries, in respect of emissions from those journeys. For both stationary and aircraft operators, inclusion thresholds are defined within the EU ETS Directive. The system predominantly concerns CO_2 emissions, although nitrous oxide and perfluorocarbons are also included for certain chemicals sectors and aluminium production respectively. To avoid double counting, the EU ETS focuses on direct fuel combustion and does not capture electricity consumption, since these emissions are accounted for at the power generation stage.

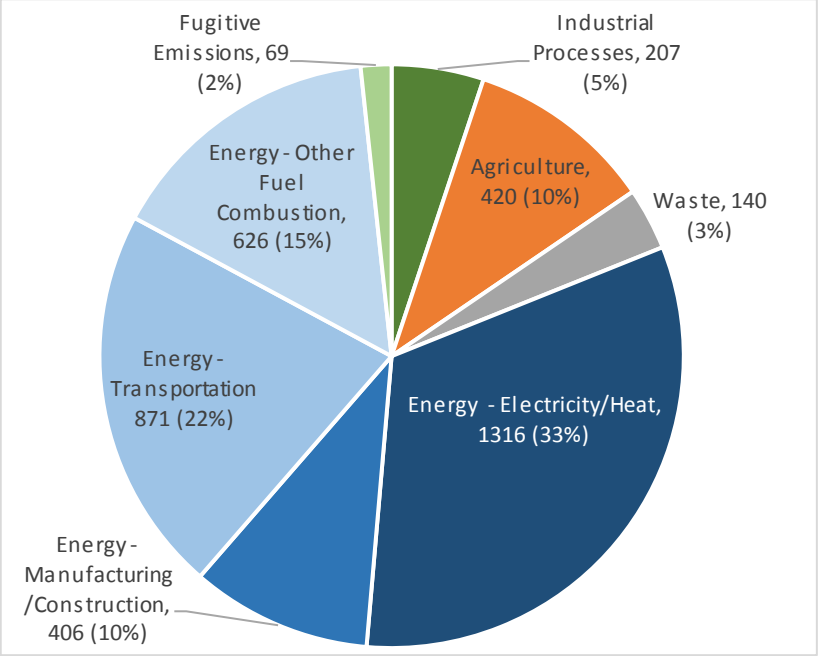

Figure 1 Total GHG emissions by sector for the European Union ($MtCO_2e$)[1]

Mechanism

The EU ETS is a cap-and-trade mechanism. Allowances are created for each tonne of CO_2 permitted to be emitted within the system. The total number of allowances released corresponds to the emissions cap, since each entity covered by the system must acquire allowances equal to what it emits. If the demand for allowances rises, then so does their price, such that all abatement cheaper than the

[1] Based on data from CAIT Climate Data Explorer. 2017. Washington, DC: World Resources Institute. Available online at: http://cait.wri.org

allowance price is incentivised, which should be sufficient to ensure that the allowance cap is met with the cheapest abatement within the system. The EU ETS operates in phases, with the emissions cap determined prior to each phase. The evolution of phase is illustrated in the following figure.

Timeline and Development

The first phase of EU ETS was seen as a trial. The second phase (2008-2012) was linked to the first commitment period of the Kyoto Protocol, during which the EU and other industrialised countries were required to meet their targets to limit or reduce greenhouse gas emissions. Iceland, Lichtenstein and Norway were introduced in the second phase. The emissions were capped at around 6.5% below 2005 levels to help ensure that the EU as a whole and Member States individually delivered on their Kyoto commitments.

The EU ETS Directive was substantially revised and harmonised for the third phase (2013-2020). Amongst the changes adopted, a single centralised approach to cap setting and allowance allocation based on benchmarks was introduced. The third phase provided for a linear reduction in emissions per year to 2020, at a rate of 1.74% per year. Croatia was introduced for the third phase.

The fourth phase will run from 2021 to 2030 with an annual emission reduction of 2.2%. Detailed plans are being developed, which will include updating the allocation benchmarks and greater use of funds to support modernisation and innovation within the system.

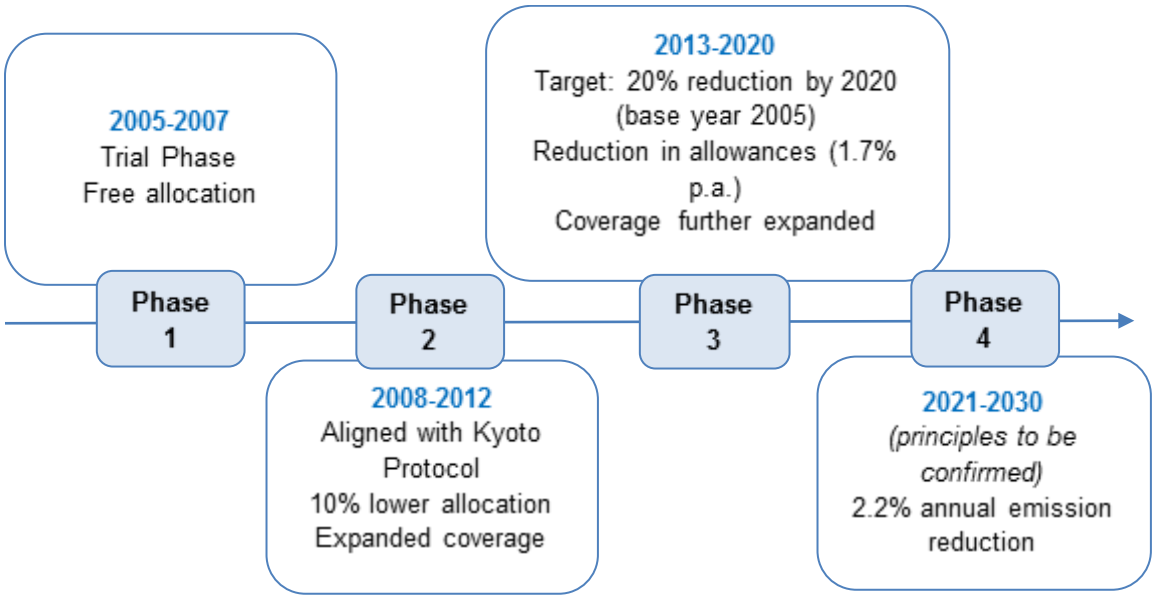

Figure 2. EU ETS development timeline

Decision-making for a strong price signal

The EU ETS inherently creates a uniform carbon price for the sectors that it covers, in that all operators within those sectors can benefit from the value of one emission allowance for every tonne of CO_2 that they save. There are several important aspects to the robustness and uniformity of that decarbonisation signal. These are:

- The governance processes by which the system rules are developed and implemented. This gives confidence to the market regarding the stability and longevity of the policy.
- The scope of the sectors covered. This determines which sectors are subject to the decarbonisation incentive signal and which are not.

- The emissions cap, which defines the policy ambition that underpins the carbon price.
- The allowance allocation mechanism, which can affect the level of incentive for some operators compared with others,

These aspects are considered below.

Governance

The governance of the EU ETS falls under the EU structures for the development and agreement of legislation. Proposals for directives are developed by the European Commission and then finalised in negotiations between the European Parliament and European Council, the latter comprising representations of EU Member States. The European Commission coordinates and engages in lower level technical discussions amongst Member States through the Climate Change Committee and its sub group the Working Group on EU Emissions Trading. It also carries out studies and produces Regulations and Decisions on technical matters where empowered to do so by the relevant legislation. Centralised aspects of the system's implementation, such as administering the allocation decision process or maintenance of the allowance registry are carried out by the European Commission.

Within the UK EU ETS policy development is the responsibility of the Department for Business, Energy and Industrial Strategy (BEIS), whose Minister is responsible to the UK parliament. BEIS policy experts participate in the EU level discussion mentioned in the previous paragraph and have responsibility for transposing the EU legislation into national law. In earlier phases, when there was greater autonomy for each Member State as to how it developed the EU ETS in its country, BEIS's predecessors had a greater role in policy design. Chris Dodwell[2] provides an interesting insight into how cross departmental interests in policy issues can be managed. He explains that for Phases 1 and 2 of the EU ETS, the overall emissions cap (and the policy in general) was the responsibility of Defra, but the decision on how those allowances were allocation in order to mitigate competition impacts on industry was given to the Department of Trade and Industry, whose remit concerned supporting UK industrial competitiveness. Dodwell argues that this helped to gain cross departmental agreement to EU ETS cap and allocation decisions.

The legal framework for the EU ETS comprises legislation at EU and UK level. The following are in place:

- The EU ETS Directive (2003/97/EC) establishes the trading system in EU law and describes the overarching policy design. Over time it has been amended by other Directives concerning rule changes, increases in scope (including inclusion of aviation) and the rules for use of Kyoto project credits.
- European Commission Regulations govern many aspects of the system and have direct applicability in the Member States, without need for transposition into national law. They cover:
    - MRV arrangements. There is a regulation for Monitoring and Reporting emissions and another for Verification and Accreditation.
    - International credit entitlements.
    - The establishment of a European union-wide allowance registry.
    - Auction of allowances (Regulations and amendments relate to the timing and administration of auctions, adoption of particular auction platforms, and quantities of allowances to be auctioned).
- European Commission Decisions provide detailed rules on the application of the ETS directive. For instance the emissions caps and allocation rules are defined in Commission Decisions, based on the rules within the Directives. They also cover arrangements for reporting of system information by Member States to the European Commission.

[2] Chris Dodwell led the team responsible for implementing the first phase of the EU ETS at Defra. He is currently an employee of Ricardo Energy & Environment. Chris was interviewed for this project on 4th April 2018 and his personal views are represented here. Each further citation against Chris in this case study refers to discussions had with the authors during the above interview.

- Within the UK, the system is formulated within the Greenhouse Gas Emissions Trading Scheme Regulations (2012). This transposes the EU legislation into UK law.

The most pertinent example of how governance arrangements can influence market prices and market confidence concerns the release of the first compliance year emissions data. In the first phase of the system the national allowance caps were developed by Member States, but this was not generally done on the basis of verified data. There was widespread market expectation that the system required significant emissions abatement and, prior to the release of first year data, this sustained a relatively high allowance market price (in the region of €30/tCO_2).

However, the publication of data for the first compliance year, 2005, demonstrated that the actual emissions covered by the system were lower than previously thought, resulting in there being very little or no need for abatement. This precipitated a market price crash that persisted through the remainder of the phase.

The way in which the emissions information was released to the market impacted how this price adjustment evolved in practice. Each Member State managed its own emissions reporting system and, following the reporting deadline, published aggregate data that for the first time allowed market participants to understand how actual emissions compared with the level of the cap. However, the publication of this data was not done in a coordinated way across the system. Each Member State released its data on its own timescales, through its own communication channels, and centralised data was either less prominent or only made available some time after that.

Operators were required to submit their 2005 verified emissions data to their respective Member State competent authority by 30th April 2006. However, as explained by Ellerman and Buchner (2006) the oversupply of allowances became clear to the market over a four day period from Tuesday 25th April 2006, when the Netherlands and Czech Republic each published substantially complete data, followed by similar announcements by the Walloon region of Belgium, France, and Spain. During that time there were substantial changes in the market price as each new piece of information was released, with subsequent smaller adjustments following the release of other Member State data up to the 15th May 2006 when the European Commission issued a press release giving consolidated emissions data. Even at that time, however, the picture was clouded by the unavailability of data from some Member States and questions over the accuracy of data from others (European Commission, 2006).

This experience highlights the importance of careful management of market sensitive data for environmental policies such as the EU ETS. Transparent systems are needed to ensure that important data is released as soon as it is available and that all interested market participants gain access to that information in the same way. In response to this and other concerns over market integrity, the EU ETS was progressively brought under wider EU legislation for the operation of financial markets.

Coverage

Given the impact and importance of a policy instrument of the EU ETS scale, the European Commission undertook a detailed analysis of the sectors which were to be included in the ETS (Commission of the European Communities, 2000). The five principles outlined in that paper became the basis for the ETS sector selection:

- Environmental effectiveness
- Economic efficiency
- The potential effects on competition
- Administrative feasibility
- The possible existence of alternative policies and measures

In applying these criteria the European Commission took the view that it is best to start by covering a relatively small number of sectors comprising sources that contribute significantly to total emissions. On this basis, it concentrated on the electricity generation sector and heavy industries. By focusing on large stationary sources in high emitting sectors, there was a high coverage (environmental effectiveness) for relatively small administrative burden (giving good economic efficiency) and administrative efficiency. It put emphasis on standardisation across Member States to address competition concerns – although some Member State autonomy was allowed in early phases, this was reduced, especially with the introduction of third phase rules.

In an assessment of the potential to extend the system to other sectors and gases (European Commission, 2006), the European Commission considered cases where there might not be abatement potential. It argued that inclusion of such sectors would reduce the overall cost effectiveness of the system because of the additional administrative burden incurred by those sectors and the system administrators.

The green paper did not present a discussion on whether it would have been preferable to regulate the emitters directly or consider upstream approaches, although this would have been debated at the time. The focus on a relatively small number of very large emitters, often with process emission sources, together with heavy reliance on analogous experiences with non CO_2 industrial emission regulation, seems to have made point of emissions regulation a logical choice. Chris Dodwell provides views on this issue. He argues that regulation of CO_2 emissions was a new concept, and many policymakers saw it as a natural extension of industrial regulation under the Industrial Pollution Prevention and Control (IPPC) Directive[3]. This was important to some Member States who would have resisted a more novel approach requiring new regulatory systems. Thus, the decision for direct regulation of emitters was not really challenged.

Subsequent expansions of the EU ETS were incremental with new sectors being included, but were relatively small compared with the initial sectors chosen.[4] Indeed, a wider conclusion can be drawn which is that the EU ETS policy development has generally been evolutionary rather than revolutionary. Changes to scope have been modest and changes to other factors, such as the level of free allocation, have for the most part been gradual. Chris Dodwell offers some insights as to why that might be. He suggests that in the main, industry was relatively slow to react to the implications of EU ETS policy as it was developed and initially introduced. However, as these industries developed stronger positions and evidence to support those, they became a greater lobbying force on policy decisions. Dodwell believes that this is a factor in the European Commission officials being relatively reluctant to opening up discussion on EU ETS principles or major elements of the design, instead preferring to focus on less significant modifications to the existing architecture.

Cap setting

The emissions cap underpins the EU ETS price signal since it determines the number of allowances available in the market. However, if the cap does not represent a reduction in emissions then the price will fall to zero and the system will not deliver any additional abatement. For various reasons the EU ETS has suffered from this problem in its phases to date, as described in the following paragraphs.

- During Phase I the cap on allowances was set at the national level through National Allocation Plans (NAPs), in accordance with guidance in the ETS Directive and produced by the European Commission. Only the UK used verified data to inform its cap, therefore all other Member States

[3] However, there were concerns that the IPPC coverage threshold of 50MWth would be too high for the EU ETS since it risked inclusion of some installations but the exclusion of others within sectors in which these installations compete. Therefore a lower thresholds of 20MWth was used for EU ETS.

[4] The exception being the decision to include aviation in 2012, which was a more significant development

relied upon estimates. What's more, the approach which each Member State set its own cap leads to pressure for a lack of ambition, in order to protect domestic industries. For the Phase the total amount of allowances issued exceeded emissions and, with supply significantly exceeding demand, in 2007 the price of allowances fell to zero. They remained close to zero through the phase, but in the absence of banking the surplus was wiped out at the end of the phase and Phase II offered the opportunity for a fresh start.

- For Phase II verified annual emissions data was now available, which was taken into account in the NAPs of each Member State. The Kyoto Protocol was used as basis for individual Member State national targets and the European Commission developed updated guidance to strengthen the common basis for national cap setting. Together, these measures were envisaged to produce a cap on a much stronger footing than in Phase I. However, the 2008 economic crisis reduced demand for emitting activities, which led to a large surplus of allowances and credits.
- For Phase III, the cap was set in line with EU 2020 targets, corresponding to a reduction in system emissions of 1.74% annually. Allowances could be banked from Phase II, however, therefore the surpluses continued into Phase III, with the economic slowdown continuing to contribute to the oversupply of allowances relative to emissions.

Together, these experiences point to the importance of using verified baseline emissions data (i.e. specific data for the installations to be covered, for a period immediately prior to the period of the trading system) It also highlights the vulnerability of a cap and trade system to unforeseen changes in the demand for emitting activities, which can be exacerbated if allowance surpluses are allowed to roll-over between phases.

There is an inherent compromise to be struck in setting emissions caps and ETS policy. Chris Dodwell argues that on the one hand policy objectives require relatively short term emissions targets to be met, and that a strong carbon price be established. On the other hand, asset lifetimes covered by the system are very long, and it is necessary to send a much longer term signal to the market to stimulate the investment required. The difficulty arises in that the more precise, and hence less flexible, the longer term targets are, the greater the risk that unforeseen changes to the wider economic situation lock in an undesired level of ambition, or indeed no ambition at all. This dilemma also informs decisions about banking of allowances, since banking allows short term flexibility that the market desires but can also perpetuate allowance surpluses from one period to the next. According to Dodwell, these were important factors that EU ETS policymakers were grappling with in the early period of system design.

In setting the EU ETS cap many factors are taken into account and the approach for the third phase provides a good example of these. The cap covered the period 2013 to 2020, so aligned with the EU's targets under its 2020 climate and energy package. These targets are for a 20% cut in greenhouse gas emissions (compared with 1990), 20% of EU energy to come from renewables, and for a 20% improvement in energy efficiency. The basis for setting those targets is described in the accompanying impact assessment (European Commission, 2008), the main points of which to note are:

- The principal adopted was that the targets should be met at lowest overall cost. A cost efficient reference option was developed, in which the GHG and renewable energy targets were met (and the energy efficiency target exceeded). This was used to derive the incentive necessary to achieve both the renewables target and the GHG target (respectively €45/MWh and €39/tCO2) and helped justify the adoption of these high level targets.
- The relative abatement effort within the EU ETS and outside of it (referred to as traded and non-traded sectors respectively) was also determined on the basis of the most cost efficient approach. By analysing the costs of abatement it was determined that the overall target would best be met with an EU ETS target of 21% reduction and a non-EU ETS target of 10%.

- The overlap between renewables development and GHG reduction was recognised in the balance of effort in renewables and non-renewables sectors and traded and non-traded sectors. It was anticipated that over half of the renewables target would be met from measures that fall under the EU ETS, which was a further factor in justifying such a high level of effort in the traded vs non traded sectors.
- Thus, it can be seen that the interaction between renewables and GHG objectives are managed by the way that targets are set. Collectively, the policies should be driving towards least cost achievement of targets overall, even though a multiplicity of targets inevitably leads to higher costs of emissions abatement than just carbon targets were adopted alone.

Overall, we can derive some lessons from these EU ETS cap setting experiences, which could have more broader policy relevance. For instance:

- Targets should be set based on verified data.
- The governance of the target setting process should avoid those responsible for setting the target having an incentive to be unambitious.
- The balance of effort between traded and non-traded sectors and between carbon reduction and other measures like renewable deployment can be set by considering the costs of making investments in the relevant sectors and technologies. The EU ETS provides a good example of setting targets based on the marginal cost of abatement.
- However, the presence of multiple overlapping policies to realise these savings will mean that the effort is not carried out at least cost.

Allocation mechanisms

The vast majority of emission allowances were allocated for free during the early years of the system, and substantial free allocation remains. The purpose of free allocation can be seen as addressing two related issues. First, the introduction of a new carbon pricing policy imposes new regulatory costs on businesses, which they might not have anticipated as occurring over the economic lives of their emitting assets. Free allocation in relation to past emissions (grandfathering) can help address this. Second, a carbon price establishes costs on business within the system that may not be faced by competing business outside of the system. To protect against the competition aspects allowances can be given for free, either in relation to past emissions or according to industry emission standards (benchmarks) applied to each installation's level of activity (production). This concurrently addresses policymakers concerns over carbon leakage.

The way in which allowances are allocated is important for the decarbonisation incentive signal. The EU adopted a principal that the allocations for installations should, in general, be fixed in relation to their past performance and not changed as those installations make subsequent changes to their operations that affect their emissions. The reason for this is that if, for example, the allocation were to be reduced for installations that make emissions savings, then this has the effect of diluting the carbon price incentive for those savings. In practice however, the system does not follow this principle rigorously and there are several aspects for which future plant changes that affect emissions are recognised by changes in allocation, which are described in the following paragraphs.

The first of these is in relation to new installations and the complete closure of existing installations. If the decarbonisation incentive were to be maintained for these installations on a parity with those with continuing operations, then the new installations would not receive any free allowances and the closing ones would keep the allowances that they have already been allocated (thereby ensuring that the value of each tonne of CO_2 either emitted or saved is valued at the full carbon price). In practice this approach would pose problems. First, free allocation is the means of protecting industries from carbon price related competition. If new entrants were not allocated for free they would not benefit from that

protection in the same way as incumbents. Also, the continuing allocation of allowances to closed installations (which are more likely to be high polluters) may have validity economically but is politically difficult. For these reasons the EU allocates allowances for free to new entrants and requires closing installations to forfeit future allocations.

Related to the above there are rules in the EU ETS for adjustments to allocations in response to changes to operation for continuing installations. The changes recognised in this way are significant increases in capacity, significant decreases in capacity and partial cessations (that is reductions in activity, such as industrial output, that lead to corresponding reductions in emissions). By increasing or decreasing allocations in response to these changes, the value of carbon for the operator is not the same as the market price (but much less, or zero), because any additional allowances required for the change are provided for free, or the decrease in allowances required are matched by a reduced free allocation.

Taken together, this set of rules can also be viewed as providing some fluidity that recognises how a sector manufactures its products; under the new entrant and closure rules significant shifts in production between installations can be seen as triggering corresponding shifts in allowance allocation. This argument is important in justifying the suitability of the approach. Chris Dodwell explains some background to the early discussions on this issue. He believes that European Commission officials would have favoured a more economically rational approach without free allocation for new entrants and without allowance forfeit for closing installations. However, industry lobbied strongly for parity between incumbents and new entrants and this approach was adopted. Dodwell makes the more general observation at EU ETS allowance allocation rules have become “institutionalised”, which limits any realistic prospect of more radical changes to the architecture, including the possibility of removal of these new entrant and closure rules.

The issue was further examined in the impact assessment for the revision of the system for Phase III. This included an option where operators would continue to receive allowances throughout the trading period concerned, but would not receive allowances after closure in the next trading period. The second option includes the closure rule, but excludes any possibility for transfer. This means that allowances that are not allocated to installations due to closure would be added to the new entrants’ reserve instead. In the table below, the impact of these options in relation to relevant policy objectives is presented as assessed in the impact assessment. This assessment identified that having no closure rule would have a negative impact on the environmental effectiveness and distributional effects of the EU ETS in comparison with the option of including the closure rule. Based on this assessment, the EU decided to retain the existing closure rule and not to include an additional transfer rule.

Table 1: Summary of the impact of options for closure allocation in the EU ETS Phase III (European Commission, 2008)[5]

Option	Environ-mental effectiveness	Economic efficiency	Level playing field / competition	Simplicity, transparency, predictability	Distributional effects	Administrative costs
No closure rule	-	+	++	++	-	++
Closure rule, no transfer rule	0	+	++	++	+	+

++ = significant improvement, + = improvement, - = deterioration, -- = significant deterioration, 0 = negligible change.

A final example is the updating of benchmarks used for allocation. These benchmarks were developed and fixed for the third phase of the system based on the performance of each sector or subsector in 2008 and 2009. However, they will be updated in a way that reflects the actual changes in emissions performance of each sector or subsector. In addition, the historic activity levels for each installation, which are multiplied by the benchmarks to derive the allocations, will also be updated from the phase 2 baseline periods which were during 2005 to 2010. These changes mean that better performing sectors, subsectors or installations will in future receive lower allocations than they would have done under a continuation of the previous rules. Thus, to the extent that such rule changes were predictable, the incentive for abatement is lower as a result of these changes. The market expectation for similar changes in future has now been set, so in principle operators can expect that if they cut emissions in future then they could receive fewer allowances as a result.

These examples highlight how allowance allocation can affect the level of incentive for decarbonisation in carbon market systems.

Allowance oversupply and flexibility mechanisms.

The EU ETS experience has demonstrated that a fixed cap can lead to an oversupply of allowances if there is an unforeseen economic downturn that reduced demand for emitting activities. In response to the EU ETS oversupply problem the European Commission considered a set of possible reform options, and ultimately settled on two.

The surplus in Phase III was addressed, to a degree, through back-loading. Rather than the intended evenly spread auction of allowances within the phase, some 900 million of those planned to be auctioned in the early period will instead be auctioned in the final few years of the phase. This helps to provide short term scarcity although does not affect the overall level of the cap for the phase. This last point is important, since market confidence in the trading system is underpinned by perceptions of regulatory certainty, and any decision by the Commission to intervene and reduce the number of allowances within the system would have been thought to have been damaging to its credibility.

The longer term fix to oversupply is the Market Stability Reserve. This will be a permanent mechanism to automatically modify the volume of allowances within the market, by restricting the number of allowances auctioned when there is a surplus, or releasing withheld allowances to the market in times

[5] European Commission. (2008). Commission staff working document accompanying document to the proposal for a directive of the European Parliament and of the council amending Directive 2003/87/EC so as to improve and extend the EU greenhouse gas emission allowance trading system. COM(2008) 16 final.

of significant scarcity. It was analysed within the Commission's impact assessment[6], alongside alternative options which included permanent retirement of allowances and a carbon price floor.

The use of international offset credits has also had a role to play in the EU ETS oversupply problem, since use of cheaper Clean Development Mechanism (CDM) credits reduces the demand for EU allowances, and exacerbates their over-supply. The EU allowed a selective use of these credits for compliance, with limits intended to ensure that they are supplementary to domestic action. In practice, however, little domestic action was needed in Phases I and II, yet the credits could continue to be used up to the limits defined at the start of those phases, which meant that credits could be used instead of allowances and a surplus of allowance could be banked by participants for use in later years. The use of CDM credits has gradually been cut back over time, in part because of concerns over delivering domestic action but also in response to questions over the sustainability and additionality of certain CDM project types, and the role that the credits will play in the international climate change framework. However, the effect on the surplus of EU allowances continues to be felt.

Chris Dodwell highlights the early EU ETS debate about whether to pursue a pure economic model or to incorporate pragmatic compromises. He believes that there was a strong focus on the part of European Commission officials that the policy should follow a pure economic model aimed at ensuring least cost abatement, and that this persisted through into the discussions about how to address oversupply. Also, Dodwell explains that the focus of policymakers in the early stages was on the caps necessary to meet climate change targets, especially the Kyoto Protocol targets, and not on the incentive signal necessary to achieve a particular level of abatement. In other words there was not a strong understanding of the Marginal Abatement Cost Curve (MACC) at the time the caps were set and therefore no particular view about what the "right" carbon price should be. Dodwell believes that taken together, these factors inhibited any discussion on carbon price floor or ceiling measures, in spite of some Eastern European countries favouring a ceiling, since there was not a strong economic rationale for such floor or ceiling price interventions and no common view on the level at which they would need to be set.

Competitiveness and carbon leakage considerations

Concerns about the impact of the carbon price on industrial competition and net global carbon emissions (carbon leakage) have mainly been met through the selective allocation of emissions allowances for free, as mentioned previously. In practice there are two elements to the methodology for determining allowances: identification of which installations should benefit from free allocation and the determination of how many allowances each of these should receive. These are discussed below.

Carbon leakage risk factors

Carbon leakage is the term used to describe the situation where businesses transfer production to other countries which have lower control or constraints on GHG emissions. The risk of carbon leakage is higher in certain energy-intensive industries. The sectors and sub-sectors which are deemed to be exposed to a significant risk of carbon leakage defined in an official list established by the European Commission[7].

The carbon leakage risk factors were devised to identify sectors with high levels of trade outside of the EU and those with the highest carbon cost intensity. The tests applied are shown in Table 2.

[6] European Commission, Impact Assessment - Proposal for a Decision of the European Parliament and of the Council concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC, SWD/2014/017 final, 2014

[7] European Commission, Carbon Leakage, URL: http://ec.europa.eu/clima/policies/ets/cap/leakage/index_en.htm [Accessed 23/05/2018]

Table 2: EU ETS carbon leakage risk tests

Carbon leakage risk factor	Test	Threshold
Carbon Costs (CC)	(TCO_2 x €30/tCO_2) / gross value added	>30% (standalone) >5% (combined with TI)
Trade Intensity (TI)	(imports + exports) / (turnover + imports)	>30% (standalone) >10% (combined with CC)

These rules were applied in quantitative assessments, also supplemented by qualitative assessments, to determine which sectors should be subject to higher allocation to protect against carbon leakage. A carbon leakage factor is then applied in the calculation of allocations. If the installation belongs to an industrial sector considered to be at significant risk of carbon leakage, then this factor is 100%. Otherwise it follows a trajectory of 80% of the benchmarked allocation in the first year of Phase III (2013), declining linearly to 30% by the end of the phase (2020). There was no free allocation for electricity generation.

Overall, the number of sectors deemed to be exposed to carbon leakage has been considered to be very long, and consequently the mechanism too generous. For the fourth phase the number of sectors deemed exposed to carbon leakage will be around 50, from the current level of about 150, with the selection being focussed on those sectors at greatest risk of relocating operations outside the EU.

Allowance Allocation

The approaches to free allowance allocation to incumbents and new entrants have changed over the phases of the system. In the first two phases of the scheme, allowances were allocated to installations based on each Member State's own allocation rules, in accordance with guidelines produced by the European Commission and subject to its approval. A mix of approaches was employed across the system leading to a lack of consistency within and between sectors.

In Phase III a harmonised, centralised, EU wide approach was used. According to Article 10a of the EU Emission Trading System Directive (ETS Directive), the Commission adopted Decision 2011/278/EU (Harmonised Community -wide Implementing Measures (CIMs)) for free allocation of allowances to installation.

Free allocation, according to the CIMs, is done based on Community-wide ex-ante benchmarks. A total of 52 distinct product benchmarks[8] were established in units of allowances per tonne of product[9]. The benchmarks were based on the average of the top 10% performing installations in the sector for the years 2007–2008. Due to the complexity of industrial activities covered by EU ETS, it was not possible to establish a specific benchmark for every product made. In these cases, fall-back benchmarks based on the carbon intensity of heat use, fuel use or based on historical installation level emissions were applied.

For each industrial sub-installation, the benchmarks are multiplied by activity levels to derive an initial allocation. The activity levels are based on historic operation for incumbents (activity levels determined for the period 2005-2008 or 2009-2010) and are derived from plant capacities for allocations to new entrants and cessations due to changes in plant capacity.

[8] European Commission, Guidance Document 9 on the harmonized free allocation methodology for the EU-ETS post 2012 - Sector-specific guidance, 2011, URL: http://ec.europa.eu/clima/policies/ets/cap/allocation/docs/gd9_sector_specific_guidance_en.pdf [Accessed 23/05/2018]

[9] With the exception of the product known as 'Refinery Products', where the benchmark is expressed in units of tCO_2e per Complexity Weighted Tonne (CWT)

The preliminary total annual allocations calculated by Member States on the basis of benchmark formulas are then adjusted down by a single factor for all installations (known as the cross-sectoral correction factor) to ensure that the total allowances given out for free do not exceed the maximum set in the ETS Directive. The use of this correction factor is necessary to reconcile a top down cap with a bottom up allocation mechanism. It has been unpopular though as it is seen as arbitrarily reducing industrial emissions allocations, and an aim of the revision to the EU ETS for the forth phase has been to set stringent benchmarks so that the correction factor is not needed.

Linkage with other emission trading schemes

Emissions trading systems can be linked together so that their combined targets can be met through the least cost abatement available across the collective scope of the systems. In practice there are various ways that this linking can be transacted. It is possible that each system fully recognises each other's tradable units, such that they can be exchanged between market participants in each system, and used by obligated entities for compliance, irrespective of the system in which the units were originally generated. This is commonly called "full mutual recognition". More regulated options would involve a gateway between the linked systems, in which each system's administrator could generate new units in exchange for the surrender of the third party linked system's units.

Linking could be unrestricted or involve limits for the volume (quantitative) or type (qualitative) of third party units that could be used for compliance. Volume limits help preserve the incentive for abatement within the system that receives the units. Type limits restrict use of third party units to sectors or technologies that are consistent with the principles of the receiving system. For instance if a trading system excludes power generation, then it may not wish to allow use of credits from power sector projects in neighbouring countries with which it has grid connections.

Linking offers several potential benefits, including:

- Reducing the cost of cutting emissions
- Increasing market liquidity
- Making the carbon price more stable
- Levelling the international playing field by harmonising carbon prices across jurisdictions
- Supporting global cooperation on climate change

The EU ETS permitted use of credits from two Kyoto Protocol mechanisms, the Clean Development Mechanism and Joint Implementation, in its earlier phases, but these have become more limited over time. Chris Dowell believes that the initial enthusiasm with which this crediting was treated in the design phase reflected the importance of the EU ETS as a Kyoto Protocol compliance mechanism. However as the international climate change policy landscape has changed after the climate negotiations in Copenhagen and with the Paris Agreement, there is a weaker rationale for credits to be used in that way.

The EU ETS legislation allows for the possibility of linking to other compatible emissions trading systems in the world at national or regional level. Conditions for linking include:

- System compatibility (i.e. the systems have the same basic environmental integrity, and a tonne of CO_2 in one system is a tonne in the other system)
- The mandatory nature of the system.
- The existence of an absolute cap on emissions.

Negotiations over linking the EUETS to the Switzerland's ETS opened in 2010. A linking agreement was initialled in January 2016 and the agreement is expected to enter into force in 2019 once the ratification processes have been complete. Linking will result in the mutual recognition of EU and Swiss emission allowances[10]. The linking agreement[11] describes a long list of essential criteria for harmonisation between the systems, for stationary installations, aviation and systems aspects like the functioning of registries. The list of factors for stationary installations gives a good indication of the important issues to be harmonised:

Table 3: EU ETS / Switzerland ETS linking criteria

Harmonisation criterion
Mandatory nature of the participation in the ETS
Minimum activities to be covered
GHG to be covered
Minimum stringency of the cap
Minimum stringency on the qualitative limits for international credits
Minimum stringency on the quantitative limits for international credits
Maximum allocation of allowances for new entrants and presumption of full auctioning for activities not covered by allocation benchmarks and adjustment factors.
Minimum stringency for Monitoring and Reporting requirements
Minimum stringency for Verification and Accreditation requirements

The linking agreement defines how each of the systems meets these criteria by reference to its legislative acts. Thus, any further linking with third party systems (including a UK system post Brexit) is likely to need to satisfy these minimum requirements.

The European Commission is open to linking to other trading systems around the world, and hopes to use the linking agreement with Switzerland as a template. However, a comparative analysis of the compatibility of the EU ETS with carbon markets in China, South Korea, New Zealand, Kazakhstan and the US RGGI, concluded that there is little prospect of linking the EU ETS to these carbon markets in the near future because of differences in design features such as the relative stringency of climate targets, the recognition of carbon offsets and price or supply controls[12]. This analysis was carried out by Carbon Watch, an NGO seeking to promote effective carbon pricing and climate friendly policies.

A previous agreement to progressively link the EUETS to the Australian ETS between 2015 and 2018 failed in 2013 after carbon pricing was abolished following a change of government in Australia.

EU Directive 2004/101/EC also allows businesses to use certain types of emission reduction units generated under the CDM and Joint Implementation (JI) measures to meet their obligations under the EU ETS. The use of such units is currently restricted to 11% by volume. The Paris Agreement established a new market mechanism for international credits that replaces CDM/JI, but current plans for the EU ETS post 2020 do not envisage the use of international credits[13].

[10] European Commission, EU and Switzerland sign agreement to link emissions trading systems, 23/11/2017 , URL: https://ec.europa.eu/clima/news/eu-and-switzerland-sign-agreement-link-emissions-trading-systems_en [Accessed 23/05/2018]
[11] European Union Official Journal, AGREEMENT between the European Union and the Swiss Confederation on the linking of their greenhouse gas emissions trading systems, 2019, URL: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22017A1207(01)&from=EN [Accessed 23/05/2018]
[12] Carbon Market Watch, Towards A Global Carbon Market Prospects For Linking The EU ETS to Other Carbon Markets. May 2015, https://carbonmarketwatch.org/wp-content/uploads/2015/05/NC-Towards-a-global-carbon-market-report_web.pdf [accessed 23/05/2018]
[13] European Commission, Use of international credits , URL: https://ec.europa.eu/clima/policies/ets/credits_en [accessed 23/05/2018]

Further considerations

In this section we address three further specific issues related to the EU ETS: the options for the UK under Brexit; the interactions between the EU ETS and Climate Change agreements, and; the way in which UK policies affecting EU ETS sectors arguably have limited impact because additional corresponding emissions are permitted under the EU ETS cap.

- **The current thinking about options for UK involvement in EU ETS post Brexit**

Although the UK's future participation in the EU ETS after Brexit is uncertain, the UK Government has reiterated its commitment to carbon pricing as an emissions reduction tool, as long as energy and trade intensive businesses are appropriately protected from any detrimental impacts on competitiveness[14].

The Select Committee for Business, Energy and Industrial Strategy has also recommended that the UK Government seeks to retain membership of the EU ETS until the end of Phase III in 2020 and negotiates longer term membership of the EU ETS on the condition of commitment to future reform." [15].

The possibility that the UK could exit the EU without a negotiated agreement in March 2019, has already prompted the EU to take measures to protect the stability of the EU ETS, including a proposal to invalidate all UK allowances (EU Allowances, EUAs) for 2018-19, but after negotiation this was subsequently replaced with the requirement for UK companies to surrender their allowances by the 15th March 2019, which is six weeks ahead of the schedule submission deadline and before the earliest date for Brexit.

In the eventuality that EU ETS membership cannot be negotiated successfully then it may have the option to operate its own system and link to the EU ETS, which would require a high degree of policy alignment, or it may adopt its own policy separate from the EU ETS, in which case a divergent approach is possible. Whilst there has been some discussion of these options in the academic and trade press, the UK government has not engaged in these discussions, so it is difficult to identify the most likely alternative. To date all non-EU members of the EU ETS (Iceland, Lichtenstein and Norway) have been members of the European Economic Area (EEA). Switzerland, which is not a member of the EEA but is a member of the European Free Trade Association will have its carbon trading system linked to the EU ETS. All four of these countries are participants in the EU single market.

- **The issues around the marriage of UK Climate Change Act with the EU ETS (traded sector)**

The EU ETS Directive 2009/29/EC is transposed into UK law via the Greenhouse Gas Emissions Trading Scheme Regulations 2012[16], and amended normally annually by the negative resolution procedure to refer changes to the EU ETS rules, scope and allocations. The European Commission proposes to implement Phase IV by amending the Directive and UK Government has indicated that consolidated regulations will be prepared to implement these proposals if the UK remains in the EUETS.[17]

The 2008 Climate Change Act (CCA) contains provision for the implementation of UK emissions trading schemes, but these provisions are not currently used, as EU ETS does not fall inside their remit. However, the 2008 CCA requires that the CO_2 reductions that will be realised under the EU-ETS be taken into account when setting net carbon budgets after allowing for trading, and when reporting on progress. The

[14] House of Commons, Leaving the EU: negotiation priorities for energy and climate change policy: Government Response to the Committee's Fourth Report of Session 2016–17, 2017 https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/550/550.pdf [accessed 23/05/2018]
[15] House of Commons, Leaving the EU: negotiation priorities for energy and climate change policy: Government Response to the Committee's Fourth Report of Session 2016–17, 2017 https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/550/550.pdf [accessed 23/05/2018]
[16] The Greenhouse Gas Emissions Trading Scheme Regulations 2012, https://www.legislation.gov.uk/uksi/2012/3038/contents/made [accessed 23/05/2018]
[17] BEIS, Explanatory Memorandum To The Greenhouse Gas Emissions Trading Scheme (Amendment) Regulations 2017 No. 1207 Https://www.legislation.gov.uk/uksi/2017/1207/pdfs/uksiem_20171207_en.pdf [accessed 23/05/2018]

government intends to ignore any crediting and debiting of UK carbon units that occurs as a result of trading with non-UK participants under the EUETS, and can use the safety valve mechanism to address any resulting shortfall in UK emissions reductions[18]. However, if the UK leaves the EU-ETS then an accounting adjustment could be needed to preserve the intent of the carbon budgets[19].

- **The debate about how UK action does not increase aggregate GHG reduction, just suppresses EUA prices**

The cap and trade nature of the EU ETS means that the total quantity of emissions for the system over a phase is defined by the cap set prior to that phase. This means that additional policies that drive down emissions within a subset of EU ETS participants will not deliver additional savings, since they can be offset by higher emissions elsewhere in the system. In market terms these supplementary policies should have the effect of suppressing EU ETS prices below the level that they would otherwise reach, although discerning that effect in practice would be difficult. By preferentially targeting emissions from a subset of participants or using a subset of technologies, the overall costs of achieving the cap are increased.

The types of additional policies that can interact with the EU ETS in this way particularly include renewable electricity support schemes and electricity demand reduction measures, such as white certificate schemes, but generally any policies that affect EU ETS emissions raise the same concern. It is a logical conclusion that policies targeting EU ETS emissions will not deliver additional savings for a given EU ETS cap. There may also be the suggestion that through though the supposed suppression of the EU ETS price and increases in emissions elsewhere in the system, that this represents a lost opportunity to deliver greater savings overall. In practice it is necessary to look at how the EU ETS cap is set to understand this further.

In phases I and II the caps were set by each Member State in the NAP process, mentioned above. Each Member State considered the role of its other policies and defined EU ETS targets to deliver additional savings within the trading system. The caps, however, were designed to enable each country to meet its Kyoto target, and thus the ambition was defined not for the EU ETS alone but by reference to the Kyoto targets. In practice the Kyoto targets were set on the basis of what was considered achievable against historic baselines and implicitly factored in what could be supported by policies. Therefore the EU ETS caps were not set in isolation but with an understanding of the savings to be sought from other policies.

For Phase III, the EU ETS cap was designed to achieve EU emissions targets recognising the costs and potential of savings within the traded and non-traded sectors. The cap was intended to lead to broadly equivalent marginal costs of abatement between these groups. Therefore, the targets affecting each sector represented the technical potential for that sector – i.e. the volume of emissions that could be saved and at what cost - rather than whether or not there were existing policies that would contribute to realising those savings. The presence of overlapping policies would not affect the overall sector ambition on this basis, but it would, in theory, affect the cost effectiveness of meeting those targets.

- **Relationship between UK climate Change Agreement targets and the EU ETS**

Currently companies that are part of Climate Change Agreements (CCA) are entitled to pay a reduced rate of Climate Change Levy (CCL) on electricity, gas and other fuels consumed in eligible CCA facilities. Eligible CCA facilities may include activities that are covered by the EU ETS, but since 2013, the fuel used by EUETS installation is discounted when determining the target reduction required to

[18] DECC, Explanatory Memorandum To The Climate Change Act 2008 (2020 Target, Credit Limit And Definitions) Order 2009, https://www.legislation.gov.uk/ukdsi/2009/9780111478523/pdfs/ukdsiem_9780111478523_en.pdf [accessed 23/05/2018]

[19] Committee on Climate Change , Meeting Carbon Budgets – Implications of Brexit for UK climate policy Briefing, October 2016 https://www.theccc.org.uk/wp-content/uploads/2016/10/Meeting-Carbon-Budgets-Implications-of-Brexit-for-UK-climate-policy-Committee-on-Climate-Change-October-2016.pdf [accessed 23/05/2018]

meet the CCA agreement. However, the reduced rate of CCL is payable on the fuel used by the EUETS installation, provided that the CCA facility represents at least 70% of the total site energy use.

If the CCA facility represents less than 70% of site energy use, then it must be sub-metered and the reduced rate of CCL is restricted to the CCA facility. Prior to 2013, the fuel used by the EUETS installations were included within CCA agreements, but as part of an administrative simplification EUETS fuel use was excluded and the previous 90/10 rule was replaced with the 70/30 rule. These changes meant that more energy qualified for a reduced rate of CCL, and reduced the need for new entrants to the CCA scheme to purchase sub-meters. It also made CCA participation more attractive, thereby increasing the level of carbon dioxide savings that could be realised by the CCA scheme[20].

The effect of these interactions is that the incentive for UK emissions abatement within the EU ETS is not the same for all sources. The CCL incurs an energy content related charge for energy use, which includes energy within the EU ETS, such that the incentive is different from non-energy use emissions and is not the same in carbon terms for all fuels. Also, some selected sectors can receive a rebate on the CCL payments associated with energy within the EU ETS, but this depends on their eligibility for, and achievement of, CCL targets.

Key findings

In this case study the following main findings are drawn:

The extent to which carbon pricing policies can deliver a consistent decarbonisation incentive across many sectors will depend on their suitability to be covered by a uniform framework. The scope of the EU was determined on the basis of environmental effectiveness, economic efficiency, administrative feasibility and the existence or suitability of alternative policies and measures. On this basis it was originally decided to cover power generation, other combustion and a set of emission intensive industries. The approach was designed to mirror existing industrial emissions regulation, since this was easier for policymakers to accept across the EU. Beyond subsequent inclusion of aviation, further changes to scope have been relatively modest – the political difficulty of making evolutionary changes has been a factor in this.

Emissions trading caps should be set with consideration as to what savings can be achieved in other sectors. The EU ETS third phase cap was set such that the marginal cost of meeting EU targets would be the same for traded and non-traded sectors. This approach also meant that the amount of renewables to be deployed within and outside the EU ETs was anticipated, and thus taken into account in the target setting. The presence of preferential renewables policies, however, means that decarbonisation targets would not necessarily be achieved at lowest cost to the economy.

Free allocation of emissions allowances can help mitigate concerns that sectors exposed to international competition are disadvantaged by the carbon price. However, if the allocation mechanism adjusts future allowances in response to future changes in emissions (updating) then the decarbonisation signal is reduced. In the EU ETS this has been the case for allocation mechanisms for new entrants and closures and will be the case as benchmark allocations are updated in the fourth phase.

Free allocation to counter carbon leakage concerns should be based on robust technical assessments of each sector or subsectors exposure to international competition. The EU ETS applies criteria based on carbon costs and trade intensity. It is seeking to reduce the number of sectors deemed exposed to leakage for phase 4, with a focus on sectors at highest risk of relocating their

[20] DECC, Proposals on the future of Climate Change Agreements , 2011, URL: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42825/2630-cca-simplification-ia.pdf [accessed 23/05/2018]

production outside the EU. Ultimately, a longer term trajectory in which the removal of free allocation is profiled would sent a clear signal to the market.

Carbon market linking can help decarbonisation targets to be met at lowest cost, by increasing the available abatement opportunities. It also harmonises carbon pricing signals across jurisdictions. Strong harmonisation between linked systems is important and the EU and Swiss authorities have agreed a set of mandatory criteria in their ETS linking agreement. These include the mandatory nature of the systems and alignment of scope and coverage as well as stringency in ambition, use of credits and MRV standards. Alignment of allowance allocation methods is also important. However, linking of carbon markets is a more complex subject under the Paris Agreement than the Kyoto Protocol. The former recognises a more diverse range of mitigation actions and, consequently, ways to account for these. This makes harmonisation of policy instruments to a degree necessary that emission savings are tradable a more difficult prospect.

Careful management of market sensitive data is necessary to avoid disruptive market volatility and to avoid damage to market confidence. The piecemeal release of EU ETS first year verified data, which revealed the extent of the unforeseen lack of allowance scarcity, resulted in a turbulent period in which there were several successive large drops in the allowance price. The European Commission sought to strengthen transparency and communication of information following this experience.

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