Revenue dimensions of the EU ETS Phase III

Lead Authors
Simone Cooper
Professor Michael Grubb

Contributing Authors
Adam Rysanek
Tim Laing

12th May 2011

Climate Strategies aims to assist government in solving the collective action problem of climate change. A “not for profit” membership organisation, Companies House Number 05796323. Funders include governments and foundations. All our research is published in the public domain.

www.climatestrategies.org
Lead Authors
Simone Cooper, Climate Strategies
Professor Michael Grubb, University of Cambridge, Climate Strategies

Contributing Authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam Rysanek</td>
<td>University of Cambridge</td>
</tr>
<tr>
<td>Tim Laing</td>
<td>The London School of Economics</td>
</tr>
</tbody>
</table>

Acknowledgement
The authors wish to thank without implicating: Dr. Dora Fazekas (Climate Strategies), Emmanuel Guerin (IDDRI), Dr. Susanne Droege (SWP Berlin), Greg Cook (Carbon Counts), Peter Wooders (IISD), Dr. Stephanie Monjon (CIRED), Dr. Felix Matthes (Oeko-Institut), and Alex Vasa (CPI Berlin), for many useful comments and assistance.

Publisher
Climate Strategies 2011

For citation and reprints, please contact the publisher Climate Strategies
Revenue dimension of the EU ETS Phase III

Contents

Executive summary ........................................................................................................3
Introduction ..................................................................................................................5
1. Overview and focus of the paper................................................................................6
   1.1. Emissions profile of sectors covered by the EU ETS........................................7
   1.2. Policy developments in Phase III of the EU ETS..............................................8
   1.3 The issue of carbon leakage................................................................................10
   1.4. Profiling the cement and steel sectors in Europe..............................................13
2. Relative scales of revenue .........................................................................................16
   2.1. Common assumptions and the move to 30%......................................................16
   2.2. Current allocation structure.................................................................................17
   2.3. Inclusion of cement and steel into full auctioning from 2013 with border levelling.....19
   2.4. Limitations of the approach.................................................................................21
3. Gross revenues..........................................................................................................22
   3.1 Gross revenues by Member States......................................................................24
      3.1.1 Current allocation structure..........................................................................24
      3.1.2. Auctioning in the cement and steel sectors................................................24
   3.2. Receipts after redistribution to New Member States ..........................................25
4. Whose money, used for what? ..................................................................................28
   4.1. Introduction: economics and politics of revenue and rent....................................28
   4.2 Current climate-related commitments and potential programmes.......................28
      4.2.1 ‘Adjustment’ for electricity consuming industries and vulnerable groups.........28
      4.2.2 CCS set-aside..............................................................................................30
      4.2.3. Broader government-financed RD&D of low carbon technologies ..............31
      4.2.4. Other direct supports to low-carbon power generation and infrastructure .......32
      4.2.5. Programmes in manufacturing sectors .......................................................33
   4.3. International support of climate mitigation, adaptation & capacity building .........33
   4.4. Beyond climate expenditures (i): recycling and ‘Double dividend’ debates...........35
   4.5. Beyond climate expenditures (ii): Europe’s Debt crisis ......................................36
5. Conclusions ..............................................................................................................40
References ....................................................................................................................42
Annex I – Modelling the European Commissions’ cement and steel sector benchmarks ....44
Annex II - Numerical estimates of potential revenue generated in Phase III..................47
List of figures

Figure 1: Emissions profile of sectors covered by the EU ETS in 2008 .............................................8
Figure 2: Allocation and emissions in the EU ETS across the phases ....................................................10
Figure 3: Emissions from the cement and steel sectors 2005-2009 ..........................................................13
Figure 4: Import volumes 2005-2009 .....................................................................................................13
Figure 5: Sectoral breakdown of aggregate revenues under different allocation methods and targets ...............................................................................................................................20
Figure 6: Scales of revenues in the cement and steel sectors under different allocation methods and targets ...............................................................................................................................22
Figure 7: Relative sector contribution to total auction revenues in the 20% (a) scenario. ...............Error! Bookmark not defined.
Figure 8: Relative sector contribution to total auction revenues in the 30% (a) scenario. ..........25
Error! Hyperlink reference not valid.
Figure 10: Projected 2013 auction revenues as % of 2009 deficits ..................................................38
Figure 11: Projected 2013-2020 auction revenues and debt-GDP ratios 2010 ....................................38
Figure 12: Relative division of Blast Oxygen Furnace and Electric Arc Furnace produced steel in a selection of European countries .................................................................................................................46

List of tables

Table 1: Emissions from manufacturing and power sectors in 2008 (Mt/CO2) .................................8
Table 2: Overview of the move from a 20-30% reduction commitment .............................................9
Table 3: Upper and lower bounds on likely carbon prices in 2020 based on different assumptions on the use of offsets and achievement of RES targets. .........................................................17
Table 4: Allocation methodologies in sectors covered by the EU ETS in Phase III ............................18
Table 5: Exercise to calculate equivalent auction revenues from border levelling ........................20
Table 6: Scale of revenue to be redistributed to NMS ........................................................................20
Table 7: Modelling results which show revenue accrued to Member States following redistribution of auction rights entitlements .................................................................................................................27
Table 8: Review of recent multilateral and bilateral international support schemes developed by the EU and Member States .................................................................................................................35
Table 9: The European Commissions’ benchmarks for the cement and steel sectors ..................45
Executive summary
This paper addresses three basic questions:

1) **What is the likely scale and distribution of revenues associated with auctioning allowances** under the currently proposed structure of EU ETS Phase III, and how might this be affected if the EU were to move to a stronger 2020 cap than 20%?

2) **What might be the revenues raised by moving to auctioning in the cement and/or steel sectors** (which we assume would be in combination with border levelling to prevent carbon leakage), with full auctioning from 2013 representing the extreme case?

3) **What might be appropriate uses of revenues raised under Phase III** and how do these relate to current EU commitments, plans and concerns in climate change, competitiveness and beyond?

Core assumptions
For transparency and simplicity we use scenarios in which the carbon price starts at €15/tCO2 in the first year of Phase III (2013) and rises linearly towards the price levels projected for 2020 in the published scenarios of the European Commission\(^1\), and present results in terms of the total cumulative revenues over the eight years of Phase III. Since markets are forward looking (and €15/tCO2 is at the low end of current expectations) this will tend to underestimate the impact of the higher price scenarios. We explicitly model the impact of allocation benchmarks in cement and steel, but not in other sectors, and for simplicity we assume that the overall decline in emissions corresponding to the cap is distributed equally across regions and sectors.\(^2\)

We argue that revenues should be directed first and foremost to climate-related expenditures, with priority to those associated with the sectors paying for the allowances, before considering wider economic applications.

Results
*i) Currently proposed structure (auctioning for the power sector, BM free allocation for sectors classified at risk of leakage).* With these assumptions, the current proposals would raise €150-190bn across the EU out to 2020. This would rise to €200-310bn should the EU move to a 30% target (with 34% EU ETS cap relative to 2005). Germany would receive the highest proportion of auction revenue by far (€37-46bn under 20%), even after redistribution of 12% of auction revenue to MS with lower GDP per capita and who have significantly exceeded their Kyoto target. Italy, Poland, Spain and the UK would each accrue over €10bn in auction revenue from the power sector alone.

*Sector-related expenditures.* Such revenue could be most obviously used for, or offset against, expenditures on
(i) Helping some major electricity consumers and vulnerable groups invest in improving electricity efficiency to ameliorate the cost impacts;

---

\(^1\) We assume carbon prices of €17/t, €25/t, €30/t and €55/t in 2020. For a fuller explanation, please refer to page 16 of the report.

\(^2\) Thus we assume that emissions from all sectors decline in proportion to the overall cap, relative to historic levels. There is some expectation that power sector emissions may decline more relative to manufacturing, though this is not certain; this would imply lower revenues from power sector auctions, but correspondingly greater revenues from manufacturing sector purchases. Ignoring the impact of sector benchmarks other than iron and steel (ie. assuming a level of free allocation in other manufacturing sectors equal to each sectors’ proportionate share) would also tend to underestimate the scale of manufacturing sector purchases.
(ii) Demonstrating CCS, which including the "NER300" could account for over €5bn,
(iii) Doubling of other low carbon energy RD&D towards the SET goal of €50bn over the next decade,
(iv) Strengthening EIB project loans for renewables (currently around €3-4bn/yr) and transnational grid infrastructure.
This combined with technology expenditures (excepting the direct national support schemes like feed-in tariffs) are estimated to be lower than the likely scale of auction revenues.

**ii) Auctioning in cement and/or steel sectors.** Our previous research has underlined the theoretical benefits of auctioning over free allocation, subject to constraints arising from potential carbon leakage. Our proposed alternative scenario of auctioning in the cement sector from 2013, which may in fact address some of the risks associated with free allocation based on a clinker benchmark, would raise €20-25bn across the EU under 20% target, rising to €26-€40bn under the 30% target. Revenues from steel in the current proposed structure are a bit higher than cement, but still much smaller than the corresponding figures for the alternative scenario of full auctioning in the steel sector from 2013 which raises €13-25bn (20% target) or €17-41bn (30%).

Cement is more evenly distributed across Member States, but with relatively higher proportion in the former Cohesion countries (Portugal, Spain, Italy, Greece and Ireland) where auctioning in cement would raise €7.5–15bn across the various scenarios. Though the totals are similar for steel, its production (and any associated auction revenues) are more concentrated in a limited number of Member States (notably Belgium, Czech Republic, France, Germany and Italy). It is not credible for revenues on the scales indicated from cement to be used mainly for technology-related measures within the sector. The possible needs for steel sector technology investments are greater, and the long term economic benefits potentially greater, but the net fiscal gains from auctioning to steel overall would be more uncertain and less widely distributed.

**iii) Non-sector-related uses of revenues.** Additional potential uses of revenues raised include: *International climate expenditures.* Public funds for international climate expenditures already exceed €1bn/yr and the EU is committed under the Copenhagen-Cancun agreements to increase this, under the “fast start” financing to €21bn over 2010-2012, and ultimately up to €100bn/yr collectively across industrialised countries from all sources including private sector (e.g. offsets). Auction revenues would be an obvious potential source, and revenues from any border levelling measures would have particular relevance in this context.

‘Revenue recycling’ through reduction in other taxes, which touches on a long but still contested literature on the potential macroeconomic benefits of raising more money from pollution charges and less from income or corporate taxation.

**Debt reduction.** Total auction revenues overall would amount to only a few percent of the EU’s overall 2009 debt levels (about 2% at the lower level, up to 4-5% for the high scenarios). At the same time, this amount is trivial in absolute terms, particularly in relation to the severe fiscal difficulties a number of Member States face. Using auction revenues for wider fiscal purposes would be controversial, and has potential to damage and distort the fundamental purpose of the EU ETS. At the same time, it is hard to envisage the likely level of revenues in the early years of Phase III being sensibly absorbed for sector/technology-specific, or even broader climate-specific purposes, as these programmes necessarily scale up over time. Our earlier work underlined efficiency arguments for auctioning, subject to solutions regarding carbon leakage.

This paper concludes that auction revenues will be easily on a scale commensurate with key technology and infrastructural dimensions towards transforming the European economy. However,
the revenue dimension does remain relevant to the wider debate on European debt and fiscal stability.

Introduction

The fundamental purpose of the EU Emissions Trading Scheme (EU ETS) is to generate emissions reductions through a declining cap, incentivised by a carbon price and the opportunity to trade allowances. A large body of economic literature exists outlining the merits of auctioning versus free allocation from an efficiency and effectiveness viewpoint\(^3\). Recognising this, there has been a shift towards increased levels of auctioning in the EU ETS in the power sector and free allowances based on benchmarking in manufacturing sectors which reduces but does not fully eliminate the efficiency loss from free allowances.

An associated issue related to increased levels of auctioning is the public sector revenues that could be generated which to date has received relatively little public attention. Under the current provisions, in Phase III of the EU ETS, the power sector (with special derogations for new member states (NMS) and certain manufacturing sectors will face increasing levels of auctioning between 2013-2020 whilst manufacturing sectors classified by the European Commission as being at risk of carbon leakage will receive benchmarked free allocation against a declining overall cap.

The potential scale of public sector revenue that could be generated in Phase III will change depending on the price and the number of allowances auctioned (including considerations relating to sectoral coverage) and whether or not the EU decides to move beyond a 20% emissions reduction target in 2020.

Understanding the scale of revenue generated under different climate policy options is extremely important for particular sectors and regions. The EU has made strong commitments to transform energy use and emissions in the 2008 EU Climate and Energy Package (CEP), which may indeed be strengthened should the EU move beyond a 20% reduction target in 2020. There are also genuine concerns regarding the competitiveness impacts of a more stringent carbon price in the EU in particular sectors and the timely opportunity to shift towards low carbon production practices which will not be fully realized with a carbon pricing policy alone. In addition to outlined domestic ambition, the EU has expressed the commitment to assist with finance for climate adaptation, mitigation and developing country capacity building at the international level.

Against this policy backdrop, a number of EU Member States are experiencing extreme fiscal difficulties. Both Greece and Ireland received sizeable bailouts last year when they were unable to sustain levels of public debt and there are still fears that Italy, Spain and Portugal could experience similar difficulties given their high debt to GDP ratios and slowed economic growth rates. However, the scale of debt extends beyond these selected Member States. In 2011, the EU has to refinance more debt than at any time since the launch of the Euro currency, in the order of 560 billion Euros (an increase of €45bn in 2010)\(^4\).

\(^3\) Please see Neuhoff & Matthes (2008)
\(^4\) Please see ft.com
1. Overview and focus of the paper

The aim of the paper is to explore the relative magnitude of auction revenue that could be generated under different allocation scenarios (also framed within the context of whether or not the EU moves beyond a 20% emissions reductions target) and appropriate uses of any revenues raised.

There are two distinct research questions in this paper which, through simple calculations, can provide a broad indication regarding the ability of the EU ETS to significantly contribute to both the EU’s ambitions on emissions reductions and alleviating its worsening public sector finances.

1. What is the scale of public sector revenues that could be generated under different policy scenarios?
2. What are the options for using these public sector revenues?

This analysis is meant to serve as a first, broad indication of the scale of finance that could be generated and catalyse further work in this area.

The analysis begins with an overview of the aggregate impacts of 2 distinct policy scenarios and 4 different assumptions on the carbon price in 2020. These are discussed in section 2. There is a particular emphasis on the impact of the EU increasing its level of ambition in 2020 to move beyond a 20% reduction target as this would affect the cap and price of carbon in Phase III of the EU ETS.

Should the EU move to a 30% target, the EU ETS Directive would need to be re-opened and as such a number of revisions might be made to design provisions in the scheme e.g. the number of international offsets that can be used in the scheme. This design uncertainty translates into additional price uncertainty and so for the purposes of this analysis, two carbon prices for a move to 30% have been chosen based on updated assessments by the Commission5. These act as an estimated bound on the possible revenues that could be generated under different permit allocation structures.

The analysis on the scale of revenues continues with a deeper look at the regional revenues that could be generated from alternative allocation methods. The European Commission has determined that auction revenue should accrue to individual Member States (with the exception of 12% of the total revenue generated to be transferred to poorer MS and those who have already exceeded their Kyoto target significantly). The revenues accrued to each Member State from auctioning allowances will be dependent on a number of factors including the fuel mix in their power sector (latterly determining the carbon intensity of fuel generation and the associated emissions), the size of their manufacturing sectors (principally cement and steel), and their openness to international trade. Understanding the national level revenues of different policy options will be particularly important when looking at the differing situations Member States face in relation to public sector debt and expressions of climate related ambitions both domestically and abroad.

The second component of the report focuses on the options for using this public sector revenue estimated in section 1. It explores the financial commitments made by EU Member States relating to Climate Change at a national, EU-wide and international level, including

---

5 Presentation of the European Commission’s carbon prices in 2020 under different assumptions can be found in Sijm (2011)
sensitivity analysis around the issue of moving beyond a 20% emissions reductions commitment in 2020. This section will also bring together a number of estimates on the necessary scale of investment required in the power, cement and steel sectors to shift them onto a low carbon trajectory consistent with international climate ambitions. Similarly to section 1, this section begins with an aggregated assessment and then identifies regional debt and spending options.

The numbers generated in the paper are based on best available information and sensible assumptions, however there is inherent uncertainty regarding a number of the contributing factors which determine the scale of auction revenue and thus affect the accuracy of the results. Most pertinently, the carbon prices and their trajectory in Phase III are uncertain and subject to a number of determinants. As such, this paper provides upper and lower bounds on estimates based on different carbon price assumptions.

The limitations of this approach are outlined fully in section 2.5 however there is still value in understanding the relative magnitude of revenue from different allocation methods.

1.1. Emissions profile of sectors covered by the EU ETS

Figure 1 gives a profile of verified emissions covered by the EU ETS in 2008. Non-power sector emissions are disaggregated into those that have and have not been officially classified as being at risk of carbon leakage by the European Commission. Figure 1 and Table 1 below indicate their relative magnitude. Manufacturing sectors at risk of leakage comprised of around 80% of total manufacturing emissions in 2008 and the cement and steel sectors accounted for up to half of these emissions. The power, steel and cement sector accounted for around three quarters of all emissions covered by the EU ETS in 2008 according to the CITL database.

We offer an additional upper bound to the steel sector estimate because of inconsistencies with classification of emissions into different sectors by Member States. This is explained fully in section 2.2. There is a strong likelihood that emissions from the steel sector are not fully captured by NACE code 2710 on the CITL database alone because of reporting inconsistencies amongst member states. Some steel installations are likely to be listed at the NACE 2 level 2700.

---

6 This is explained fully in section 1.3
7 The contribution from the steel sector might be higher than this in actuality due to differences in sector classification across Member States. At NACE 4, a number of sources were classified as 27 which denotes the manufacture of basic metals. This NACE 2 code includes the manufacture of basic iron and steel and of ferro-alloys (NACE 2710) but also includes other metals such as aluminium. It is not possible to distinguish what percentage of these NACE 2 emissions originate from steel but it is reasonable to assume a large percentage could be from iron and steel production, providing an upper bound on the analysis.
8 NACE is the acronym for “Nomenclature generale des Activites economiques dans les Communautes Europeennes” and is the classification system used for industry in Europe. It is linked to the UN International Standard Industrial Classification (ISIC) and so is comparable at NACE 2 level to industry classifications outside of the EU. NACE 4 is coded at the 4 digit level and is a higher level of sector disaggregation than NACE 2.
Figure 1: Emissions profile of sectors covered by the EU ETS in 2008, Source: CITL

<table>
<thead>
<tr>
<th>Sector</th>
<th>Total verified emissions (2008) Mt/CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing classified as at risk</td>
<td>640,000</td>
</tr>
<tr>
<td>Manufacturing not classified as at risk</td>
<td>150,000</td>
</tr>
<tr>
<td>Power sector</td>
<td>1,365,000</td>
</tr>
<tr>
<td>Total</td>
<td>2,155,000</td>
</tr>
</tbody>
</table>

Table 1: Emissions from manufacturing and power sectors in 2008 (Mt/CO2), Source: CITL

1.2. Policy developments in Phase III of the EU ETS

The EU ETS will enter Phase III in 2013, benefitting from 7 years of trading experience and refinements to its design. A number of changes have been implemented which will ultimately increase the stringency of commitments from installations and the associated carbon price.

The principle changes include:

- A centralised, known, EU-wide cap on emissions
- Increased levels of auctioning, estimated to be around 50% of total EU allowances (EUAs) in 2013 (principally the power sector\(^9\) and some manufacturing sectors),
- A cap on the permissible level of emissions reductions from outside the EU (i.e. Assigned Allowance Units (AAUs) and Certified Emissions Reductions (CERs) to be traded,
- Linking of aviation into the scheme
- The redistribution of 12% of auction revenue to go to Member States (mainly Eastern Member States) with lower GDP and who have made significant reductions beyond their Kyoto commitments. Based on later estimations in this paper, this is equivalent to between €18-23bn over Phase III of the EU ETS.

\(^9\) With lower levels of auctioning for NMS early in Phase III.
- A non-legally binding commitment to spend at least half the revenues from auctioning (based on later estimations this is equivalent to approximately €75-90bn) to tackle climate change in the EU and in developing countries.

- Sectors classified by the European Commission as being at significant risk of relocating production outside of the EU due to the carbon price (i.e. carbon leakage) will receive allowances for free. The exact amount each installation receives will be based on a benchmark set as the average of the top 10% most greenhouse gas efficient installations in the EU. I.e. an installation that is as efficient as the average top 10% will receive 100% of their required allowances for free and this percentage will decline depending on the emissions efficiency of the installation. There are 52 product benchmarks expressed in terms of emissions per tonne of output.

- Sectors not classified as being at significant risk of carbon leakage will receive 80% of their benchmarked allocation for free in 2013, declining to 30% in 2020 and 0% in 2027.

The cap for Phase III will be revised downwards reflecting the increased stringency and ambition for Europe between 2013-2020 as is outlined in Figure 2. In Phase II of the EU ETS, the overall cap was set as 6.5% below 2005 levels for 2008-12 and which will increase to 21% below 2005 levels by the year 2020. Should the EU increase its level of overall ambition and move beyond a 20% emissions reduction target in 2020 and the additional emissions reductions are realised domestically, the EU ETS cap is expected to be tightened further to 34% below 2005 levels.

The European Commission has recently determined that the cap for 2013 will be just under 2.04 billion allowances\textsuperscript{10} and it will decline by 37Mt/CO\textsubscript{2} per annum throughout Phase III. This is equivalent to a 1.74% decrease of the average total quantity of allowances issued by Member States in Phase II of the EU ETS (2008-2012).

This annual reduction of 37Mt/CO\textsubscript{2} will continue beyond 2020 but may be subject to revision not later than 2025. If the EU moves to a 30% target, and the 2013 allocation remains unchanged, this annual decrease in the cap will rise to 79 Mt which is equivalent to a 3.7% annual decline of 2008-2012 levels in the total quantity of allowances issued by Member States in Phase II of the EU ETS\textsuperscript{11}.

Table 2 outlines the differences these two emissions reductions targets have on the overall cap and rate of decline in emissions in the EU ETS.

<table>
<thead>
<tr>
<th></th>
<th>Av 2008-2012 (Gt/co2)</th>
<th>2013 (Gt/co2)</th>
<th>2020 (Gt/co2)</th>
<th>% below 2005 levels</th>
<th>Annual decrease (Mt/co2)</th>
<th>As a percentage of Av 2008-2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>2.2</td>
<td>2</td>
<td>1.8</td>
<td>21</td>
<td>37</td>
<td>1.7</td>
</tr>
<tr>
<td>30%</td>
<td>2.2</td>
<td>2</td>
<td>1.5</td>
<td>34</td>
<td>79</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Table 2: Overview of the move from a 20-30% reduction commitment

Figure 2 offers a graphical representation of the allocation and cap decisions that have been made in Phase I, II and III of the EU ETS as it stood in 2008. The analysis was undertaken prior to the European Commissions’ decision to classify 164 sectors at risk of carbon leakage but still offers a good sense of the scale of manufacturing emissions that will be the focus of this paper. The light

\textsuperscript{10} The European Commission's calculates this to be 2,039,152,882 allowances with an annual decline of 37,435,387 t/CO\textsubscript{2} per annum

\textsuperscript{11} This calculation is based on the assumption that 37Mt equates to a decline of 21% on 1990 levels and should the EU move to a 30% commitment, the EU ETS cap will reduce emissions to 34% below 1990 levels assuming current levels of offsets.
blue section denoted as “manufacturing at 100% share” i.e. the 164 sectors at risk of leakage will have a growing share of the overall percentage of emissions covered by the EU ETS whilst manufacturing industries that aren’t at risk of leakage will contribute to an ever smaller percentage.

Figure 2: Allocation and emissions in the EU ETS across the phases. Source: Climate Strategies, Grubb et al. (2009) GMF

1.3 The issue of carbon leakage

Carbon leakage is the situation where emissions in the EU are not reduced because of mitigation action undertaken by installations covered by the EU ETS, instead there is simply a relocation of production to areas outside of the EU where carbon prices are lower. This could occur either through increased imports or a physical relocation of industry. If this were to occur on a large scale, it would have significant environmental and economic impacts. As such, the issue of leakage has been high on the EU and international agenda in recent years. The EU’s response, as a leader in this area of climate policy, could impact the way that the risk of leakage is addressed in other regions of the world considering carbon pricing.

The issue of carbon leakage is particularly pertinent for determining the changes to the allocation methodologies in Phase III of the EU ETS and the associated magnitude of public sector revenues that could be generated. In December 2009, the European Commission proposed a list of 164 manufacturing subsectors (NACE 4 digit level) covered by the EU ETS that were deemed to be at risk of carbon leakage in Phase III.
Following the EU ETS Directive, the Commission applied two criteria:

1. Carbon costs as a percentage of Gross Value Added (GVA)\(^{12}\), assuming a CO2 price per tonne of € 30.
2. Trade intensity given trade data average from 2006-2007

Individual and combination thresholds were applied to decide whether or not a particular sector could be at risk of carbon leakage. These thresholds were:

- The extent to which the sum of direct and indirect additional costs induced by the implementation of this directive would lead to a substantial increase of production cost, calculated as a proportion of the GVA, of at least 5%;
- The Non-EU Trade intensity defined as the ratio between total of value of exports to non EU + value of imports from non-EU and the total market size for the Community (annual turnover plus total imports) is above 10%. **AND**
- If the sum of direct and indirect additional costs induced by the implementation of this directive would lead to a particularly high increase of production cost, calculated as a proportion of the Gross Value Added, of at least 30%;
- If the Non-EU Trade intensity defined as the between total of value of exports to non EU + value of imports from non-EU and the total market size for the Community (annual turnover plus total imports) is above 30%\(^{13}\). **OR**

If data was incomplete or unreliable, supplementary qualitative assessments of sectors were used to identify if there was a risk of leakage.

According to calculations from the CITL database\(^{14}\), the 164 sectors classified as being at risk of leakage accounted for **approximately 80%** of the total manufacturing emissions that were covered by the EU ETS in 2008. This contribution may have changed following the impact of the economic downturn.

There are a number of other methodological approaches that could be used to identify sectors at risk of leakage. The approach by the European Commission has been criticised by some\(^{15}\), in particular for its use of the single trade intensity criterion which allowed for the inclusion of 117 sectors. Other studies have identified relatively fewer sectors to be at risk of leakage in the EU including the Carbon Trust (2010) who identify that only a few high emitting sectors including: **steel, cement, aluminium, pulp and paper, ceramics, some chemical subsectors and refineries** are likely to be at risk. This does not preclude other sectors from undergoing analysis

---

\(^{12}\) Gross value added is a measure of economic value of goods and services produced that contribute to a region’s GDP.

\(^{13}\) Please see European Commission Carbon leakage Q&A

\(^{14}\) 2008 is the newest publically available emissions data from the Community Independent Transaction Log (CITL) database which matches installations to their equivalent sector NACE code.

\(^{15}\) For a full assessment, please see Droege and Cooper (2010)
to determine if a risk exists, but perhaps a redirection of efforts to firstly address the specific risks of leakage that these sectors face.

In addition to the provisions in Directive 2003/87/EC to determine sectors at risk, 4 options were outlined for the European Commission to use to address the risk of leakage in these sectors:

1) Free allowance allocation
2) Inclusion of importers into the scheme
3) Binding sectoral agreements

In addition, Article 10a, paragraph 6 offers:
4) Provision of state aid by Member States, in case the indirect carbon cost from electricity pricing causes leakage.

Previous studies by Climate Strategies, (Neuhoff & Matthes (2008) Droege, S et al. (2009), Droege, S & Cooper, S (2010) have outlined the strengths and weaknesses of these different policy options in terms of their economic efficiency and effectiveness, administrative, geopolitical and legal viewpoints, identifying in particular the numerous trade-offs associated with free allocation.

Sector characteristics differ greatly e.g. in terms of ability to pass through carbon costs, the impact of carbon costs on their cost schedule, levels of capacity utilization, investment cycles, transport costs and vertical integration. These differences extend to the installation level within a sector.

When faced with carbon costs, firm can:
1) Increase their product prices,
2) Reduce their profit margins,
3) Invest in cleaner technologies
4) Choose to relocate production to areas where they don’t face these costs.

The ability of a firm to increase product prices can be measured by their cost pass through rates\(^{16}\). Subsequently the nature of the risk of carbon leakage will differ at an installation and sector level and as such cannot be best addressed by a single policy tool.

Free allocation is not suitable for addressing the incentives all sectors covered by the EU ETS have to relocate production abroad in light of carbon pricing\(^{17}\). In the first instance free allocation would need to be linked to continued operation or else there is the chance that production would be scaled back and permits would simply be traded in the carbon market. Free allocation is useful for industries with complex integrated production processes. However, it is complex to administer in particular if combined with benchmarking. Instead, the policy response should differ to reflect sector characteristics. Given resource constraints, the analysis needed to tailor responses should be confined to a few energy and emissions intensive industries where the risk of carbon leakage is strongest, such as those identified by the Carbon Trust (2010), as these sectors account for the majority of emissions in the manufacturing sector.

On the 15\(^{th}\) Dec 2010, the European Commission’s Climate Change Committee outlined a draft decision to determine harmonised benchmarking rules following industry stakeholder engagement. They proposed benchmarks for 52 products for manufacturing sectors. The development of

\(^{16}\)Most studies on the risk of carbon leakage are undertaken at a sector level however some studies are able to calculate the risk of leakage at the installation level such as Grattan Institute (2010) which applies an assessment of leakage to installations in Australia.

\(^{17}\) Please see Droege & Cooper (2010)
these benchmarks was both lengthy and data intensive process and is currently under a 3 month scrutiny period by the European Parliament and Council and an impact assessment on this proposal is due on the 21st March. Should the benchmarking decision by the European Commission pass, Member States will have until 30th Sept 2011 to calculate the absolute number of EUAs to be allocated to each installation based on the benchmarks.

1.4. Profiling the cement and steel sectors in Europe

The steel and cement sectors merit further analysis in this study. They are strong candidates for a more tailored response to the risk of carbon leakage given their high contribution to overall manufacturing emissions covered by the EU ETS as outlined in Figure 1. An increasing body of research exists on understanding the impact that carbon pricing will have on these sectors from both the academic and industrial community which allows for a more nuanced understanding of the risk of leakage they face. In addition, these sectors have been the focus of a number of studies which aim to identify how to make the necessary shift to a low carbon trajectory through sectoral investments. This is explored further in section 4 of the report.

According to CITL database, the cement and steel sectors both experienced rising emissions during the early years of Phase I of the EU ETS. In 2008 and 2009, the contraction in emissions was attributable to the fall in output following the economic downturn. The level of allocated permits has always exceeded the verified level of emissions in the two sectors between the years 2005-2009, allowing them to bank or sell surplus emissions credits. This was partly by design for market liquidity reasons in the early years of the EU ETS for fear of trade volumes in the power sector being too low. Taking the average yearly spot price as a carbon price estimate, the total value of these surplus allowances received by the entire cement and steel sectors between the years 2005-2009 was in the order of €1bn and €2bn respectively.

The allocation of allowances in the latter part of Phase II and in Phase III will be lower than it has been to date which will reduce this gap and likely provide a stronger signal to reduce emissions in these sectors.

Figure 3: Emissions from the cement and steel sectors 2005-2009, Source: CITL/ EEA.

Note that the data used in this calculation is taken from the EEA’s sectoral calculations which uses the CITL database. However, they have a broader sectoral definition for the cement and steel sectors which is “cement and lime” and “steel and pig iron” respectively. The remaining analysis uses a narrower sectoral definition based on the definition of cement and steel production at the NACE 4 level.
In Phase III there are 5 product benchmarks specifically for the “Manufacture of Iron, Steel and Ferro Alloys” (NACE 2710) and for the “Manufacture of Cement” (NACE 2651) which are outlined in Annex II. These are expressed in terms of allowances per tonne of output of product and the level of the benchmark reflects the top 10% best performing installations in these sectors in the EU in terms of emissions efficiency. This means that an installation whose output produces lower emissions than the benchmark will have surplus emissions to sell whilst more emissions intensive installations which have an emissions/output ratio which is higher than the benchmark will be required to purchase the shortfall of emissions allowances at auction or in the market. However, free allocation is not universally agreed upon as the most suitable remedial policy for addressing leakage given sector-specific characteristics which determine the nature of the risk of leakage these sectors face.

Cement is the most carbon intensive manufacturing sector because of the process emissions involved in clinker production. It is a homogenous good which is heavy relative to value-added, making it relatively expensive to transport overland. The maximum distance cement travels overland is around 300km (road and rail); anything longer than this and road transportation costs could exceed the costs of production. Shipping cement can be more economically efficient over longer distances. Distances of over 400km are often cheaper by sea than by land transportation. However most markets are regional and international trade in cement is low.

Another interesting characteristic which gives some insight into the type of leakage the sector faces is that it is the least capital intensive of the major manufacturing activities which means that above a certain carbon price it makes economic sense to reduce output from existing plants, sell allowances and import cement instead – i.e. there is a risk of operational, not investment, leakage.

Due to the high substitutability of domestic and international cement and clinker production, there is the risk of two distortionary impacts arising from the Commission’s decision to give free allocation based on a clinker benchmark.

1) **Windfall profits** – Regional markets and relatively few true substitutes mean that cement producers may choose to generate substantial profits by passing on the incremental carbon costs (opportunity costs) to consumers in the form of increased product prices for cement.

2) **Increased imports** – For installations located near to non-EU markets, in particular via sea transport, there is a risk that it will be more profitable to reduce output and import clinker and sell the free allowances they receive. The incentive to do this arises directly from the application of a clinker rather than cement product benchmark.

As a result of these risks, The Carbon Trust (2010) suggests that the “best – maybe the only effective – option is to include cement importers into the EU ETS” and cement installations in Europe should be required to purchase allowances at auction.

We therefore suggest this approach as an alternative **hypothetical allocation method** for the cement sector in Phase III and include this approach in our calculations as an ‘alternative scenario’.

**Steel sector**

The Carbon Trust (2010) study recommends that free allocation should be for a limited period of time in the steel sector and that the end date of free allocation should be known in advance to allow enough time for the industry to react and respond.
This time to adjust is needed because steel plants are capital intensive and operate over long time horizons and produce more complex outputs than in the cement sector. They experience fluctuating prices and profit margins which are largely driven by pro-cyclical demand from downstream sectors. Extra-EU capacity has increased in recent years and carbon pricing could compound the risk of closure and relocation of industry; this risk already exists in extra-EU regions close to iron ore deposits. Steel qualities differ and will have different applications but it is essentially a commodity.

In addition, the trade intensity of the steel sector is much higher than that of the cement sector, partly because of lower transport costs but principally because of the higher value-added per tonne of product. Unlike in the cement sector, international competition will reduce the ability of EU installations to enjoy windfall profits from passing on carbon costs to consumers as they could easily switch consumption to extra-EU imports.

The Carbon Trust (2010) suggests that free allocation should only be given to the steel sector for a finite period of time and allocated based on steel output, for simplicity, rather than plant specificities which is closer to the European Commission’s current approach of distinguishing the benchmark based on the production process used. The reason for this limit on free allocation is that if continued, it will dampen the incentives to properly transform the sector and mitigate emissions. In addition, the EU steel sector has been experiencing a historic decline even prior to the introduction of carbon prices and so free allocation may in fact distort these prevailing market trends by maintaining steel production in the EU at higher levels than BAU.

The Carbon Trust (2010) suggests that after free allocation finishes, one of the following three options should be negotiated for implementation in the steel sector in Europe:

1) **Auctioning and border levelling** for steel imported into regions imposing a carbon cost possibly together with carbon rebates on steel exported to countries not taking equivalent action

2) **Specific agreements** with principal producer regions (e.g. Russia, Ukraine, Kazakhstan, Brazil and South Africa) for them to impose carbon charges on steel exports

3) **A global sectoral agreement** imposing carbon costs on steel production in all significant producer countries.

Other work by Climate Strategies has explored the option of regional and international sectoral agreements in the steel sector more fully. This paper provides the opportunity to better understand the option to move to auctioning with border levelling by offering an assessment on the revenues dimension of this hypothetical allocation method.

---

19 Please see papers from the Climate Strategies report “International Sectoral Approaches” available at [http://www.climatestrategies.org/research/our-reports/category/54.html](http://www.climatestrategies.org/research/our-reports/category/54.html)
2. Relative scales of revenue

2.1. Common assumptions and the move to 30%

The analysis in this section provides a broad indication of the relative scale of revenues that could be generated within the EU under different policy assumptions including the hypothetical scenarios offered in 1.4. This ignores any intra-EU transfer of funds and concentrates on the absolute quantities of revenues that could be generated based on best available data from the CITL database. The CITL database reports the permits allocated verified and surrendered by each installation covered by the EU ETS. The most recent data publically available that matches up installations to their sectoral NACE code, allowing for in-depth analysis, is for 2008. This is only first year of Phase II of the EU ETS, and as such has not fully captured the impact of the economic downturn on global emissions and individual installation’s production levels. In order to estimate the emissions in 2013, we take the Commission’s estimate of the cap in 2013 as 2Gt, down from 2.2Gt in 2008 and apply the same ratio of emissions across installations and sectors in 2008. As such we don’t assume any closures or new entrants (including associated changes to the fuel mix in the power sector) or depreciation of capital without replacement that may have occurred as a result of the economic downturn or indeed could continue to occur throughout Phase III of the EU ETS.

Carbon prices

Our scenarios start with a CO2 price of €15/tCO2 in 2013, and rises linearly towards the carbon prices in 2020 as suggested by the modelling of different cases20. €15/tCO2 reflects current expectations (as reflected in current market prices for allowances, that can be banked to 2013). Prices are assumed to change linearly over the period, and we cite the main results in terms of total revenues over the eight year period for several reasons21.

The carbon prices in this paper are taken from recent publications by the European Commission22. In 2009, the Commission included updated carbon prices for a 20% emissions reduction target in their “Energy to 2030” paper. The upper carbon price in 2020 is estimated to be €25/tCO223 (known as 20% (b)). This assumes that the total permissible level of CDM allowances (conservatively estimated to be 1600Mt) is used and that the market clears over the time period 2008-203024. The lower carbon price in 2020 is €17/tCO2 (known as 20%(a) which is calculated based on the same assumptions as the upper estimate but additionally assumes the achievement of the EU’s Renewable Energy Target to generate 20% of power from renewable sources by 2020and the implementation of additional energy policies that were agreed between April 2009 and December 2009 that would lower energy consumption and associated demand for EUAs.

---

20 Carbon prices were taken from the European Commission (2010a)
21 Total revenues estimated using these carbon prices would appear lower in terms discounted ‘net present value’, but on the other hand, if and as a tougher target were confirmed and clarified this would feed back into higher starting prices, which would increase the ‘present value’ (and total revenues). We therefore consider our approach to yield a reasonable and readily comprehensible indicator
22 Earlier versions of the impact assessment forecasted higher carbon prices in 2020 that have since been revised downwards because of the economic downturn.
23 Unless stated otherwise, all carbon prices are expressed in € prices of 2008.
24 The paper estimates 2030 carbon prices to be €19t/CO2 and €39/CO2 under the low and high carbon price scenarios outlined.
If the EU moves to a 30% target, the carbon price will increase. The EU ETS would be a key policy tool to generate additional reductions in EU emissions. The overall cap in 2020 would be lower (the Commission assumes that if additional emissions reductions reflecting the move from 20-30% occur domestically, the EU ETS cap declines to 34% below 1990 levels in 2020). The main driver for the carbon price differences in the 30% scenario is the permissible level of offsets. The upper bound on the carbon price assumes no additional use of CDM offset credits and assumes a cost effective split between ETS and non-ETS sectors. This generates a carbon price of €55/tCO2 in 2020 (known as 30% (b). Should half this additional reduction target be met through the increased use of CDM offset credits, the carbon price is anticipated to fall to around €30/tCO2 (known as 30% (a).

<table>
<thead>
<tr>
<th>Code</th>
<th>20% target</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20% (a)</td>
<td>20% (b)</td>
</tr>
</tbody>
</table>

Table 3: Upper and lower bounds on likely carbon prices in 2020 based on different assumptions on the use of offsets and achievement of RES targets. Source: Climate Strategies, Sijm (2011).

These carbon prices offer some bounds on the anticipated carbon prices under different emissions reduction targets. However uncertainty regarding the carbon price and its likely trajectory in Phase III still exists. In terms of key endogenous factors, assumptions on economic growth rates will have a strong influence on the likely carbon price and high level of uncertainty still exists regarding exogenous variables e.g. breakthrough technologies, unforeseen carbon market fluctuations, new emissions trading schemes developing outside of the EU etc and so the absolute figures may still exceed or fall below the estimated bounds.

2.2. Current allocation structure

Table 5 outlines the current allocation provisions for different groups of sectors participating in Phase III of the EU ETS. The power sector will face full auctioning from 2013 onwards except in certain new European Member States who will experience a more gradual introduction of auctioning. Manufacturing sectors not classified as being at risk of leakage will receive 80% of their average emissions from the years 2005-2007 which declines to 30% by 2020 from a declining overall cap.

Temporary derogation is permissible if: in 2007, the electricity network of a particular Member State was not interconnected with the EU system; or in 2007, the electricity network was connected to the EU system through a single line with a capacity of less than 400MW; or in 2006, more than 30% of electricity of a particular Member State was produced from a single fossil fuel and the GDP per capita in relation to the EU average did not exceed 50% of the average GDP per capita of the EU.
Using the CITL database we can estimate the scale of auction revenues this allocation provision will generate in broad terms for the power and manufacturing sectors not classified as being at risk by: imposing a declining cap on the overall emissions, assuming the maximum permissible use of free allocation based on benchmarks and the remaining percentage of emissions to be met through auctioning, adjusting for the percentage of auctioned allowances in each year of Phase III of the EU ETS and using the carbon price assumptions outlined in section 2.1.

Table 4: Allocation methodologies in sectors covered by the EU ETS in Phase III. Source: European Commission

<table>
<thead>
<tr>
<th>Sector</th>
<th>2013</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity generation</td>
<td>100% auctioning</td>
<td>100% auctioning</td>
</tr>
<tr>
<td>Electricity generation NMS</td>
<td>Transitional free allocation not to exceed 70% of total emissions</td>
<td>No free allocation</td>
</tr>
<tr>
<td>Manufacturing (default)</td>
<td>Free allocation based on benchmarks representing 80% of total emissions</td>
<td>Free allocation based on benchmarks representing 30% of total emissions</td>
</tr>
<tr>
<td>Manufacturing classified as being at risk of leakage</td>
<td>100% benchmarked free allocation from a declining cap</td>
<td></td>
</tr>
</tbody>
</table>

Given the focus on the cement and steel sector in this piece and the complexities involved with accurately modelling benchmarks for all manufacturing sectors, only the product benchmarks for these two sectors have been included in the analysis. Even modelling just two benchmarks is extremely complex and a number of broad, simplified assumptions have been applied, e.g. we assume that all cement and steel installations produce at the EU average level of emissions efficiency and identify the difference between this amount and the EU benchmark and assume installations will purchase the shortfall of allowances. Assuming all installations produce at the average EU level of emissions efficiency ignores country differences and as such, we only offer EU aggregated revenues for benchmarks.26

Due to this partial application of benchmarks in the analysis on revenues, any estimates on the revenues generated from manufacturing sectors not at risk of carbon leakage will be an underestimate as there is the implicit assumption that installations will receive a fixed amount of free allowances to meet their required emissions based on the benchmarks (i.e. all installations’ emissions intensity per tonne of output is at the level of the top 10% producers in each sector)

26 Please see Annex II for a fuller description of the approach used. We also make no assumptions on exogenous variables such as breakthrough technologies. Further to these methodological complications, there remain complexities particularly around steel arising from classification issues which result in a range of estimates for steel driven by this as well as carbon price ranges. The manufacture of basic iron and steel and Ferro-alloys is coded as NACE 2710 in the CITL database. However, a number of installations covered by the EU ETS in multiple countries are not accurately classified at the NACE 4 level. Instead they are listed at the NACE 2 level; 27 (Manufacture of basic metals). This parent sector classification includes steel production and as well as the production of aluminium, copper etc. It is likely that a high proportion of emissions under this code are attributable to the activities in NACE code 2710, however we cannot accurately outline what percentage. As such, using the CITL database, we use NACE 2710 as a lower bound of estimates for the steel sector and aggregated NACE 2710 and NACE 27 emissions as the upper bound. This is reflected by the range of estimates for the steel sector in Annex III. When a range of estimates is not explicitly offered, the single figure for the steel sector represents the average of these upper and lower bounds.
and as such won’t need to purchase any additional emissions at auction. Similarly, the report offers no assessment on the scale of auction revenue that will be purchased by manufacturing sectors classified as being at risk of leakage who may choose to purchase allowances at auction because their benchmarked free allowances are lower than their verified emissions levels. This is a second reason for expecting this value to be an underestimate.

In aggregate though, the scale of auction revenue might in fact be an overestimate as we assume the minimum level of abatement occurs and the remainder of emissions are covered by purchasing of allowances at auction. In other words we assume that the level of abatement in each installation is exactly equivalent to the declining cap that they face during Phase III of the EU ETS. This does not take into account the cost of abatement and the opportunity to abate more or less emissions than the cap and the opportunity to trade. It is likely that for many sectors, the cost of abatement will be lower than the carbon price – particularly for prices in the 30% scenarios.

2.3. Inclusion of cement and steel into full auctioning from 2013 with border levelling

A number of studies have outlined the merits of a tailored sector-specific response to the risk of leakage, rather than relying on a blank free allocation approach for all sectors. As outlined in section 1.4, cement and steel have been a particular focus of our studies, and account for a considerable share of manufacturing emissions. Our previous research suggests that there is a legitimate concern about carbon leakage in these sectors, but that free allocation is not necessarily the best approach.

Specifically, the sectoral study by the Carbon Trust (2010) which looked at the most appropriate sector specific responses to the risk of leakage, suggested serious problems with free allocation to cement, whilst in steel it might be justified as a transitional measure but does not offer a satisfactory long-term solution. The principal alternative is to move these sectors to auctioning, combined with ‘border levelling’ so that importers face similar carbon costs, and potentially European exporters are reimbursed for carbon costs. 27

This section explores the relative magnitude of auction revenues that could be generated should the European cement and/or steel sectors face full auctioning in phase III of the EU ETS. By implication from our previous work, we assume this is in conjunction with border levelling, though we do not explicitly consider the revenue dimensions of the levelling charges themselves.

As outlined in Figure 1: according to the latest CITL data, in 2008 emissions from the cement and steel sector accounted for approximately 13% of total emissions covered by the EU ETS and between 40-50% of all manufacturing sectors classified as being at risk of leakage. Given their relatively large contribution to the share of overall emissions, it is possible that either of both of these two sectors could be included in the same auctioning provisions as the power sector (again coupled with complementary sector specific remedial policies to address the risk of leakage e.g. inclusion of importers into the scheme or assistance with sectoral investment).

Similar provisions for NMS derogation may apply in the steel and cement sector under this scenario but it is difficult to accurately speculate about any such provisions. As such, the numbers in Section 3 for auctioning in the cement and steel sector should be viewed as an upper bound on the aggregate revenues that could be generated under this allocation scenario, which models the

27 Please see The Carbon Trust (2010) See section 1.4 of this paper for a brief summary of the options set out for steel.
Again, border levelling would help to ensure that steel and cement products consumed in the EU pay a carbon price, irrespective of where they have come from, to avoid discriminating against domestic production. WTO rules allow for appropriate forms of border levelling (as with excise duties), but it would clearly not be possible to charge importers for costs not incurred by domestic producers; hence the need to consider full auctioning alongside border levelling. WTO compatibility is most easily ensured by required importers to purchase allowances per tonne of product, based on a sector-wide benchmark on emissions levels from best available technology. For reasons set out in the Carbon Trust (2010), this may be easier to achieve for cement than for steel, which forms an additional reason to consider the two sectors separately. However though more complex (because of the wider variety of steel products and processes), it would also be possible for steel, and for completeness, we study revenue implications of Phase III auctioning to each.

![Image: Figure 4: Import volumes 2005-2009. Source: Eurostat](image)

Estimates of revenues generated from border levelling have not been included in the aggregate section 2.4 and 3.1 because of insufficient data and realistic assumptions on trends in production and trade volumes in these two sectors between the years 2013-2020. If we simply take the average level of imports over the years 2005-2009 and project equivalent import levels during Phase III, we can assume equivalency of emissions intensity of production and the requirement to purchase EUAs at the same price as EU producers and offer some order of magnitude on the scale of revenue generated from border levelling from clinker and iron and steel imports based imports of tonne of product. Although we caution the use of these absolute figures, results are in the range of €12-15bn in the 20% scenario and €17-27 in the €30% scenario.

<table>
<thead>
<tr>
<th></th>
<th>Revenues generated from border levelling 2013-2020 (€bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20% (a)</td>
</tr>
<tr>
<td>Clinker imports</td>
<td>1.2</td>
</tr>
<tr>
<td>Imports of iron and steel products</td>
<td>11.1</td>
</tr>
</tbody>
</table>

Table 5: Exercise to calculate equivalent auction revenues from border levelling. 
Source: Eurostat
2.4. Limitations of the approach

By matching up emissions per installation with anticipated carbon prices in Phase III and applying sector specific allocation methods, our simple calculations attempt to use best available information and sensible assumptions to understand the potential scales of public sector revenue that could be generated. However, a number of limitations to the approach exist and as such the absolute values of the results should be viewed as broad estimates.

A number of these caveats regarding interpretation of the numbers arise because we have used the Commissions’ price estimates and as such we incorporate their assumptions into our analysis which ignores an explicit representation of: the EU’s CEP, economic growth rates and the impact of auctioning in reducing the carbon price etc. In particular, the introduction of the EU’s 2020 renewables target will alter the emissions intensity of the power sector by 2020 and as such, cement and steel auctioning under our alternative scenario might actually lead to a proportionally larger contribution of overall auction revenues than our estimates suggest.

In addition we consider sectoral emissions proportional to (declining) cap and therefore there is no explicit representation of abatement costs.

We also assume free allocation baseline proportion to declining cap for sectors not explicitly modelled and there are no benchmarks below this for other ‘leakage’ sectors (so no net purchase) and non-leakage sectors

Finally, we do not consider other external influences on the Phase III volumes or prices and there is no explicit representation of entry or exit provisions, or banking or borrowing between phases.

The simplifications made in the calculations may result in actual revenues exceeding our estimated ranges. Profiling economic growth rates, Monjon (2011) has demonstrated that assumptions on this can lead to large changes in the carbon price.
3. Gross revenues

This section of the paper offers insight into the relative scales of revenue that could be generated under different allocation scenarios and reduction targets.\textsuperscript{28}

Figure 5: Sectoral breakdown of aggregate revenues under different allocation methods and targets. Source: CITL & own calculations

Figure 6 offers an indication of the likely scales of revenue that would be accrued from auctioning under the current allocation provisions and offers insight into the additional revenue that could be accrued from our alternative scenario which includes auctioning in the cement and steel sector.\textsuperscript{29}

\textsuperscript{28} The complete calculations can be viewed in Annex III but should be interpreted as broad estimates for the reasons outlined in section 2.4.

\textsuperscript{29} The potential revenues from border levelling associated with auctioning not included in these calculations – please see section 2.3 for a fuller discussion. Note that potential impact of auctioning or border levelling on reducing the carbon price is not accounted for.
Figure 6: Scales of revenues in the cement and steel sectors under different allocation methods and targets. Source: CITL & own calculations

20-30% current allocation - Under a 20% scenario, the current allocation methods will generate public sector revenues in Phase III of the EU ETS in the order of €150-190bn. This is predominantly auction revenues accrued from the power sector. Should the EU move to a 30% commitment, this rises to €200-310bn.

Inclusion of cement and steel in auctioning

Auction revenue from the power sector dominates the mix but the cement and steel sectors contribute towards an increasing proportion of total revenues under the alternative hypothetical scenario. Their contribution to total revenues may in fact be higher if the electricity fuel mix changes to reflect the increasing share of renewable as part of the EU’s CEP. Figure 7 takes a deeper look at the relative scales of revenue between these two allocation methods and shows that under the 20% scenario, auctioning will increase revenues from approximately €2bn in the cement sector to €18-22bn and in the steel sector from €3bn to €14-17bn. Under the 30% scenario, in both sectors, the amount of revenue generated through benchmarking is between €3

---

30 Again, it should be noted that the proposed alternative scenario with auctioning in the cement and steel sector is conditional on the introduction of border levelling. Revenues from border levelling are not included in this analysis for reasons outlined in section 2.3.

31 Revenues from border levelling would be additional to these estimates.
and 5bn in the cement sector and slightly higher in the steel however the revenue from auctioning rises to €23-36bn in the cement sector and €18-28 bn in the steel sector.

In total, under this alternative hypothetical allocation scenario, we estimate total revenues from all sectors to be in the order of €180-225bn in the case of a 20% target and €240-370bn in the 30% scenario. Additional revenues would also come from border levelling.

A key finding of our analysis is that the relative scale of the addition would vary considerably between Member States, and we now turn to consider this.

### 3.1 Gross revenues by Member States

**3.1.1 Current allocation structure**

It is not possible to accurately measure the impact of the benchmark in the cement and steel sectors at the Member State level. The CITL does not offer corresponding output levels or production routes and so it is not possible to estimate the emissions efficiency of production at the installation level. In some countries there are only a handful of installations in the steel and cement sectors and so relative emissions efficiency is a key determinant of the level of allowances that are required to be purchased at auction. Given the absence of this key variable, estimations at the Member State level would be unsubstantiated and so only the aggregate values are offered as per section 3.

**3.1.2. Auctioning in the cement and steel sectors**

![Figure 7 relative sector contribution to total auction revenues in the 20% (a) scenario.](image)

*Please see footnotes 26 and 28 regarding the exclusion of revenues from border levelling in this analysis.*

Given the absolute size of the German power and industrial sector, it is not surprising that this is the country which generates the most revenue in our scenarios. In most countries, revenues from

---

32 Given the limitations outlined in section 2.4, these figures offer approximate figures. Fuller calculations can be made using the results of our modelling in the Annex.
the power sector is by far the largest contributor but in some countries (namely those with fuel mixes that are less carbon intensive such as France with its emphasis on nuclear power), cement and steel auctioning could make up a large percentage of overall revenue. This is the case in Italy, Spain, France, Belgium, Austria and Slovakia.

Figure 8: relative sector contribution to total auction revenues in the 30% (a) scenario. Please see footnotes 26 and 28 regarding the exclusion of revenues from border levelling in this analysis.

Although we only present carbon pricing scenarios in the 20% and 30% case, the ratios for each sector contribution will stay for all carbon prices we model. However, in absolute terms, the increase in revenues in each Member State will be around 25% higher than estimates in Figure 7 under the 20% (b) case and under the 30% (b) scenario our upper estimate for the carbon price in 2020 is €55/t and as such, revenues will rise by around 55% compared to the levels in Figure 8.

3.2. Receipts after redistribution to New Member States

The European Commission has included provisions to redistribute some of the EU ETS auction revenue amongst New Member States. Although revenues accrue to individual Member States, 12% of allowances will be redistributed. 10% of the allowances are distributed to poorer Member States to take account of the lower GDP per head and higher prospects for growth and emissions. Another 2% of the allowances are distributed to nine Member States who in 2005 had achieved a reduction of at least 20% in greenhouse gas emissions compared with the reference year set by the Kyoto Protocol. This means that auction revenues in Figure 8 will in fact be higher in NMS and lower in others. At the aggregate level, 12% of revenues to be redistributed are valued in Table 6 based on our scenarios.
To estimate the overall implications for revenue by Member States, we apply estimates of the 12% redistributive effect derived from Ellerman et al (Eds), "Pricing Carbon", to the detailed results that are presented in the Annex. The net results are brought together in Table 7, which presents our overall estimates of the revenues that Member States might receive overall during Phase III, for the different scenarios as set out in this paper.
<table>
<thead>
<tr>
<th>Country</th>
<th>Final auction rights entitlement (%)</th>
<th>20% (a) scenario (€17/tCO2)</th>
<th>20% (b) scenario (€25/tCO2)</th>
<th>30% (a) scenario (€30/tCO2)</th>
<th>30% (b) scenario (€55/tCO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Power &amp; manufacturing not at risk</td>
<td>Cement &amp; steel</td>
<td>Power &amp; manufacturing not at risk</td>
<td>Cement &amp; steel</td>
</tr>
<tr>
<td>Austria</td>
<td>88</td>
<td>1,040</td>
<td>1,263</td>
<td>1,294</td>
<td>1,571</td>
</tr>
<tr>
<td>Belgium</td>
<td>96.8</td>
<td>2,194</td>
<td>1,891</td>
<td>2,737</td>
<td>2,352</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>150.3</td>
<td>3,562</td>
<td>645</td>
<td>4,623</td>
<td>803</td>
</tr>
<tr>
<td>Cyprus</td>
<td>105.6</td>
<td>312</td>
<td>180</td>
<td>404</td>
<td>224</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>117.4</td>
<td>5,878</td>
<td>1,455</td>
<td>7,632</td>
<td>1,808</td>
</tr>
<tr>
<td>Denmark</td>
<td>88</td>
<td>2,242</td>
<td>239</td>
<td>2,790</td>
<td>297</td>
</tr>
<tr>
<td>Estonia</td>
<td>145.2</td>
<td>1,567</td>
<td>199</td>
<td>2,033</td>
<td>248</td>
</tr>
<tr>
<td>Finland</td>
<td>88</td>
<td>2,554</td>
<td>722</td>
<td>3,179</td>
<td>897</td>
</tr>
<tr>
<td>France</td>
<td>88</td>
<td>4,299</td>
<td>3,775</td>
<td>5,357</td>
<td>4,616</td>
</tr>
<tr>
<td>Germany</td>
<td>88</td>
<td>36,591</td>
<td>4,177</td>
<td>45,551</td>
<td>5,196</td>
</tr>
<tr>
<td>Greece</td>
<td>103</td>
<td>6,530</td>
<td>1,187</td>
<td>8,125</td>
<td>1,639</td>
</tr>
<tr>
<td>Hungary</td>
<td>120.7</td>
<td>1,067</td>
<td>316</td>
<td>1,386</td>
<td>392</td>
</tr>
<tr>
<td>Ireland</td>
<td>88</td>
<td>1,335</td>
<td>348</td>
<td>1,668</td>
<td>433</td>
</tr>
<tr>
<td>Italy</td>
<td>89.8</td>
<td>14,365</td>
<td>4,155</td>
<td>17,888</td>
<td>5,169</td>
</tr>
<tr>
<td>Latvia</td>
<td>196.9</td>
<td>181</td>
<td>121</td>
<td>236</td>
<td>151</td>
</tr>
<tr>
<td>Lithuania</td>
<td>173.6</td>
<td>399</td>
<td>182</td>
<td>519</td>
<td>227</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>95</td>
<td>5</td>
<td>86</td>
<td>7</td>
<td>107</td>
</tr>
<tr>
<td>Netherlands</td>
<td>88</td>
<td>4,869</td>
<td>402</td>
<td>6,062</td>
<td>500</td>
</tr>
<tr>
<td>Poland</td>
<td>128</td>
<td>16,878</td>
<td>1,728</td>
<td>21,907</td>
<td>2,136</td>
</tr>
<tr>
<td>Portugal</td>
<td>102.1</td>
<td>2,121</td>
<td>772</td>
<td>2,640</td>
<td>960</td>
</tr>
<tr>
<td>Romania</td>
<td>152</td>
<td>3,972</td>
<td>2,086</td>
<td>5,157</td>
<td>2,596</td>
</tr>
<tr>
<td>Slovakia</td>
<td>129.2</td>
<td>775</td>
<td>1,671</td>
<td>1,006</td>
<td>1,216</td>
</tr>
<tr>
<td>Slovenia</td>
<td>105.6</td>
<td>427</td>
<td>137</td>
<td>553</td>
<td>169</td>
</tr>
<tr>
<td>Spain</td>
<td>99.4</td>
<td>13,300</td>
<td>3,533</td>
<td>16,563</td>
<td>4,394</td>
</tr>
<tr>
<td>Sweden</td>
<td>96.8</td>
<td>684</td>
<td>745</td>
<td>852</td>
<td>968</td>
</tr>
<tr>
<td>UK</td>
<td>88</td>
<td>18,537</td>
<td>854</td>
<td>23,077</td>
<td>1,062</td>
</tr>
</tbody>
</table>

**Table 7:** Calculations which show revenue accrued to Member States following redistribution of auction rights entitlements. Source: CITL & Ellerman et al (Eds) “Pricing Carbon”

Some of the relative changes in auction revenues appear extremely significant. In Latvia, redistribution provisions leads to almost a doubling of auction revenues. In absolute terms, the biggest change will be the revenues accrued to Germany which will be 12% less following redistribution (in the order of €5-6bn under the 20% scenario and current allowance allocation structure).

---

34 Note all carbon prices are for 2020
4. Whose money, used for what?

4.1. Introduction: economics and politics of revenue and rent

The scale of potential auction revenues for the EU is significant by any standard. Over the eight years of Phase III, auctioning in the power sector alone could raise between €145-295 billion, while our estimates for total potential revenues range from €180 to €360 billion, across the different scenarios.

With so much money at stake, it is inevitable that there will be huge political struggles. The money is extracted from industry, which will seek to pass most of the costs to consumers, but are somewhat constrained by impacts on demand and non-EU competition. All society thus has a legitimate stake in debate about the potential use of revenues, but the most immediate links are with the industries impacted and the overall task of restructuring towards a low-carbon European economy. The money raised is associated with climate change policy, and the transformation of the EU’s energy system is clearly a massive undertaking that will require extensive investment; it is natural to seek linkages between the revenues raised from a sector, and the expenditures that may be required to help the sector adjust.

The bulk of revenues accrue directly to Member States, and some (12%) is already committed for redistribution to help adjustment in the New Member States. Ultimately, the use of all revenues, except where otherwise committed, will be at the discretion of the Member States, but it remains crucial to consider the issues relating to appropriate use of these revenues.

In addition to sums already committed, there is a need for expenditure on other climate-related, technological or sectoral adjustment purposes. At the same time, there are long-standing economic debates about optimal distribution of tax revenues, for instance between consumption-based, corporate-based, and resource/pollution-based taxation. Finally of course, the revenues come at a time when a number of EU Member States are facing severe fiscal difficulties at least partially as a result of the global financial crisis.

This section considers some of the data and issues around use of any revenues that might be raised. It looks at the specific and committed areas of expenditure, through broader climate- and energy-related applications, and also offers insights into the broader macroeconomic debates, before drawing conclusions.

4.2 Current climate-related commitments and potential programmes

4.2.1 ‘Adjustment’ for electricity consuming industries and vulnerable groups

The general philosophy of carbon pricing is that the costs should feed through the economic system to provide a broad-based incentive towards carbon efficiency. However, particular problem may arise where

(a) The effect of carbon costs on electricity producers’ cost schedules and prices may impact downstream on sectors at risk of carbon leakage. This applies particularly to heavy electricity-intensive manufacturing, like aluminium for example which operates in a highly competitive international market and for which electricity costs are the dominant input cost; or

(b) For consumers who are disproportionately vulnerable to electricity price increases.

The revised EU ETS Directive acknowledges that electricity-intensive manufacturing sectors may need assistance to adjust to the impact of carbon pricing, in the form of finance subject to state-
aid rules. The earlier referenced Carbon Trust study also concluded that this appears to be the most practical way at present of addressing the leakage risk that may be faced by electricity-intensive, trade-exposed industries (Droege et al, 2009; Carbon Trust, 2010).

However, a potential issue facing the straightforward provision of state-aid finance to individual stakeholders may be the lack of clarity currently given by the Directive on the types of finance mechanisms that are permissible under EU law. Most of the current regulation on State Aid has focused on the topic of direct allowances allocation. The existing rulings by the EC follow a common sense approach; that any allowances given out by individual Member States must be provided in a transparent manner and must not exhibit any favouritism towards particular actors or sectors. While this has provided direction on the topic of explicit allocation of allowances, it has not directly addressed the fairness of alternative mechanisms that may also lower the cost burden of the EU ETS on certain sectors and consumers. Such mechanisms include offering direct grants to consumers or producers to support the cost of implementing low-carbon technologies, or subsidizing the cost of electricity to large consumers in order to buffer against expected increases to market electricity prices.

Perhaps due to this lack of clarity on the types of permissible mechanisms, DG Competition office has had significant involvement as a policing agency, investigating and ruling on individual domestic financing measures on a case by case basis. Some general observations can be accrued from cases investigated by the Commission in recent years. For the most part, the EC has not raised objections to state-aid finances awarded to large energy consumers and producers if any goal of reducing GHG emissions was only secondary to achieving wider public RD&D objectives. This was the case of finance awarded by Germany in 2010, two large iron and steel manufacturers received in the order of €50 million to finance the cost of implementing advanced, demonstration-level production and recycling facilities.

By contrast, finances awarded for non-technical initiatives, such as energy tariff subsidies and other direct cost exemptions, have not been accepted as favourably by the EU. In 2010 and 2011, the Commission ruled that electricity price subsidies awarded by Italy and Greece to domestic aluminium manufacturers, in the order of €35 m, were against State Aid regulations and would need to be reclaimed. The Commission argued that any domestic subsidy provided to large energy consumers, even if done to reduce provincial distortions in electricity prices, could catalyze a much larger subsidy race across Europe and distort the impact of mechanisms such as the EU ETS. Subsequent disagreements with Greece over the matter have now taken the issue into formal litigation. In a separate case, which occurred in March 2011, DG Competition announced its intention to investigate Austria over the exemption it offers large consumers in specific industries by allowing them to avoid the national requirement to purchase a minimum amount of low-carbon (thus high-cost) electricity.

The potential impact of electricity price rises on disproportionately ‘vulnerable consumers’ is more diffuse, and country-specific. Also the solutions may be more varied. The UK for example offers ‘winter fuel payments’ to some categories of consumers, but clearly the best long-run solution is improvement in energy efficiency. This has been a particularly important theme in East European Member States, inheriting building stock from communist times, and with many poorer people. Such programmes for example have formed an important part of the ‘Green Investment Schemes’ developed by a number of the New Member States for using revenue generated from sales of their surplus Kyoto allowances. Addressing this issue is really therefore part of a broader thrust to improve energy efficiency and the building stock, in the context of the EU’s energy efficiency goals and national programmes; the redistribution of some of the auction revenues to the New Member States could sensibly be part of this.
Since these issues are driven directly by carbon costs added to electricity, it seems entirely appropriate to use auction revenues for any authorized State-Aid expenditures to industry, and also to help fund domestic energy efficiency programmes.

### 4.2.2 CCS set-aside

The EU has made clear its intention to prioritize carbon capture and storage (CCS) as a key technology in the effort to reduce GHG emissions, and in particular facilitate mitigation across the industrial sector (e.g., steel, aluminium, cement, etc.). In fact, the industry lobby has been adamant that existing economic drivers have already increased the European sector’s energy efficiency to sufficient levels, limiting the opportunities for large-scale mitigation within industrial processes (Allwood and Cullen 2009). Thus, the discussion has instead leaned towards support of implementing CCS to sequester process exhaust emissions in industry.

The interest in CCS is not limited to industry, however. It can also be deployed to store emissions generated externally by the power sector. A few Member States have indicated that deployment of CCS is likely to be required where alternative low-carbon energy resources remain costly or unavailable in light of ever-increasing domestic emissions targets. So far the Netherlands and the UK have set-aside specific funds for the development of CCS projects, with the UK committing £1 billion (€1.16 bn) of capital funding for a first-of-its-kind large-scale (300 MW) CCS demonstration project.

At the European level there is the “NER300” financing instrument recently established by the European Commission, European Investment Bank (EIB), and Member States. As implied by its name, NER300 involves the set-aside of 300 million allowances in the New Entrants Reserve (NER) of EU-ETS for directly subsidizing emerging renewable energy technology projects and CCS installations. The total money raised by the sale (to occur in 2011) may be as high as €4.5 billion with an anticipated carbon price of €15/MtCO2. The EIB has commissioned reviews of applications, expecting 20 CCS proposals and 90 renewable energy supply projects during the first call. The programme follows on from the separately-managed European Energy Programme for Recovery (EEPR Regulation), which allocated €1.5 billion in 2009 to 15 small-scale CCS and off-shore wind projects as part of an EU-wide economic recovery package.

Thus, CCS will clearly absorb several € billion of public finance, as one of the larger ‘big ticket’ technologies. As the biggest application would be to power generation, it seems entirely appropriate that this could be a possible use of revenues from auctioning EUAs. As CCS remains a technology with high mitigation costs in comparison to many other measures, the intention of current investment in CCS in the EU is not to achieve immediate widespread emissions reductions, but rather facilitate low-carbon technology growth and cost reduction along the technology’s learning curve. Though RD&D-type support schemes such as NER300 are likely to affect the future expected costs of CCS deployment (see section 4.2.4), existing forecasts suggest that the marginal abatement cost of CCS will lay between €40 and €80 per MtCO2 by 2030, with a total global abatement potential by then of 5 GtCO2 per annum (McKinsey 2010). The European Commission’s current price estimates for 2030 are below this under the 20% scenario.

---

35 For information, visit the Department of Energy and Climate Change (DECC) website at: [http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/ccs/ccs.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/ccs/ccs.aspx)

36 Detailed information and reference to original EC documentation is provided at: [http://www.ner300.com](http://www.ner300.com)

37 European Commission (2010 a)
4.2.3. Broader government-financed RD&D of low carbon technologies

One of the main, publicized objectives of European governments on climate change is to support low-carbon innovation, with financial support for research, development and demonstration (RD&D) across the full spectrum of feasible mitigation technologies. In 2009, public RD&D expenditures on low-carbon measures in Europe was in the order of €2.5 billion, a 145% increase on 2008, and amounting to just under 30% of total global research expenditures related to climate mitigation technologies (IEA 2010). Also in 2009, the European Commission called for an additional €50 billion in public research funds to be made available over the 2010-2020 period in order to facilitate the roadmap set out by the EC’s Strategic Energy Technology Plan (SET Plan) first announced in 2009 (EC 2009b). A breakdown of the individual measures to be supported by SET Plan funds is illustrated in figure 9.

Determining the specific impact that increased research may have on the mitigation potential and cost of GHG reduction objectives is difficult; it is not always feasible to establish direct links between the level of research commitment in a given technology and the resulting long-term cost of GHG mitigation. However, the scale of roughly estimated costs in existing literature versus the existing funding commitments in developed countries is striking. In the IEA’s 2010 Energy Technology Perspectives review, for instance, it was determined that across all IEA members, total annual investment in low-carbon RD&D would need to increase from €7.2 billion per annum to at least €35–€70 billion per annum for 2050 carbon reduction targets to be feasibly met (IEA 2010). When disaggregated to the individual technology level, for example, the recommendations represent a more specific increase in investment into advanced vehicle technologies (hybrid/electric vehicles, fuel cells, etc.) from €1.35 billion per year (in 2009), to €16 – €32 billion per annum; and for CCS from €0.39 billion (in 2009) to a range of €6.4 - €13 billion per annum.

Figure 9: Total European public and private RD&D investment objectives in low-carbon technologies between 2010-2020, (bns)

Keystone objective:
- Wind: Next-generation offshore turbine developments
- Solar: First-of-a-kind Concentrated Solar Power (CSP) plants and mass production manufacturing processes of Photo Voltaics (PV)
- Market and network: improved utilization of ‘smart’ practises and integration of energy markets
- Bio-energy: Pilot generation plants
- CCS: Industrial-scale demonstration
- Fission: Support commercial deployment
- Urban energy efficiency: Develop low-carbon transition pathways for cities
- SET-Plan management: Implementation of joint programmes

Targeted research and diffusion of emerging technologies - whether done within the EU or abroad - is likely to be the main way to reduce the cost of technologies which would not otherwise be feasibly incentivized by the EU ETS alone. Many technologies, including CCS, are currently estimated to cost more than the likely carbon price in 2020. The SET-Plan for example establishes a specific research goal to reduce the marginal cost of CCS to €30-€50/MtCO2 by 2020. This is still
below the Commissions’ own current estimates on carbon prices in 2020 but other modelling studies such as Climate Strategies, Monjon (2011) have suggested carbon prices within this range.

At a time of continuing fiscal crisis, doubling RD&D from the current €2.5bn/yr towards the targeted €50bn in the SET plan over the next years is not going to be easy. Auction revenues would seem to be an entirely appropriate source, and well within the scale of the amounts that will be raised.

Alternatively, without such investment in research, Europe could postpone demonstration of expensive technologies and reap the long-term cost reduction benefits arising from RD&D by leapfrogging endeavours undertaken in other countries and regions. However, there are obvious risks to not developing a position in new energy technology markets. In the case of the solar PV industry for example, until 2006, Germany and Japan - the two largest initial RD&D supporters of solar PV through the 1980s and 1990s - were also the producers of 2/3 of the world's photovoltaic modules. Today, though the industry has seen a rapid entry of emerging players in China and Taiwan, Germany and Japan still have a major stake in an industry valued in 2009 at €28 billion and increasing in size at an annual rate of 20%-38. Europe’s stake in the wind business – mainly in Germany, Spain and Denmark – has of course grown to be much bigger for similar reasons relating to early action.

The distribution of RD&D expenditures shown in Figure 9 is heavily oriented towards electricity technology and urban energy efficiency. We outline some issues in considering other industrial RD&D in section 4.2.5.

4.2.4. Other direct supports to low-carbon power generation and infrastructure

Direct subsidies are the minor part of supports to renewable energy in Europe. Feed-in tariffs, the most popular support scheme for renewable power generation, are now offered by 21 of the EU-27 Member States (EC 2011). Alternative mechanisms, such as investment grants, tax exemptions, and premiums exist in the remaining six countries (Denmark, Finland, the Netherlands, Poland, Romania, and Sweden), alongside other mechanisms such as the UK Renewables Obligation.

On average, financial support awarded from national support schemes in the EU-27 has been provided at an average rate of €6/MWh delivered, with a total of €16.9 billion in support awarded by EU-27 States in 2009 - an increase of €9 billion from 2007 (Ecofys et al. 2011). Of course, this is an obvious simplification of the dynamics of individual support measures in the EU. The level of tariff or subsidy provided varies according to each Member State and energy supply technology. For instance, in 2009, the minimum level of subsidy provided for onshore wind and solar PV projects in the Czech Republic was €125/MWh and €450/MWh. This contrasted to Spain, where support awarded for both technologies was less, at €85/MWh and €325/MWh respectively. There remains some debate about whether existing levels of support are sufficient to spur growth of renewables in order to meet the region’s 2020 renewable targets.

As of 2011, the European Commission has argued that net annual investment in renewable energy projects will have to rapidly increase from levels of €35 billion, as seen in 2009, to €70 billion per annum in order to provide sufficient renewable power generation by 2020 (EC 2011). Though some of this investment may be supported via existing tariff schemes, where energy consumers already share the direct costs of investment, the EC could also make increased use of central funds to more specifically provide capital grants and lending to large-scale projects.

---

38 Data from Solar Buzz Research and analysis, available at: http://www.solarbuzz.com/
Between 2007 and 2009 for instance, the EU spent roughly €9.8 billion on renewable energy initiatives, principally in the form of project loans offered by the European Investment Bank. The Commission has argued that, by increasing short-term uptake of capital-intensive renewable energy projects, the benefits from learning will expedite the long-term phase-out of existing subsidies as renewable technology costs approach their non-renewable counterparts.

The case for scaling up direct financial support for technologies that are dominated by indirect supports (such as feed-in tariffs) at a very much larger scale would need further scrutiny. There is however an obvious complementary area of investment. 2050 Roadmap studies clearly point towards the need to greatly strengthen the EU grid infrastructure, particularly to make best use of renewable energy resources in the North Sea and in the Mediterranean region. Such investment would have multiple benefits, including in terms of enhancing energy flexibility and security in the EU. Financing European grid infrastructure and encouraging the uptake of renewable technology projects are thus obvious potential uses of revenues from ETS auctions to the power sector.

4.2.5. Programmes in manufacturing sectors

Tackling climate change must clearly involve tackling emissions in the manufacturing industries, and indeed that is a prime purpose of the EU ETS extending to these sectors. There is substantial potential for new low carbon technologies in many of these sectors, including both cement and steel. The steel industry, for example, has an extensive collaboration in low carbon steel, and has identified potential for substantially increased RD&D expenditure in this direction.

Whilst there are clearly issues relating to market structure which explain relatively low levels of RD&D in many of the relevant sectors, it is likely to be difficult and politically sensitive to redistribute revenues from auctioning to support R&D in certain sectors in a manner that is transparent, equitable across sectors and legally compliant with WTO legislation. As such is hard to see revenues from the power sector – or indeed general public monies - being used to support very sector-specific RD&D.

If these sectors did move towards auctioning, however, clearly there would more be scope for bargaining use of at least some of the revenues towards low carbon R&D in these sectors. Very broadly, the analysis in this paper suggests that moving directly to auctioning might generate during Phase III revenues for a 20% target in the order of:

- €20-25bn in the cement sector
- €13-25bn in the steel sector

The wider range in steel is partly due to classification difficulties in current data. A percentage of the estimated €20-30bn may be used to support RD&D in cement. This could be expanded if the sectoral coverage was broadened to include the full chain of low carbon construction or if CCS technology development was pursued actively. The sums are also very large for the steel sector, though as a much higher value and more technologically sophisticated industry, there might be much bigger scope for useful RD&D expenditure. For reasons indicated in other research, (Carbon Trust 2010) the case for moving promptly to auctioning in the steel sector seems less urgent, though the same fundamental arguments apply for moving in this direction.

4.3. International support of climate mitigation, adaptation & capacity building

Within the Kyoto Protocol, and now under the Copenhagen Accord and Cancun agreements, Annex-I countries (including the EU-27) have remained committed to facilitating mitigation, adaptation, technology transfer and capacity building in developing countries and emerging
economies. In the latter agreement, governments agreed to provide at least €21 billion in direct transfers to non-Annex I States between 2010 and 2012 in support of adaptation, mitigation, and deforestation reduction. The Accord also set out to increase such transfers to €100 billion annually by 2020, through both government and private investment, with a broader focus on low-carbon technology development and capacity assistance (UNFCCC 2009). To coordinate the management of this financial mechanism, under the Accord it was agreed to establish a Copenhagen Green Climate Fund which would serve as the principal agent interacting between donor and recipient countries. However, as it remains unclear to what extent the financial commitments will be served from either public or private funds, and for what purpose, it is difficult to assess the potential for these expected financial transfers to yield credited emissions reductions in donor countries.

In the European context, two main approaches have been used to support international objectives:
1) Direct private investment in mitigation projects using the UNFCCC's Clean Development Mechanism (CDM) and Joint Implementation (JI) mechanisms; and
2) Government-initiated multilateral and bilateral support schemes.

As we are focusing in this work mainly on the application of government support programmes, we aim to describe a few of these schemes here, and illustrate the variation they have in purpose and in their potential to affect domestic GHG emissions.

At the multilateral level, the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD) established the Multilateral Carbon Credit Fund (MCCF) to operate as an intermediate agent managing CDM and JI projects in Eastern Europe and Central Asia, and offer purchasable emissions credits to Central European Member States and private companies. Though the MCCF has so far generated €208.5 million in investment transfers, most committed projects are yet to be completed, preventing quantification of the total emissions reduction credits awarded by the scheme.

Bilateral schemes within the EU have been less focused on facilitating emission credit transactions, and instead have been designed to provide a broad mix of direct capacity building, mitigation and adaptation support on individual projects and programmes. This is summarized in Table 8. However, though the support offered by existing bilateral schemes may not be directly associated with domestic GHG reduction objectives of donor countries, some schemes - such as the EU Global Climate Change Alliance - are explicit in their intention to improve developing countries’ capacities to take-up projects via the CDM.

Overall, across the EU, the annual direct financial support for climate-related actions in developing countries has increased from €124 million in 2002 to €740 million in 2009 (IEA 2010), and current commitments are to provide an additional €7.2 billion between 2010-2012 to fulfil the Copenhagen Accord near-term objectives (EC 2010). This value equates roughly to 30% of total expected international commitments over the same period. **In the long-term, the EU expects this commitment to grow anywhere between €22 and €50 billion per annum by 2020** (EC 2009a).

Despite recent doubts expressed at the Commission-level on the extent to which the CDM - and similar mechanisms - may operate post-Kyoto, the scale of mitigation possible and the benefits of supporting mitigation in developing countries is not difficult to estimate. In its post-downturn examination of global and regional GHG mitigation costs and potentials, McKinsey estimates that while achieving annual GHG savings of 3.0 GtCO2 by 2030 domestically would cost the EU an additional €100 billion per annum, achieving the same level of savings on the African continent
(2.78 GtCO2 saved annually by 2030) could be achieved at an annual cost of only €34 billion (McKinsey 2010).

### Table 8: Review of recent multilateral and bilateral international support schemes developed by the EU and Member States

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Managing agency/country</th>
<th>Purpose</th>
<th>Amount (est.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multilateral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multilateral Carbon Credit Fund (MCCF)</td>
<td>European Investment Bank</td>
<td>Intermediary management of CDM and JI projects between Central Europe (donors) and Central Asia (recipients)</td>
<td>€208.5 m</td>
</tr>
<tr>
<td>Bilateral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Transformation Fund – International Window</td>
<td>United Kingdom</td>
<td>Finance of low-carbon technology transfer and capacity building with respect to adaptation</td>
<td>€960 m</td>
</tr>
<tr>
<td>International Climate Initiative</td>
<td>Germany</td>
<td>Capacity building via direct funding of mitigation, adaptation, and REDD projects</td>
<td>€371.9m</td>
</tr>
<tr>
<td>Millennium Development Goals Achievement Fund</td>
<td>Spain</td>
<td>Capacity building with respect to climate change adaptation and improving access to finance</td>
<td>€89.5 m</td>
</tr>
<tr>
<td>Global Climate Change Alliance</td>
<td>European Commission</td>
<td>Capacity building to facilitate non-Annex I GHG mitigation and poverty reduction targets, and improve uptake of CDM projects</td>
<td>€164 m</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td></td>
<td><strong>€1,794 m</strong></td>
</tr>
</tbody>
</table>

Sources: IEA (2010), Climate Funds Update (2011)

In short, substantial sums need to be found for international climate expenditures. Public funds already exceed €1bn annually, but will need to rise substantially to help the EU meet its Cancun commitments, particularly if EU policy increasingly downgrades the importance of the CDM and associated private sector transfers. The upper levels of projections of EU contributions towards 2020 could indeed be commensurate with the projected scale of auction revenues in the EU, at a few tens of €bns annually.

One interesting feature of proposals for a combined auctioning & border levelling approach is that there is the opportunity of utilising revenues raised at the border for international climate expenditures. This could help to ease the politics of negotiating border levelling measures, and also has a clear logical basis in the fact that the responsibility for emissions generated in one country to make goods sold in another is ambiguous. This is discussed elsewhere, in a study which also estimated the border revenues that might accrue from this approach applied in cement and steel.  

4.4. Beyond climate expenditures (i): recycling and ‘Double dividend’ debates

On paper one of the simplest uses of the revenue that accrues from EU ETS actions is to recycle it back to those who face the costs of the scheme on a lump-sum basis. This might be to those who bear the initial cost (in which case there is no difference from free-allocation), or to the population at large who face the higher prices if the cost of purchasing allowances is passed through to them. The recycling could either be on a per-capita basis or via some measure of those most affected by the implementation of auctions. Such a scheme may help increase the political acceptability of

---

39 Grubb, M.J. (2011)
auctioning but there is theoretical evidence that such schemes are economically inefficient and/or bureaucratically cumbersome.

Although dealing with distributional issues (especially in the realm of energy poverty) is crucial to gaining wider political acceptance, identifying those affected by implementation of auctioning is unlikely to be possible on a detailed scale, rendering such programmes extremely difficult; witness the difficulties in targeting existing programmes to address energy poverty such as the UK’s winter fuel payments to pensioners and the difficulties associated with setting product benchmarks and establishing sector level MRV systems to determine the level of allowances to be allocated for free to manufacturing industries at risk of leakage.

There is theoretical and empirical evidence that rather than returning revenues in lump-sum forms, it may be more efficient to use the revenues arising from environmental taxation – or in this case environmental auction revenues – to reduce economically distortionary taxes, such as income taxes or value-added taxation. This is implicitly moving from taxing ‘goods’ such as earning or spending, to taxing ‘bads’ such as environmental pollution. This ‘double dividend’ has been much discussed in the literature but evidence as to its existence is mixed.

There may, however, be unwanted effects of implementing auctions that may undermine these efficiency gains. In situations where the cost of purchasing allowances is passed through to consumers introducing auctions could lead to increases in the price of energy leading to falls in real wages and reducing labour supply. Of course if the price is passed through in situations where there is no auctioning (in the power sector in the first two phases of the EU ETS for example), the potential for windfall profits and the existence of negative downstream effects without the benefit of the auction revenue that allows the reduction of other distortionary taxes.

In economic theory the use of environmental revenues, such as those that will accrue under the EU ETS is often hypothecated to reduce other distortionary taxes, and can provide improvements in efficiency over simple lump-sum redistribution. The likelihood of tax reductions in the current fiscal difficulties across the EU, as discussed above, is doubtful in the short-term. There are also political economy factors that influence the use of revenues and rents that may undermine the ability of governments to take such efficiency improving actions.

4.5. Beyond climate expenditures (ii): Europe’s Debt crisis

Finally, the EU faces unprecedented levels of public sector debt. The financial crisis and the associated slowing of economic growth and numerous financial bailouts have pushed both deficits and debts to record levels. This financial strain forced the EU to bailout Greece, Ireland, Portugal and Spain may follow, but the financial issues extend far beyond these countries. The EU27’s level of total debt rose by over 25% from 2005 to 2009 and by almost 13% between 2008 and 2009. Total EU 27 deficits mushroomed by 173% between 2008 and 2009. In addition to the rising levels of deficits and debt, economic growth rates have slowed dramatically, from 3% in 2007 to 0.5% in 2008 to -4.2% in 2009 and recovering only slowly to a forecasted 1.8% in 2010. This combination


\[41\] There are in fact two types of proposed double divided – a weak one where the introduction of an environmental tax with a corresponding reduction in a distortionary tax has lower costs than returning the revenues on a lump-sum basis; and a strong one where such the introduction of such a tax with a reduction in a distortionary tax has zero or negative costs.

\[42\] This ‘tax-interaction’ effect is discussed in Parry, I.W.H., (2003)

\[43\] Data taken from Eurostat
of rising debts and declining growth rates has put the EU’s finances into an increasingly unsustainable position.

The potential auction revenues from Phase III may inevitably be considered in this context, especially in the light of how much of this increasing debt needs to be re-financed in the short term. The Euro zone faces repaying or refinancing €560 billion in 2011, the largest amount in the euro’s history, and €45 billion more than in 2010.\textsuperscript{44} Portugal is especially vulnerable having to re-finance or repay €20 billion by the middle of next year.

Use of EU ETS auction revenues to help to plug some of the fiscal gap would be highly controversial. The view from industry, quite bluntly, is that it would be grossly unfair to use revenues extracted from industry through a supposedly environmental policy to compensate for the fiscal incontinence of European governments. This view is entirely understandable, and indeed trying to use auction revenues as a cash-cow poses substantial risks to the reputation of the EU ETS and its perceived purpose and legitimacy.

Also, in contrast to most of the issues we have considered, the amounts anticipated from auction revenues are dwarfed by the overall scale of the debt crisis. Across the EU as a whole the lowest bound of our projected 2013 auction revenues could meet 2% of the EU’s total deficit in 2009 if just auction revenues from the power sector and manufacturing not identified by the European Commission at risk are included. Should auctioning spread to the steel and cement sectors this increases to over 2.5%.

In particular cases though the numbers look more substantial. For example the value of auctioning from power generation alone equates to 7% of Germany’s 2009 deficit, while increasing auctioning to the cement and steel sector equate to over 3.5% of Sweden’s deficit.

\textbf{Auction revenues 2013 as % of 2009 deficit}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{auction_revenues.png}
\end{figure}

\textsuperscript{44} FT (2010)
Possibly the greatest interest may be found in those countries with greatest immediate threat from debt, notably Greece, Ireland, Portugal and Spain (Fig 10). We have noted earlier in this paper also the disproportionate share of cement in particular in some of these countries, reflecting the economic boom before the bust. In Greece auction revenues could offer €6.5bn up to 2020 while adding cement and steel could increase this by 20% to €7.7bn. In Portugal, which has a debt-GDP ratio of over 83%, power sector auctioning offers almost €2.1bn up to 2020 while adding cement and steel could increase this by 35% to €2.9bn.

The potential role of auction revenues in relation to national debt is bound to be very controversial, and may be best considered as a transitional question. The fact is that the EU will move to auctioning in the power sector from 2013 for sound economic reasons, and this will drive a major leap in revenues.

The basic economic rationale for auctioning in cement, the most “electricity-like” of the manufacturing industries, has also been underlined in previous research.\(^{47}\) The likelihood, as explained in that research, is that a substantial portion of carbon costs would anyway be passed through to cement prices irrespective of free allocation, generating a huge surge in cement profits under the current allocation proposals. A move to auctioning driven by these basic economic considerations is legitimate, and will have revenue implications.

\(^{45}\) 2013 auction revenues assume 20% target and low-carbon price scenario – and lower bound of steel sector. The steel and cement sector auction revenues are those accrued under the alternative scenario and do not include calculations on the scale of revenue from border levelling.

\(^{46}\) 2013 auction revenues assume 20% target and low-carbon price scenario – and lower bound of steel sector. The steel and cement sector auction revenues are those accrued under the alternative scenario and do not include calculations on the scale of revenue from border levelling.

\(^{47}\) See notably Carbon Trust (2008).
A move to tighten EU targets, for reasons of consistency with the environmental goals and efficient time-paths, would also increase revenues as indicated in this study.

This section has suggested that there is a natural hierarchy to considering possible uses of revenues. There is a strong case to put revenues from power sector auctions preferentially towards

(i) Helping some major electricity consumers and vulnerable groups invest in improving electricity efficiency to ameliorate the cost impacts;

(ii) Demonstrating CCS, which including the “NER300” could account for over €5bn,

(iii) Doubling of other low carbon energy RD&D towards the SET goal of €50bn over the next decade,

(iv) Strengthening EIB project loans for renewables (currently around €3-4bn/yr) and transnational grid infrastructure

Beyond these relatively ‘internal sectoral’ expenditures, another level of potentially use of revenues would be

(v) International climate expenditures

Particularly if other sectors like cement and steel do move towards auctioning, a natural priority would be to use these revenues to amplify RD&D in low carbon technologies in these sectors. The revenues raised by border levelling charges on importers, which forms a relatively modest share in relation to the amounts raised by internal auctions, would also be a natural candidate to be used to support international climate expenditures.

Finally, there are two other potential dimensions of expenditure. One is through the ‘double dividend’ arguments which suggest potential macroeconomic gains (or at least offsetting benefits) by shifting tax burdens from ‘goods’ to ‘bads’. The other would be using revenues to help address the EU’s fiscal crisis.

In considering the implications, note also that using auction revenues to address ‘direct’ needs (e.g. i-iv) does obviously have indirect benefits to the wider economy, in terms of reducing the potential drain on other financial sources for climate purposes. To some degree, the distinction is therefore partly semantic. At the same time, it does suggest a case to consider the wider uses of auction revenues mainly if they exceed the direct uses.

This is partly a matter of timing. Whilst the ‘direct’ uses (i)-(iv) could indeed grow to absorb tens of billions of € annually over time, it does not seem credible that such amounts could be well used starting in 2013, when auction revenues will leap. In this respect, considering the potential contribution of ‘residual’ auction revenues to help stabilise the Euro zone in the short to medium term, particularly in terms of Cohesion country debt, is a legitimate consideration. However, we note and reiterate the risks of viewing ETS auctions as a cash cow to plug European fiscal concerns on an ongoing basis. The low carbon transition is a massive challenge, and should form the primary long-term strategic focus of debates around the use of auction revenues.
5. Conclusions

The EU has strong climate and energy ambitions and continues to lead the way in developing climate policy. Changes in Phase III reflect cumulative learning experiences and has seen a number of changes in the design which will strengthen the stringency and economic effectiveness of the scheme. Included in these changes is the provision lower levels of free allocation and increased auctioning, most notably in the power sector. We estimate revenues for this sector alone to be in the region of between €145-295 billion across the entire of Phase III. The upper estimate is under a scenario whereby the EU would move to a 30% reduction commitment which it is currently under consideration.

In addition to increased auctioning provisions in Phase III, the European Commission has classified 164 sectors to be at risk of carbon leakage which is equivalent to 80% of all manufacturing sector emissions covered by the scheme and has developed 52 product benchmarks to determine the level of free allowances each installation will receive.

Existing literature by Climate Strategies and others have highlighted potential pitfalls of using such a uniformed remedial policy measure for all sectors because the nature of the risk of leakage differs amongst sectors. An important study by the Carbon Trust (2010) highlights the potential role for auctioning combined with border levelling in the cement and steel sectors as a hypothetical alternative allocation scenario. This approach in the former sector would reduce the risk of windfall profits and increased imports, undesirable from both an environmental and economic viewpoint, as is anticipated under the current benchmarking rules on clinker production.

Under this proposed alternative approach, total auction revenues would increase from approximately €2bn in the cement sector to €18-22bn and in the steel sector from €3bn to €14-17bn. Under the 30% scenario, in both sectors, the amount of revenue generated through benchmarking is between €3 and 5bn in the cement sector and slightly higher in the steel however the revenue from auctioning rises to €23-36bn in the cement sector and €18-28 bn in the steel sector. Whilst the purpose of the EU ETS is not to act as a revenue raising tool, this scale of this extra revenue is an important consideration, particularly in light of the necessary transformations these sectors will need to undergo, with government support, to decarbonise against a backdrop of high levels of public sector debt in a number of Member States.

The potential scale of auction revenue is significant. Ranging from €150-190bn under the 20% scenario and rising to €200-310bn should the EU move to a 30% reduction target. These estimates would be even higher if domestic cement and steel were included in the auctions, supported by border levelling measures.48

However, the potential scale of ambition is also significant.

This paper is not intended to be prescriptive with regards to how to spend the revenues which accrue to Member States governments but recognises that a number of commitments and expressions of intent have been made by the EU and as such, these auction revenues may have a preferential role in financing such measures as:

---

48 Further to our list of proposed use of revenues, auctioning in the cement and steel sectors may lead to sector-specific uses of auction revenues e.g. steel and cement sector technology investments
(i) Helping some major electricity consumers and vulnerable groups invest in improving electricity efficiency to ameliorate the cost impacts,

(ii) Demonstrating CCS, which including the “NER300” could account for over €5bn,

(iii) Doubling of other low carbon energy RD&D towards the SET goal of €50bn over the next decade,

(iv) Strengthening EIB project loans for renewables (currently around €3-4bn/yr) and transnational grid infrastructure

Beyond these relatively ‘internal sectoral’ expenditures, another level of potentially use of revenues would be:

(v) International climate expenditures - Public funds for international climate expenditures already exceed €1bn/yr and the EU is committed under the Copenhagen-Cancun agreements to increase this, under the “fast start” financing to €21bn over 2010-2012, and ultimately up to €100bn/yr collectively across industrialised countries from all sources including private sector (eg. offsets).

(vi) ‘Revenue recycling’ through reduction in other taxes, which touches on a long but still contested literature on the potential macroeconomic benefits of raising more money from pollution charges and less from income or corporate taxation.

(vii) Debt reduction - Total auction revenues overall would amount to only a few percent of the EU’s overall 2009 debt levels (about 2% at the lower level, up to 4-5% for the high scenarios). At the same time, this is not trivial particularly in relation to the severe difficulties in key Member States.

Using auction revenues for wider fiscal purposes would be controversial, and has potential to damage and distort the fundamental purpose of the EU ETS.

The decision on how to spend these auction revenues lie ultimately with the individual Member States. Many of whom are facing severe financial difficulties right now which may factor into their decisions somewhat. However, the low carbon transition is a massive challenge, and should form the primary long-term strategic focus of debates around the use of auction revenues which if used correctly could make a meaningful contribution towards helping the EU realise its climate ambitions.
References


CIA (2011), World Factbook

Climate Strategies, (Forthcoming), Monjon, “Is there a case for the EU to move beyond 20? – Addressing leakage concerns”.

Climate Strategies (Forthcoming) Sijm, “Is there a case for the EU to move beyond 20% GHG emissions reduction by 2020 – considering the implications for low carbon technology innovation and policies”.


Climate Strategies (2009), , Monjon & Quirion, “Addressing leakage in the EU ETS: Results from the CASE II model”. Available at: http://www.climatestrategies.org/research/our-reports/category/32/141.html


Ecofys, Fraunhofer ISI, Oeko-Institute (2009), Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the cement industry

Ecofys, Fraunhofer ISI, Oeko-Institute (2009), Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the iron and steel industry


Eurostat (2010), Government Deficit and Debt

Financial Times (2010), Euro crisis fears grow amid debt moves, Dec 12 2010


Grattan Institute (2010) Restructuring the Australian Economy to Emit Less Carbon


The Carbon Trust (2008), “Impacts on profitability and trade”.

Annex I – Modelling the European Commissions’ cement and steel sector benchmarks

<table>
<thead>
<tr>
<th>Product benchmark</th>
<th>Definition of products covered</th>
<th>Definition of processes and emissions covered (system boundaries)</th>
<th>Benchmark value (allowances/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey cement clinker</td>
<td>Grey cement clinker as total clinker produced</td>
<td>All processes directly or indirectly linked to the production of grey cement clinker are included.</td>
<td>0.766</td>
</tr>
<tr>
<td>White cement clinker</td>
<td>White cement clinker for use as main binding component in the formulation of materials such as joint fillers, ceramic tile adhesives, insulation, and anchorage mortars, industrial floor mortars, ready mixed plaster, repair mortars, and watertight coatings with maximum average contents of 0.4 mass-% Fe2O3, 0.003 mass-% Cr2O3 and 0.03 mass-% Mn2O3</td>
<td>All processes directly or indirectly linked to the production of white cement clinker are included.</td>
<td>0.987</td>
</tr>
<tr>
<td>EAF carbon steel</td>
<td>Steel containing less than 8% metallic alloying elements and tramp elements to such levels limiting the use to those applications where no high surface quality and process ability is required.</td>
<td>All processes directly or indirectly linked to the process units electric arc furnace, secondary metallurgy, casting and cutting, post-combustion unit, dedusting unit, vessels heating stands, casting ingots preheating stands, scrap drying and scrap preheating are included. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.</td>
<td>0.283</td>
</tr>
<tr>
<td>EAF high alloy steel</td>
<td>Steel containing 8% or more metallic alloying elements or where high surface quality and processability is required</td>
<td>All processes directly or indirectly linked to the process units electric arc furnace, secondary metallurgy, casting and cutting, post-combustion unit, dedusting unit, vessels heating stands, casting ingots preheating stands, slow cooling pit, scrap drying and scrap preheating are included. The process units FeCr converter and cryogenic storage of industrial gases are not included. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered</td>
<td>0.352</td>
</tr>
</tbody>
</table>
Table 9: The European Commissions’ benchmarks for the cement and steel sectors

| Hot metal | Liquid iron saturated with carbon for further processing | All processes directly or indirectly linked to the process units blast furnace, hot metal treatment units, blast furnace blowers, blast furnace hot stoves, basic oxygen furnace, secondary metallurgy units, vacuum ladles, casting units (including cutting), slag treatment unit, burden preparation, BF gas treatment unit, dedusting units, scrap pre-heating, coal drying for PCI, vessels preheating stands, casting ingots preheating stands, compressed air production, dust treatment unit (briquetting), slag treatment unit (briquetting), steam injection in BF unit, steam generation plant, converter BOF gas cooling and miscellaneous are included. | 1.328 |

**Modelling the cement benchmark**

For the cement sector, the European Commission offers two benchmarks: one for grey clinker and one for white which are energy and emissions intensive inputs into the cement production process. White cement, made using white clinker, is a niche market and globally production of grey cement is 150 times the size of that of white cement. As such, this report will only account for the impact of the grey clinker benchmark on industry.

The benchmark is for emissions per tonne of clinker output but the EU ETS requires reporting on cement emissions. As such, we approximate a cement benchmark using the following equation:

\[
\text{Emissions per tonne of cement} = \frac{\text{clinker benchmark}}{\text{cement: clinker ratio}}
\]

In order to estimate the number of allowances that cement installations need to purchase, we take annual emissions levels from this sector, divide it by the average emissions per tonne of output for grey cement[^49] to estimate the tonnes of cement produced. We then multiply this number by the cement benchmark using the European Commission’s clinker benchmark to obtain an average number of allowances that would be allocated for free to cement installations in the EU. We subtract this number from the original emissions data and use the difference as a proxy for how many allowances would need to be purchased at auctioned. As such, we make no assumptions on the relative emissions efficiency of production of cement installations in the EU. Due to this, we are unable to disaggregate the impact of the benchmark to work out the associated revenues collected at a Member State level.

[^49]: Cembureau provided the data on average emissions intensity of grey clinker production in the EU to be 0.766 and we use the CSI’s Getting the Numbers Right calculation of average EU cement to clinker ratio on 0.73
Modelling the steel benchmark

It is even more difficult to accurately model the impact of the steel sector benchmark. The European Commission has developed 5 benchmarks for the steel sector. 3 for the production process itself (2 for electric arc furnace and one for hot metal (blast furnace), and two for pre-production (coke production and one for sintered ore). In this paper we limit the definition of the steel sector to NACE code 2710 and assume that the product benchmarks for sintering of iron ore is captured in subsector 1310 (mining of iron ores) and coking of iron is captured in subsector 2310 (manufacture of coke oven products).

The majority of emissions arising from steel production in Europe (95%) are generated through the blast furnace production route\(^{50}\). The CITL database does not distinguish between the production processes and as such, for simplicity we only apply the benchmark for blast oxygen furnace to those installations covered by NACE code 2710 (manufacture of basic iron and steel and Ferro-alloys). Although this approach reduces the accuracy of the estimate on revenues for benchmarks, it is difficult to make assumptions on the relative division of emissions between blast furnaces and electric arc furnaces, particularly on a country level basis. Figure 4 demonstrates that the relative share of production processes in the steel sector can differ significantly across EU Member States.

![Figure 12: Relative division of Blast Oxygen Furnace and Electric Arc Furnace produced steel in a selection of European countries, Source: IEA.](image)

---

\(^{50}\) Based on calculations from Ecofys et al. (2009) Methodology for the free allocation of emission allowances in the EU ETS post 2012 - Sector report for the iron and steel industry
Annex II - Numerical estimates of potential revenue generated in Phase III.

Revenues generated from different allocation methods under the 20% scenario (maximum use of offsets and achievement of RES target by 2020) – carbon price of €17/t in 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>Power sector</th>
<th>Manufacturing not classified at risk (no BM)</th>
<th>Cement</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>BM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Auct</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BM</td>
<td>Auct</td>
</tr>
<tr>
<td>Austria</td>
<td>1,152</td>
<td>30</td>
<td>375</td>
<td>1,060</td>
</tr>
<tr>
<td>Belgium</td>
<td>2,134</td>
<td>133</td>
<td>566</td>
<td>1,367-1,409</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>2,337</td>
<td>33</td>
<td>429</td>
<td>0</td>
</tr>
<tr>
<td>Cyprus</td>
<td>288</td>
<td>7</td>
<td>170</td>
<td>0</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>4,665</td>
<td>342</td>
<td>352</td>
<td>15-1,759</td>
</tr>
<tr>
<td>Denmark</td>
<td>2,496</td>
<td>52</td>
<td>261</td>
<td>11</td>
</tr>
<tr>
<td>Estonia</td>
<td>1,068</td>
<td>11</td>
<td>137</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
<td>2,876</td>
<td>26</td>
<td>119</td>
<td>701</td>
</tr>
<tr>
<td>France</td>
<td>4,675</td>
<td>210</td>
<td>1,609</td>
<td>2,662-2,699</td>
</tr>
<tr>
<td>Germany</td>
<td>40,810</td>
<td>771</td>
<td>2,384</td>
<td>1,343 – 3,382</td>
</tr>
<tr>
<td>Greece</td>
<td>6,311</td>
<td>29</td>
<td>1,152</td>
<td>122-132</td>
</tr>
<tr>
<td>Hungary</td>
<td>744</td>
<td>140</td>
<td>246</td>
<td>12-19</td>
</tr>
<tr>
<td>Ireland</td>
<td>1,388</td>
<td>129</td>
<td>396</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>15,615</td>
<td>382</td>
<td>3,039</td>
<td>1,460-1,717</td>
</tr>
<tr>
<td>Latvia</td>
<td>86</td>
<td>6</td>
<td>42</td>
<td>0-39</td>
</tr>
<tr>
<td>Lithuania</td>
<td>228</td>
<td>2</td>
<td>105</td>
<td>0</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>5</td>
<td>0</td>
<td>75</td>
<td>0-32</td>
</tr>
<tr>
<td>Netherlands</td>
<td>5,400</td>
<td>133</td>
<td>72</td>
<td>0-770</td>
</tr>
<tr>
<td>Poland</td>
<td>12,931</td>
<td>255</td>
<td>1,221</td>
<td>8-250</td>
</tr>
<tr>
<td>Portugal</td>
<td>2,045</td>
<td>32</td>
<td>744</td>
<td>0-24</td>
</tr>
<tr>
<td>Romania</td>
<td>2,551</td>
<td>62</td>
<td>463</td>
<td>899-920</td>
</tr>
<tr>
<td>Slovakia</td>
<td>584</td>
<td>16</td>
<td>219</td>
<td>0-1,074</td>
</tr>
<tr>
<td>Slovenia</td>
<td>384</td>
<td>20</td>
<td>113</td>
<td>11-22</td>
</tr>
<tr>
<td>Spain</td>
<td>13,002</td>
<td>378</td>
<td>2,730</td>
<td>756-892</td>
</tr>
<tr>
<td>Sweden</td>
<td>691</td>
<td>16</td>
<td>257</td>
<td>475-580</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>20,651</td>
<td>414</td>
<td>963</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>145,270</td>
<td>3,630</td>
<td>2,152</td>
<td>18,239</td>
</tr>
</tbody>
</table>
Revenues generated from different allocation methods under the 20% scenario (maximum use of offsets) – carbon price of €25/t in 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>Power sector</th>
<th>Manufacturing not classified at risk (no BM)</th>
<th>Cement</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>BM</td>
<td>Auct</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Auct</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>1,432</td>
<td>39</td>
<td>467</td>
<td>1,318</td>
</tr>
<tr>
<td>Belgium</td>
<td>2,654</td>
<td>173</td>
<td>704</td>
<td>1,700-1,752</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>3,033</td>
<td>43</td>
<td>534</td>
<td>0</td>
</tr>
<tr>
<td>Cyprus</td>
<td>374</td>
<td>9</td>
<td>212</td>
<td>0</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>6,056</td>
<td>445</td>
<td>437</td>
<td>18-2,188</td>
</tr>
<tr>
<td>Denmark</td>
<td>3,104</td>
<td>67</td>
<td>324</td>
<td>13</td>
</tr>
<tr>
<td>Estonia</td>
<td>1,386</td>
<td>14</td>
<td>171</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
<td>3,578</td>
<td>34</td>
<td>148</td>
<td>871</td>
</tr>
<tr>
<td>France</td>
<td>5,815</td>
<td>273</td>
<td>2,001</td>
<td>3,312-3,357</td>
</tr>
<tr>
<td>Germany</td>
<td>50,760</td>
<td>1,003</td>
<td>2,965</td>
<td>1,671-4,207</td>
</tr>
<tr>
<td>Greece</td>
<td>7,850</td>
<td>38</td>
<td>1,433</td>
<td>152-165</td>
</tr>
<tr>
<td>Hungary</td>
<td>966</td>
<td>182</td>
<td>306</td>
<td>15-23</td>
</tr>
<tr>
<td>Ireland</td>
<td>1,727</td>
<td>168</td>
<td>492</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>19,423</td>
<td>497</td>
<td>3,780</td>
<td>1,816-2,136</td>
</tr>
<tr>
<td>Latvia</td>
<td>112</td>
<td>8</td>
<td>52</td>
<td>0-49</td>
</tr>
<tr>
<td>Lithuania</td>
<td>296</td>
<td>3</td>
<td>131</td>
<td>0</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>7</td>
<td>0</td>
<td>93</td>
<td>0-40</td>
</tr>
<tr>
<td>Netherlands</td>
<td>6,716</td>
<td>173</td>
<td>89</td>
<td>0-958</td>
</tr>
<tr>
<td>Poland</td>
<td>16,784</td>
<td>331</td>
<td>1,518</td>
<td>10-311</td>
</tr>
<tr>
<td>Portugal</td>
<td>2,544</td>
<td>42</td>
<td>925</td>
<td>0-30</td>
</tr>
<tr>
<td>Romania</td>
<td>3,312</td>
<td>81</td>
<td>576</td>
<td>1,119-1,145</td>
</tr>
<tr>
<td>Slovakia</td>
<td>758</td>
<td>21</td>
<td>273</td>
<td>0-1,336</td>
</tr>
<tr>
<td>Slovenia</td>
<td>498</td>
<td>26</td>
<td>140</td>
<td>13-27</td>
</tr>
<tr>
<td>Spain</td>
<td>16,172</td>
<td>491</td>
<td>3,396</td>
<td>941-1,109</td>
</tr>
<tr>
<td>Sweden</td>
<td>859</td>
<td>21</td>
<td>320</td>
<td>638-721</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>25,686</td>
<td>538</td>
<td>1,198</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>182,100</strong></td>
<td><strong>4,719</strong></td>
<td><strong>22,686</strong></td>
<td><strong>2,590-21,766</strong></td>
</tr>
</tbody>
</table>
Revenues generated from a 30% reduction target assuming a cost-effective split between the ETS and non-ETS sectors and half of this additional reduction target from 20% is be achieved through extra CDM credits – **Carbon price of €30/t in 2020**

<table>
<thead>
<tr>
<th>Country</th>
<th>Power sector (€m)</th>
<th>Manufacturing not classified at risk (no BM) (€m)</th>
<th>Cement (€m)</th>
<th>Steel (€m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BM</td>
<td>Auct</td>
<td>BM</td>
</tr>
<tr>
<td>Austria</td>
<td>1,489</td>
<td>41</td>
<td>486</td>
<td>1,370</td>
</tr>
<tr>
<td>Belgium</td>
<td>2,758</td>
<td>180</td>
<td>731</td>
<td>1,767-1,821</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>3,164</td>
<td>45</td>
<td>555</td>
<td>0</td>
</tr>
<tr>
<td>Cyprus</td>
<td>390</td>
<td>10</td>
<td>220</td>
<td>0</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>6,318</td>
<td>464</td>
<td>455</td>
<td>19-2,274</td>
</tr>
<tr>
<td>Denmark</td>
<td>3,227</td>
<td>70</td>
<td>337</td>
<td>14</td>
</tr>
<tr>
<td>Estonia</td>
<td>1,446</td>
<td>14</td>
<td>178</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
<td>3,718</td>
<td>36</td>
<td>154</td>
<td>906</td>
</tr>
<tr>
<td>France</td>
<td>6,044</td>
<td>285</td>
<td>2,079</td>
<td>3,442-3,489</td>
</tr>
<tr>
<td>Germany</td>
<td>52,756</td>
<td>1,055</td>
<td>3,081</td>
<td>1,736-4,372</td>
</tr>
<tr>
<td>Greece</td>
<td>8,158</td>
<td>40</td>
<td>1,490</td>
<td>158-172</td>
</tr>
<tr>
<td>Hungary</td>
<td>1,008</td>
<td>190</td>
<td>318</td>
<td>16-24</td>
</tr>
<tr>
<td>Ireland</td>
<td>1,795</td>
<td>175</td>
<td>511</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>20,187</td>
<td>525</td>
<td>3,928</td>
<td>1,887-2,220</td>
</tr>
<tr>
<td>Latvia</td>
<td>117</td>
<td>8</td>
<td>54</td>
<td>0-51</td>
</tr>
<tr>
<td>Lithuania</td>
<td>311</td>
<td>3</td>
<td>136</td>
<td>0</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>7</td>
<td>0</td>
<td>97</td>
<td>0-41</td>
</tr>
<tr>
<td>Netherlands</td>
<td>6,980</td>
<td>180</td>
<td>93</td>
<td>0-996</td>
</tr>
<tr>
<td>Poland</td>
<td>17,510</td>
<td>347</td>
<td>1,578</td>
<td>10-323</td>
</tr>
<tr>
<td>Portugal</td>
<td>2,644</td>
<td>44</td>
<td>961</td>
<td>0-31</td>
</tr>
<tr>
<td>Romania</td>
<td>3,455</td>
<td>84</td>
<td>599</td>
<td>1,163-1,190</td>
</tr>
<tr>
<td>Slovakia</td>
<td>790</td>
<td>23</td>
<td>284</td>
<td>0-1,388</td>
</tr>
<tr>
<td>Slovenia</td>
<td>520</td>
<td>27</td>
<td>146</td>
<td>14-28</td>
</tr>
<tr>
<td>Spain</td>
<td>16,808</td>
<td>513</td>
<td>3,529</td>
<td>978-1,153</td>
</tr>
<tr>
<td>Sweden</td>
<td>899</td>
<td>23</td>
<td>332</td>
<td>663-750</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>26,696</td>
<td>562</td>
<td>1,245</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>189,403</strong></td>
<td><strong>4,945</strong></td>
<td><strong>23,578</strong></td>
<td><strong>2,692-4,304</strong></td>
</tr>
</tbody>
</table>
Revenues generated under a 30% reduction target with no additional use of CDM offset credits and assuming a cost-effective split between the ETS and non-ETS sectors – **carbon price of €55/t in 2020**

<table>
<thead>
<tr>
<th>Country</th>
<th>Power sector</th>
<th>Manufacturing not classified at risk (no BM)</th>
<th>Cement</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>BM</td>
<td>Auct</td>
</tr>
<tr>
<td>Austria</td>
<td>2,284</td>
<td>67</td>
<td>745</td>
<td>2,103</td>
</tr>
<tr>
<td>Belgium</td>
<td>4,232</td>
<td>292</td>
<td>1,122</td>
<td>2,711-2,795</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>5,122</td>
<td>73</td>
<td>851</td>
<td>0</td>
</tr>
<tr>
<td>Cyprus</td>
<td>632</td>
<td>16</td>
<td>338</td>
<td>0</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>10,227</td>
<td>752</td>
<td>698</td>
<td>29-3,489</td>
</tr>
<tr>
<td>Denmark</td>
<td>4,951</td>
<td>114</td>
<td>517</td>
<td>21</td>
</tr>
<tr>
<td>Estonia</td>
<td>2,340</td>
<td>23</td>
<td>273</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
<td>5,705</td>
<td>58</td>
<td>236</td>
<td>1,390</td>
</tr>
<tr>
<td>France</td>
<td>9,274</td>
<td>463</td>
<td>3,191</td>
<td>5,281-5,354</td>
</tr>
<tr>
<td>Germany</td>
<td>80,947</td>
<td>1,712</td>
<td>4,728</td>
<td>2,664-6,709</td>
</tr>
<tr>
<td>Greece</td>
<td>12,518</td>
<td>64</td>
<td>2,286</td>
<td>242-264</td>
</tr>
<tr>
<td>Hungary</td>
<td>1,631</td>
<td>308</td>
<td>488</td>
<td>25-37</td>
</tr>
<tr>
<td>Ireland</td>
<td>2,754</td>
<td>284</td>
<td>785</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>30,974</td>
<td>852</td>
<td>6,027</td>
<td>2,896-3,393</td>
</tr>
<tr>
<td>Latvia</td>
<td>189</td>
<td>14</td>
<td>83</td>
<td>0-78</td>
</tr>
<tr>
<td>Lithuania</td>
<td>503</td>
<td>5</td>
<td>209</td>
<td>0</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>11</td>
<td>1</td>
<td>148</td>
<td>0-63</td>
</tr>
<tr>
<td>Netherlands</td>
<td>10,710</td>
<td>292</td>
<td>142</td>
<td>0-1,528</td>
</tr>
<tr>
<td>Poland</td>
<td>28,343</td>
<td>562</td>
<td>2,422</td>
<td>15-495</td>
</tr>
<tr>
<td>Portugal</td>
<td>4,056</td>
<td>71</td>
<td>1,475</td>
<td>0-47</td>
</tr>
<tr>
<td>Romania</td>
<td>5,592</td>
<td>136</td>
<td>919</td>
<td>1,784-1,825</td>
</tr>
<tr>
<td>Slovakia</td>
<td>1,279</td>
<td>37</td>
<td>435</td>
<td>0-2,130</td>
</tr>
<tr>
<td>Slovenia</td>
<td>842</td>
<td>44</td>
<td>224</td>
<td>21-44</td>
</tr>
<tr>
<td>Spain</td>
<td>25,789</td>
<td>832</td>
<td>5,415</td>
<td>1,500-1,769</td>
</tr>
<tr>
<td>Sweden</td>
<td>1,379</td>
<td>37</td>
<td>510</td>
<td>1,018-1,150</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>40,961</td>
<td>911</td>
<td>1,911</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>293,583</strong></td>
<td><strong>8,019</strong></td>
<td><strong>36,177</strong></td>
<td><strong>21,714-34,711</strong></td>
</tr>
</tbody>
</table>
Climate Strategies is an international organisation that convenes networks of leading academic experts around specific climate change policy challenges. From this it offers rigorous, independent research to governments and the full range of stakeholders, in Europe and beyond.

It is made up of a global network of experts and bridges the gap between academia and policymakers to provide unrivalled analysis for international decision makers in the field of climate change and energy policy. Our work is funded through a broad spectrum of governments businesses and foundations.

Climate Strategies, c/o University of Cambridge, 21 Silver Street, Cambridge CB3 9EL, UK
+44 (0) 1223 764 874; www.climatestrategies.org