Calculation of additional profits of sectors and firms from the EU ETS 2008-2015

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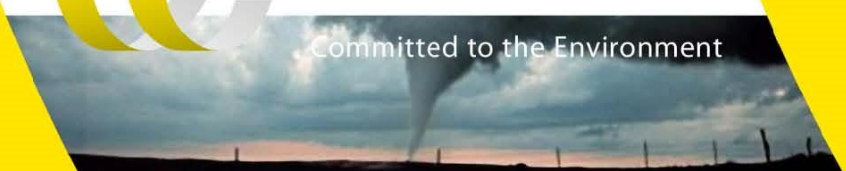

Calculation of additional profits of sectors and firms from the EU ETS 2008-2015

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Executive Summary

This study has calculated the additional profits that sectors and companies have made from the EU ETS from 2008 to 2015, distinguishing between three types of profits:

1. Profits from overallocation of free emission allowances. In many sectors/ countries, free allowances have been granted in excess of verified emissions, allowing industries to generate additional profits by selling this surplus in the market.
2. Profits from using CDM/JI credits for compliance. Companies were entitled to a certain extent to use cheaper CDM/JI credits for compliance. This has created additional profits since many companies have used these credits for compliance and sold the saved freely obtained allowances on the ETS market.
3. Profits from passing through the opportunity costs of freely obtained allowances. There is ample empirical evidence that companies have been able to pass through (part of) the carbon costs in product prices. Although the allowances were granted free of charge, the majority of sectors were thus able to pass through the opportunity costs of these allowances in product prices, thus making so-called windfall profits.

Profits in each of these categories from 2008 to 2015 have been calculated for 15 sectors (in general the most polluting ones) in the 20 EU countries that are also part of the OECD. The analysis in this study differs from those in earlier studies on this subject by our having corrected for allocation of waste gases to the iron and steel industry, which have been transferred to the electricity sector on a statistical basis. In our view this yields a more accurate estimate of the extent of overallocation to the iron and steel sector compared with other studies.

Our results show that between 2008 and 2015 European industry received additional profits amounting to over 7.5 billion euro through overallocation. This number was down from 8.2 billion euros of additional profits between 2008-2014 implying that the oversupply to industry was reduced in 2015 because of the cross-sectoral correction factor and benchmarks applied in the allocation since 2013. There are considerable differences in the extent of overallocation per country. Austria was the only country where industry did not gain additional profits from overallocation. Spain had the highest profits, totalling over 1.6 billion euro between 2008-2015. In addition, the 20 countries profited from using cheap CERs for compliance, yielding an estimated profit of over 780 million euro up to 2012. This source of profit continued after 2012 but could not be measured anymore due to changes in the monitoring regulation in the EU ETS.

The largest additional profit category derived from passing through carbon costs. There is plenty of empirical evidence that companies receiving free allowances pass through part of the value of these allowances onto product prices – as economic theory would predict. However, there is scientific uncertainty how much of the costs are exactly passed through. In a minimum variant we estimated that the additional profits in this category totalled over 16.7 billion euro for the 15 sectors in the 20 countries investigated. In an average variant, this cost category would increase to 29.1 billion of euros.

1 Introduction

1.1 Background

The EU ETS is the cornerstone of the climate policies of the European Union. Through the EU ETS about 45% of GHG emissions are being regulated from the entire electricity generation and the majority of the industry sector. When measured in size, the EU ETS is the largest emission trading system in the world. It serves as a blueprint for many emission trading systems being currently designed worldwide.

Last year the 10th anniversary of the carbon reduction policy instrument was celebrated. However, despite the size, impact and durability of the EU ETS, the policy instrument has been criticized from the outset. The critiques especially relate to the potential lack of regulatory incentives that stem from the system, especially when evaluated as being additional to the other climate policy instruments.[1] This is most pressing for sectors, such as industry, that have largely been set free from auxiliary regulatory instruments because they participate in the EU ETS. The main purpose of the upcoming revision for Phase 4 of the ETS (2021-2030) is therefore to try to set the incentives right so the EU ETS can steer companies in their transformation towards a low-carbon economy.

In a previous report CE Delft (2016) calculated that most firms have substantially generated additional profits from participating in the EU ETS. These profits stemmed from three factors:

- profits from generous over allocation of free allowances, especially in the years 2008-2012;
- profits from generous possibilities to use CERs for compliance instead of the freely obtained allowances making it possible to use CERs for compliance and sell the EUAs on the carbon markets (to primarily electricity producers);
- profits from passing through (part of) the value of freely obtained allowances into product prices.

1.2 Objective

The objective of this project is to deliver a report containing a country-by-country analysis of the additional profits that sectors and companies have made from the EU ETS between 2008-2015. The analysis is similar to the analysis undertaken in the earlier report presented in March.

[1] Some ex-post investigations have claimed that the EU ETS so far has not really contributed to emission reduction additional to the existing renewable energy support schemes. Others, e.g. (CE Delft, 2015), have argued that although the scheme has contributed to emission reductions in e.g. the UK power market when prices rose above the € 20/tCO_2, the present system has been so overfloaded with free allowances that the regulatory impact has been minimalized.

1.3 Delineation

1.3.1 Definition of additional profits

Additional profits have been defined here as profits stemming from three categories:

- Overallocation of free emission allowances. Free allowances have often been granted in excess to the verified emissions so that industry received more free allowances than they needed being able to sell the surplus on the market or to bank them if they expect that this is more profitable due to future price increases.
- Use of CDM/JI credits for compliance. In this case companies have used cheaper international credits from the Kyoto Protocol's market mechanisms, e.g. the Clean Development Mechanism (CDM) or Joint Implementation (JI), for compliance instead of their free allowances. They have instead sold the remaining free allowances on the market (or banked them for compliance in later years).
- Passing through carbon costs. Although the allowances have been granted for free, the majority of sectors were able to pass through the opportunity costs of these allowances into product prices obtaining so-called windfall profits according to the research literature on this topic.

Other costs and benefits that are generated through the EU ETS **have not been** quantified in this study. This includes, *inter alia*:

- costs for abatement of carbon emissions;
- costs or benefits from higher prices of inputs or auxiliary outputs (e.g. electricity and heat including cross-sectoral heat and electricity flows) [2];
- administrative costs for compliance to the EU ETS;
- benefits from compensation of indirect emission costs, as defined in the ETS Guidelines;
- eventual costs and benefits associated with banking and/or hedging on ETS markets;
- eventual costs and benefits from indirect consequences, such as a shift in market shares, costs of paid dividends, impacts on the labour market, etc.

These cost categories are not straightforward to quantify in a uniform way and treatment of these falls outside the scope of the present study. Moreover, except for the costs of carbon abatement and administrative costs, each cost category can in some circumstances be a benefit and in other circumstances present itself as a cost. For the total EU28, these costs are most likely to be neutral, though for individual companies or sectors, they can be more substantial. Therefore some caution should be paid to the interpretation of the analysis below.

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[2] Companies have received additional free allowances for heat purchased from installations that fall under an auctioning rule. Under the EU ETS Directive owners of such installations do not receive free allowances for the part of the heat that goes to an ETS consumer, as the ETS heat consumer will receive the free allowances for the heat it consumes. We have regarded these allowances as "benefits" that can be used to verify the company's own emissions. Eventual higher costs for heat deliveries that have been negotiated in these heat transfers have thus not been taken into account. A similar situation holds for companies that operate a CHP unit under their account. For the electricity part, this installation has not received free allowances. Eventual shortage in allowances have in our accounts thus been recorded as a cost to the company, while in fact the electricity most likely is delivered to the grid including coverage for carbon costs so that there have been no additional carbon costs.

1.3.2 Definition of countries

The analysis has been undertaken for nineteen countries (all of the EU MS that are also part of the OECD, minus Luxembourg). The countries are:

- Austria;
- Belgium;
- Denmark;
- Finland;
- France;
- Germany;
- Greece;
- Ireland;
- Italy;
- Luxembourg
- The Netherlands;
- Portugal;
- Spain;
- Sweden;
- United Kingdom;
- Poland;
- Hungary;
- Czech Republic;
- Slovak Republic;
- Slovenia.

1.3.3 Delineation of sectors

The analysis has been undertaken for several sectors that have the highest carbon emissions in the ETS, excluding electricity, heat and aviation. Some additional sectors have been included since some companies that are active one carbon intensive sector tend to have installations in other sectors as well. The following sectors have been included in this study.

- Refineries 19.20;
- Extraction of crude petroleum and gas 06.10;
- Iron and Steel 24.10;
- Manufacture of coke oven products 19.10;
- Cement 23.51;
- Lime 23.52;
- Petrochemicals 20.14;
- Inorganic chemicals 20.13;
- Industrial gases 20.11;
- Manufacture of plastics in primary form 20.16;
- Fertilizers 20.15;
- Flat glass 23.11;
- Hollow glass 23.13;
- Other glass 23.14;
- Manufacturing of bricks 23.32.

1.3.4 Delineation of companies

We use in this research, next to sectors and installations, individual companies by linking the installations to their legal owners. This provides additional information on the total net profits for individual companies. We take here as an entity, as much as possible, the company that publishes an annual financial report as one company. If one company runs more than one installation, these installations were merged together. However, only the installations that fall under the abovementioned fifteen sectors are taken into account in the calculus.

If, e.g., a company active in the manufacturing of bricks (NACE 23.32), also has installations that produce tiles (NACE 23.31), these installations are not being attributed to this individual company.

A company that produces in more than one installations belonging to two different NACE codes has been treated as two companies. In the Netherlands operates Shell, e.g., installations in the refineries and petrochemical industries. In this case the installation in the refineries industry was labelled as a company Shell Netherlands Refinery and the installations in the petrochemical industry were labelled as Shell Netherlands Chemicals.

In the previous research we have used our own databases with respect to the ownership with companies, which was based on information from the University of Florence (Juraite *et al.*, 2014). However, this information turned out to be relatively outdated and sometimes confusing account holder names with companies. Therefore in this research we have investigated bottom-up, for each country, the top-5 companies that received the highest additional profits from overallocation of allowances into more detail and revealed the ownership from these companies by visiting websites and conducting telephonic information requests. We therefore can state with more confidence that the identified installations truly belong to the companies listed.

1.4 Methodological Approach

The methodological approach did not differ from CE Delft (2016) and the reader is referred to there. In short this implies:

Three components have been used for calculating the additional profits: (i) Profits from overallocation[3]; (ii) Profits from CER/EUA conversion used for compliance.[4]; Profits from passing through (part of) the carbon costs to their customers.[5]

[3] In many countries, and for many industrial sectors, free allowances have been granted in excess to the verified emissions. This results in the fact that industry received more free allowances than they needed for compliance under the ETS regulation. The excess allowances have been either banked for future compliance or sold on the market to generate additional profits. Even if the allowances have been banked they can be considered as "additional profits" since they can be used or sold in the future.

[4] Companies participating in the EU ETS are entitled to use a certain amount of ERUs/CERs for compliance. Since the costs of international credits are substantially lower than the EUA price, this contains an additional profit for companies involved as they can use the converted allowances for compliance and sell the excess freely allocated allowances on the ETS market.

[5] Although the allowances have been granted for free, many studies have evidenced that the majority of sectors were able to pass through the opportunity costs of these allowances into product prices obtaining so-called windfall profits. In many cases such additional profits may have occurred unintentional.

Profits from overallocation and CER/EUA conversion have been calculated using average annual prices of EUA and CERs from the market (see Table 1).[6] Overallocation to the iron and steel industry has been reduced for the additional carbon content (compared to natural gas) in the delivery of waste gasses to the electricity sector.[7] This has been based on data from the International Energy Agency.[8]

Table 1 **Average annual prices of EUAs and CERs used in this report**

	2008	2009	2010	2011	2012	2013	2014	2015
EUAs average	21.946	13.0467	14.3176	12.8804	7.3191	4.4573	5.9453	7.6774
CERs average	17.47	11.94	12.60	9.96	2.97	0.39	0.18	0.39

Source: 2008-2012: data from Bluenext; 2013-2015: data from SendeCO2.

We have used the database at CE Delft on the installations from the EU ETS. This database is slightly more accurate than the EU ETS Database viewer since, through our research, we have allocated more installations to NACE codes than on the websites of the European Commission are presented. Moreover, we have omitted double entries in the database. Since our database is continuously improving, our results here are, for some countries, slightly different from the previously reported data. In all cases the resulting changes are well below the 0.5%.

6 Daily prices have been converted to annual averages.

7 It may be the case that individual iron and steel sectors pass through a larger share of allowances to the electricity producers but unless these are clearly recorded in annual accounts, we cannot correct for them.

8 For Luxembourg no IEA data could be found. However, it was concluded that Luxembourg shut down their blast furnaces in the 1990s implying that the units currently in operation are no longer producing waste gasses. Also installations operating under the iron and steel sector in Denmark, Greece, Ireland, Portugal and Slovenia do not report to have waste gasses delivered to electricity producers.

2 Results at the country level

2.1 Introduction

In this chapter we present the results of the analysis at the level of whole countries. Results for sectors and companies can be found in Chapter 3.
The results presented here can be slightly different when compared to our last report. The reason is that with the publication of the 2015 figures, also revised figures for earlier years have been published. We have used here thus the most recent figures. For about 10% of 2014 emissions, no 2015 data have been provided yet, notably in Poland and France. In these cases we have assumed that the installation had the same emissions as in 2014.

2.2 Additional profits from overallocation

Industrial installations have, in general, been overallocated in the first two phases of the ETS (2005-2012). National allocation plans, dominated in Phase 1 and Phase 2 of the EU ETS, in general tend to have favoured industrial installations at the expense of allocation to the power sector. The subsequent economic downturn in 2008 has resulted in a substantial amount surplus free allowances banked forward from Phase 2.

In Phase 3 this overallocation was substantially reduced. However, the overallocation continues for some countries and sectors. Table 2 gives the results. Between 2008 and 2015, industrial companies in the EU ETS received excess allowances worth over 7.5 billion euros. Most excess profits, over 1.6 billion euros were allocated to Spanish industry. Industry in Germany, France and the UK received over this time frame excessive free allowances worth almost 1 billion per country. Austria is the only country where industry was not granted with additional windfall profits through allocation.

Compared to previous years, a very substantial amount of installations had not yet finished their reporting requirements. This was especially the case in Poland and France. Therefore we have corrected the 2015 figures for those installations that have not yet reported verified emissions.

Table 2 **Profits from overallocation of emission allowances since 2008, in mio current euros**

	Total 2008-2014	Total 2008-2015
Austria	-227.9	-283.5
Belgium	700.5	687.3
Czech Republic	193.7	183.3
Germany	1136.3	939.2
Denmark	110.1	107.4
Spain	1676.2	1624.1
Finland	115.1	112.8
France	828.0	796.8
United Kingdom	1010.5	866.8
Greece	360.1	348.8
Hungary	52.7	52.7
Ireland	162.8	160.4

	Total 2008-2014	Total 2008-2015
Italy	522.1	504.4
Luxembourg	17.7	16.9
Netherlands	253.4	229.5
Poland	264.0	209.3
Portugal	230.5	226.2
Sweden	388.2	415.9
Slovenia	15.1	16.1
Slovakia	341.1	320.2
Total 20 countries	8150.5	7534.4

Note: Own calculations on the basis of the EU ETS Registry. 2015 figures have been corrected for installations that have not yet reported their 2015 emissions.

Note: The results for 2008-2014 are slightly different from our last study since we have been able to include a larger number of installations and have made small modifications as to the sectoral classification of some installations. Moreover, information on verified emissions has been adjusted in some cases by the EU due to reporting errors.

2.3 Profits from CERs/EUA conversions

An additional source of profits can be attributed to the conversion of CERs to EUAs. In the previous study we have quantified this only for the 15 sectors selected for the years 2008-2012. Due to changes in the administration there is no longer central information available as to which companies have used CERs for compliance.

Therefore, our previous results do not change for the sectors included except for small changes (<1%) in the registry and the overall quality of the database we use. The general formula for assessing the additional profits from conversion of CERs has been calculated as:

$$Add.Profits\ Conversion_{i,j,t} = SE\_cer_{i,j,t} * (P_{EUA,t} - P_{CER,t})$$

Where SE_cer = surrendered CERs for compliance, P_{EUA} is the price for an emission allowances in the ETS, P_{CER} is the international price for CERs and subscripts i, j and t stand for company, sector and time {2008-2012] respectively. For the years 2013 and 2014 no additional profits from conversion have been calculated. Please also notice that we have not taken into account eventual profits from conversion of ERU's

Table 3 Mio euros of profits for total industry from handing in cheap CERs for compliance under the EU ETS

	Total 8-12
Austria	19.6
Belgium	28.6
Czech Republic	18.0
Germany	237.4
Denmark	4.0
Spain	57.0
Finland	13.1
France	135.9
United Kingdom	68.0
Greece	20.9
Hungary	5.6

	Total 8-12
Ireland	3.6
Italy	60.0
Luxembourg	2.3
Netherlands	35.8
Poland	26.1
Portugal	8.7
Sweden	18.9
Slovenia	1.5
Slovakia	15.6
Total 20 countries	780.7
Total EU ETS	838.8

Cheap CERs for compliance undermines the incentive to invest in abatement technologies. In a recent research, Langeler (2016) concluded that in Holland, companies that used cheap CERs for compliance, showed less improvement in their emission intensities than companies that did not use CERs for compliance. This is an indication that the provision to hand in CERs for compliance could, to some extent, be used to avoid investment in emission reduction.

2.4 Additional profits from passing through the carbon costs

2.4.1 General mechanism

Cost pass-through has been a heavily debated subject in the context of the EU ETS. The discussion refers to the question to what extent participants in the EU ETS have forwarded the opportunity costs of the freely obtained allowances forward in product prices. Many installations in the ETS receive all, or the majority, of their allowances for free. Companies use these allowances for compliances. However, they could also sell these allowances on the carbon exchange market. Economic theory predicts that companies would use these allowances up to the point where the marginal benefit of a unit additional production equals the marginal benefit of selling these allowances on the carbon markets. In other words, they would use the value of these allowances in their product prices rather than the cost of obtaining these allowances. In many areas one can observe that value rather than costs drive economic decision making. The neoclassical economic literature shows that cost pass-through of freely obtained allowances is thus likely for profit-maximising firms. However, the question whether firms do this can only be answered empirically.

In the relatively scant empirical literature that has investigated this issue, three approaches have been chosen: ex-ante modelling, ex-post econometric analysis and surveys. Ex-ante modelling has been used by e.g. Vivid Economics (2014) and they make clear that cost pass-through of freely obtained allowances is likely for the majority of sectors they have been analysing. Such observations have been restated in empirical ex-post work. An overview by CE Delft and Öko Institut (2015) shows that cost pass-through has been revealed in various ex-post studies although the exact sectoral cost pass-through rates differ between studies and are highly method-dependent. A third branch of studies has investigated common practice at companies by conducting surveys. Warwick & Ng (2012), for example, conclude that practices with respect to valuation of freely obtained allowances vary among EU firms where some firms value them (in financial accounts) with their

opportunity costs, while others value them at nil value. However, as pointed out by CE Delft and Öko Institut (2015), the question is not if all firms adhere to opportunity cost pricing, the question is what competitors do if one firm raises prices because of opportunity cost pricing: do they follow the price in order to maximize profits, or do they ask a lower price to maximize market shares? Since the majority of firms, in questionnaires, regard themselves as price-takers instead of price-setters, it is more likely that they will follow eventually higher prices on product markets to obtain additional profits.

If opportunity costs are passed through in product prices, this may enhance the profitability of EU companies but come at the expanse of a potential loss in market shares since the products of EU manufacturers tend to become more expensive compared to foreign competitors from regions without carbon policies. It is important to notice that empirical work so far has not been capable to find evidence of such 'carbon leakage'. In an extensive analytical research study, Ecorys *et al.* (2013) were not able to find evidence of carbon leakage in the most energy-intensive sectors in the EU during Phase 1 and 2.

2.4.2 Quantitative Assessment

In the Impact Assessment accompanying the proposal for revision of the EU ETS (SWD(2015) 135 final) (EC, 2014), the European Commission has published a literature overview of available quantitative studies that have passed through the carbon costs. This literature review has later been further advanced in the study by CE Delft and Öko Institut (2015). Table 4 gives the results of both studies for selected sectors.

Table 4 Overview of the range of average expected cost pass-through in selected sectors from EC (2015) and new estimates in CE Delft and Öko Institut (2015)

Sector	Product	Literature overview EC (2015)*		New estimates Phase 2/3 (CE Delft & Oko, 2015)	
		Min	Max	Min	Max
Iron and steel	Flat products	60%	100%	55%	100%
	Long products	66%	80%		
Cement	Portland cement, white cement	35%	70%	90%	100%
	Total cement			20%	40%
	Clinker			35%	40%
Glass	Container glass	20%	50%		
	Glass fibres				
	Hollow and other glass	30%	80%	40%	100%
Refineries	Petrol	60%	120%	80%	95%
	Diesel	40%	70%	>100%	>100%
Petrochemicals	Plastics, PE, PVC, PS	25%	80%		
	PE, ethylene, butadiene, etc.			0%	>100%
Fertilisers	Fertiliser and nitrogen compounds	0%	75%	0%	>100%

Note: Minimum and maximum values have been determined as the average of minimum and maximum values found in the cited studies weighted by the number of products listed in the studies and our own interpretation of the quality of the estimates and assessment of the potential range.

From this table, and the additional literature overview given in CE Delft and Öko Institut (2015) we have calculated the following minimum and maximum cost pass-through ranges for the sectors taken into account in this study.

Table 5 **CPT rates used in this study**

		Minimum	Average	Maximum
06.10	Extraction of crude petroleum and gas	*40%*	*70%*	*100%*
19.10	Manufacture of coke oven products	*55%*	*75%*	*100%*
19.20	Refineries	40%	70%	100%
20.11	Industrial gases*	0%	0%	0%
20.13	Inorganic chemicals**	10%	24%	37%
20.14	Petrochemicals	15%	50%	100%
20.15	Fertilizers	10%	50%	100%
20.16	Manufacture of plastics	42%	70%	100%
23.11	Flat glass***	0%	40%	80%
23.13	Hollow glass 23.13	30%	55%	80%
23.14;	Other glass 23.14	24%	50%	80%
23.32	*Manufacturing of bricks*^^	*30%*	*40%*	*80%*
23.51	Cement	20%	39%	58%^
23.52	Lime***	0%	40%	80%
24.10	Iron and Steel	55%	75%	100%

Notes: * Nowhere estimated in empirical work; ** Only estimated ex-post in one study for two different products; *** Only estimated in one ex-ante study which has been taken here as max. value. ^ Maximum value calculated as average from maximum values literature review and new empirical estimates for a range of products. ^^Only estimated in two studies with three results, as average value is now taken the mean value.

A few observations should be made to explain this table. For one sector, chemical industrial gases, we could not find any literature that has quantitatively estimated the amount of cost pass-through for this sector. For that reason we have set the cost pass-through for the entire sector equivalent to zero. Also for the extraction of crude petroleum and gas and the manufacture of coke oven products, there were no studies that empirically estimated the amount of cost pass-through. However, the analysis in CE Delft and Öko Institut (2015) of the iron and steel and refineries sectors showed that it is likely that emissions earlier in the chain have been passed through, otherwise the cost pass-through ranges of the iron and steel and refineries sectors would be out of range and far above what could be expected on the basis of carbon emissions of these sectors alone. Therefore, we have set the cost pass-through of the extraction of crude petroleum and gas as equivalent to that of the refineries, and for the manufacture of coke oven products equivalent to that of the iron and steel sectors.

For petrochemicals and fertilizer sector, the new empirical evidence has listed that in some cases the null hypothesis of no cost pass-through could not be rejected. Therefore, the minimum values have been slightly lowered compared to those reported in the IA of the EC (2015).

2.4.3 Results

The additional profits from passing through the costs into product prices have been calculated in a similar way as was done in the earlier study (CE Delft, 2016) and was calculated with the minimum and average variant only for the top-15 sectors under investigation for the years 2008-2015. For the total of 20 countries, the additional profits mounted to over 16.7 billion euro in the minimum variant between 2008-2015. If we assumed *average* cost pass-through rates, the total additional profits would increase to 29.1 billion euros between 2008-2015.

One should notice that this calculation does not include the potential loss in market share from higher EU product prices. As explained above, existing ex-post research (Ecorys *et al.*, 2013) has not been capable of finding empirical evidence of a loss in market shares during Phase 1 and 2. As more and more countries adhere to carbon pricing, it is unlikely that this situation has changed during Phase 3 of the EU ETS. However, if one wants to be prudent on the total profits from passing through the carbon costs, it would be safer to take the minimum values here rather than the average values as to compensate for the loss in profitability due to an alleged loss in market shares.

Table 6 gives the minimum and average cost pass-through profits in the 20 countries chosen. This table evidences that the profits from passing through the costs have been mounting to over 3.5 billion euros in German industry in the minimum variant.

Table 6 **Total profits in mio euros between 2008-2015 from passing through part of the opportunity costs of freely obtained allowances**

	Minimum CPT	Average CPT
AT	708	1074
BE	774	1486
CZ	501	866
DE	3513	6062
DK	136	244
ES	1283	2352
FI	392	623
FR	1893	3303
GB	2223	3771
GR	330	597
HU	166	315
IE	53	107
IT	1880	3332
LU	23	45
NL	905	1680
PL	768	1377
PT	224	430
SE	357	602
SI	24	44
SK	514	794
End total	16667	29105

In Chapter 3 we will in more detail outline the cost pass-through calculations for the various sectors chosen.

3 Results at the sectoral and company level

3.1 Introduction

In this chapter we will present the total additional profits for sectors and companies between 2008-2015. For each of the 20 countries we will present calculations at the level of sectors, and at the level of individual companies. Since it is very time consuming to allocate installations in the EU ETS Registry, we will only present the top-5 companies in the respective countries.
The companies have been selected on their magnitude of additional profits gained from overallocation of allowances: these additional profits also determine their rank in the tables.

The tables are furthermore presented below without further comments.

3.2 Individual country results

Below we will see the overview of the additional profits in each country, both from the sectoral perspective as from the company perspective.

3.2.1 Austria

The overview of the total additional profits in Austria can be seen in Table 7.

Table 7 Additional profits (constant millions €) per sector, Austria, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	-22,8	4,3	97,6	79,1	170,7	152,3
20.11	Industrial gasses	-	-	-	-	-	-
20.13	Inorganic chemicals	3,3	0,1	0,2	3,5	0,4	3,8
20.14	Petrochemicals	0,6	-	4,2	4,8	12,6	13,2
20.15	Fertilizers	9,0	0,4	3,7	13,0	12,4	21,7
20.16	Manufacture of plastics in primary form	-0,4	0,0	1,4	1,0	2,3	1,9
23.11	Flat glass	-	-	-	-	-	-
23.13	Hollow glass	-1,5	0,2	4,5	3,3	8,3	7,0
23.14	Other glass	0,2	0,0	0,2	0,3	0,3	0,5
23.32	Manufacturing of bricks	6,5	0,3	6,7	13,5	9,0	15,8
23.51	Cement	11,4	3,8	47,3	62,4	92,2	107,3
23.52	Lime	5,1	1,4	-	6,5	26,4	32,9
24.10	Iron and steel	-329,1	4,2	541,6	216,7	738,5	413,6
	Total	-317,7	14,6	707,3	404,1	1.073,1	770,0

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Austria the top-5 sectors can be seen in Table 8.

Table 8 Top-5 companies CO_2 Overallocation and additional profits, Austria, 2008-2015

NACE	Company	CO_2 Over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Wietersdorfer & Peggauer zementwerke gmbh	1.040	9,0	0,61	8,7	18,4	17,0	26,6
20.15	Borealis Polyolefine GmbH	943	9,0	0,37	3,7	13,0	12,4	21,7
23.51	Kirchdorfer Zementwerk Hofman GmbH	522	4,6	0,50	3,8	8,9	7,4	12,5
23.51	Schretter & Cie GmbH & Co KG	287	3,5	0,47	3,0	6,9	5,8	9,8
20.13	Solvay SA	257	3,3	0,08	0,2	3,5	0,4	3,8

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.2 Belgium

Table 9 Additional profits (constant millions €) per sector, Belgium, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	1,7	0,1	4,4	6,2	6,0	7,8
19.20	Refineries	9,7	-	216,1	225,8	378,1	387,8
20.11	Industrial gasses	20,2	0,2	-	20,4	-	20,4
20.13	Inorganic chemicals	9,7	0,4	2,5	12,5	5,8	15,9
20.14	Petrochemicals	120,4	1,9	97,8	220,1	293,5	415,8
20.15	Fertilizers	1,8	0,1	5,3	7,3	17,8	19,7
20.16	Manufacture of plastics in primary form	9,7	0,4	23,4	33,6	39,0	49,2
23.11	Flat glass	18,8	0,8	-	19,6	27,3	47,0
23.13	Hollow glass	1,4	0,1	2,7	4,3	5,0	6,5
23.14	Other glass	2,2	0,1	2,4	4,7	4,9	7,2
23.32	Manufacturing of bricks	23,5	0,5	13,8	37,8	18,4	42,4
23.51	Cement	47,9	2,4	74,6	124,9	145,4	195,8
23.52	Lime	39,6	2,2	-	41,8	93,4	135,2
24.10	Iron and steel	302,4	14,3	330,1	646,8	450,2	766,8
	Total	609,1	23,5	773,1	1.405,8	1.485,0	2.117,6

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Belgium the top-5 companies can be seen in Table 10.

Table 10 Top-5 companies CO_2 Overallocation and additional profits, Belgium, 2008-2015

NACE	Company	CO_2 Over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
24.10	Carsid	13.801	164,9	0,45	29,2	194,5	39,8	205,1
24.10	ArcelorMittal	10.751	134,1	12,87	266,0	413,0	362,8	509,8
20.14	BASF	3.950	39,2	-	40,0	79,2	120,0	159,1
23.51	CBR	1.670	20,1	0,81	31,0	52,0	60,5	81,5
23.52	Carmeuse	1.533	19,0	0,78	-	19,8	27,2	47,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.3 Czech Republic

Table 11 Additional profits (constant millions €) per sector, Czech Republic, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	7,8	0,2	7,5	15,6	10,3	18,3
19.20	Refineries	4,1	1,5	35,0	40,7	61,3	67,0
20.11	Industrial gasses	-2,1	0,3	-	-1,9	-	-1,9
20.13	Inorganic chemicals	2,3	0,0	0,2	2,5	0,5	2,8
20.14	Petrochemicals	19,5	1,7	47,4	68,7	142,3	163,5
20.15	Fertilizers	-5,5	0,9	9,1	4,5	30,2	25,7
20.16	Manufacture of plastics in primary form	0,1	-	0,0	0,2	0,1	0,2
23.11	Flat glass	12,1	0,8	-	12,9	9,9	22,9
23.13	Hollow glass	4,0	0,4	6,0	10,3	10,9	15,3
23.14	Other glass	1,7	0,2	2,0	3,9	4,1	6,0
23.32	Manufacturing of bricks	14,2	0,3	6,0	20,5	8,0	22,5
23.51	Cement	22,6	2,7	43,4	68,7	84,7	110,0
23.52	Lime	4,6	1,5	-	6,1	33,2	39,3
24.10	Iron and steel	46,9	4,8	343,8	395,5	468,8	520,6
	Total	132,4	15,3	500,5	648,2	864,4	1.012,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Czech Republic the top-5 companies can be seen in Table 12.

Table 12 Top-5 companies CO_2 Overallocation and additional profits, Czech Republic, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	CPT Avg (constant millions €)	Total Avg (constant millions €)
24.10	ArcelorMittal	8.467	82,2	1,17	195,8	279,2	267,0	350,4
20.14	UNIPETROL RPA, s.r.o.	-973	18,0	1,30	38,1	57,3	114,2	133,4
23.11	AGC	1.035	12,1	0,81	-	12,9	9,9	22,9
23.51	Holcim Ltd	740	8,2	0,63	7,7	16,6	15,1	24,0
19.10	OKK Koksovny A.S.	794	7,8	0,22	7,5	15,6	10,3	18,3

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.4 Denmark

Table 13 Additional profits (constant millions €) per sector, Denmark, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	25,6	0,4	64,1	90,0	112,2	138,1
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	-4,5	0,5	32,0	28,1	56,0	52,1
20.11	Industrial gasses	-	-	-	-	-	-
20.13	Inorganic chemicals	-	-	-	-	-	-
20.14	Petrochemicals	0,2	0,0	0,2	0,4	0,7	0,9
20.15	Fertilizers	-	-	-	-	-	-
20.16	Manufacture of plastics in primary form	-	-	-	-	-	-
23.11	Flat glass	-	-	-	-	-	-
23.13	Hollow glass	0,2	-	1,5	1,7	2,7	2,9
23.14	Other glass	0,1	0,0	0,2	0,3	0,4	0,5
23.32	Manufacturing of bricks	2,7	0,1	2,9	5,8	3,8	6,7
23.51	Cement	61,2	1,9	30,8	94,0	60,1	123,3
23.52	Lime	2,7	0,1	-	2,8	2,1	4,9
24.10	Iron and steel	-0,1	-	3,9	3,8	5,4	5,2
	Total	88,2	3,1	135,7	226,9	243,4	334,7

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Denmark the top-5 companies can be seen in Table 14.

Table 14 Top-5 companies CO_2 Overallocation and additional profits, Denmark, 2008-2015

NACE	Company	CO_2 Over-allocation (kiloton)	Over-Allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Aalborg Portland A/S	5.333	61,2	1,91	30,8	94,0	60,1	123,3
06.10	Maersk Oil og Gas	1.730	20,9	0,36	53,5	74,7	93,6	114,8
06.10	DONG Energy A/S	365	5,9	-	4,1	10,0	7,2	13,1
23.52	Lhoist	225	2,7	0,12	-	2,8	2,1	4,9
19.20	Shell	40	1,2	-	14,4	15,6	25,1	26,3

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.5 Finland

Table 15 Additional profits (constant millions €) per sector, Finland, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	-20,3	0,0	115,4	95,1	202,0	181,7
20.11	Industrial gasses	2,8	-	-	2,8	-	2,8
20.13	Inorganic chemicals	0,2	0,0	0,2	0,4	0,4	0,6
20.14	Petrochemicals	-1,1	0,4	8,1	7,3	24,2	23,4
20.15	Fertilizers	1,4	-	0,5	2,0	1,8	3,2
20.16	Manufacture of plastics in primary form	-	-	-	-	-	-
23.11	Flat glass	-	-	-	-	-	-
23.13	Hollow glass	0,5	-	0,2	0,7	0,5	0,9
23.14	Other glass	1,5	0,0	0,7	2,3	1,5	3,1
23.32	Manufacturing of bricks	0,9	0,0	0,6	1,5	0,8	1,7
23.51	Cement	30,8	0,7	14,5	46,1	28,3	59,8
23.52	Lime	12,4	1,0	-	13,5	21,3	34,7
24.10	Iron and steel	-27,0	5,1	250,8	228,9	342,0	320,1
	Total	2,1	7,3	391,0	400,5	622,6	632,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Finland the top-5 companies can be seen in Table 16.

Table 16 Top-5 companies CO_2 Overallocation and additional profits, Finland, 2008-2015

NACE	Company	CO_2 Over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Finnsementti Oy	2.668	30,8	0,71	14,5	46,1	28,3	59,8
24.10	Outokumpu OYJ	853	16,3	0,18	28,2	44,7	38,5	55,0
23.52	Nordkalk Oy Ab	1.108	13,3	1,04	-	14,3	16,6	31,0
24.10	Fnsteel	1.133	10,4	0,55	27,0	38,0	36,8	47,8
20.11	Kemira	470	2,8	-	-	2,8	-	2,8

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.6 France

Table 17 Additional profits (constant millions €) per sector, France, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	12,2	0,1	7,0	19,3	12,3	24,6
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	44,5	16,0	523,2	583,6	915,6	976,0
20.11	Industrial gasses	-1,0	-	-	-1,0	-	-1,0
20.13	Inorganic chemicals	27,7	3,4	20,2	51,4	47,5	78,7
20.14	Petrochemicals	97,7	7,1	131,3	236,1	393,9	498,7
20.15	Fertilizers	2,1	-	9,2	11,3	30,6	32,8
20.16	Manufacture of plastics in primary form	3,2	0,2	5,0	8,4	8,4	11,8
23.11	Flat glass	11,5	1,9		13,4	24,6	38,0
23.13	Hollow glass	33,8	5,0	54,2	92,9	99,3	138,1
23.14	Other glass	3,6	0,5	3,3	7,4	7,0	11,0
23.32	Manufacturing of bricks	30,2	1,4	20,2	51,8	26,9	58,5
23.51	Cement	204,6	24,5	195,8	424,9	381,7	610,8
23.52	Lime	44,0	7,2	-	51,2	98,6	149,8
24.10	Iron and steel	-45,0	45,7	960,5	961,3	1.309,8	1.310,6
	Total	469,1	112,9	1.929,9	2.512,0	3.356,2	3.938,3

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In France the top-5 companies can be seen in Table 18.

Table 18 Top-5 companies CO_2 Overallocation and additional profits, France, 2008-2015

NACE	Company	CO_2 Over-allocation (kiloton)	Over-Allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Lafarge SA	9.415	97,0	12,53	78,3	187,8	152,7	262,2
23.51	Vicat	4.210	43,0	3,64	37,1	83,7	72,3	118,9
19.20	Compagnie Petrochimique de Berre	4.355	42,3	0,66	19,6	62,6	34,3	77,3
23.51	Heidelberg Cement	3.133	41,8	7,34	66,7	115,8	130,1	179,2
20.14	Total SA	2.389	38,2	-	28,3	66,5	84,9	123,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.7 Germany

Table 19 Additional profits (constant millions €) per sector, Germany, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-2,5	0,0	6,2	3,7	10,9	8,4
19.10	Manufacture of coke oven products	-107,9	3,0	171,2	66,2	233,4	128,4
19.20	Refineries	84,7	26,0	802,3	913,0	1.404,0	1.514,7
20.11	Industrial gasses	-1,7	-	-	-1,7	-	-1,7
20.13	Inorganic chemicals	10,9	3,2	15,7	29,7	36,8	50,9
20.14	Petrochemicals	101,3	14,6	200,2	316,1	600,7	716,6
20.15	Fertilizers	-3,6	1,5	28,4	26,3	94,7	92,6
20.16	Manufacture of plastics in primary form	-9,2	5,0	48,4	44,1	80,6	76,3
23.11	Flat glass	5,8	5,4	-	11,2	50,1	61,4
23.13	Hollow glass	7,0	3,0	45,3	55,3	83,0	93,0
23.14	Other glass	3,5	0,8	5,5	9,8	11,4	15,7
23.32	Manufacturing of bricks	37,4	2,9	32,7	73,0	43,6	83,9
23.51	Cement	69,8	34,1	342,0	445,9	666,9	770,9
23.52	Lime	119,1	23,6	-	142,7	269,7	412,4
24.10	Iron and steel	302,7	69,3	1.829,2	2.201,2	2.494,3	2.866,3
	Total	617,2	192,4	3.527,0	4.336,6	6.080,3	6.889,9

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Germany the top-5 companies can be seen in Table 20.

Table 20 Top-5 companies CO_2 Overallocation and additional profits, Germany, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
24.10	ArcellorMittal	27.443	351,8	18,36	199,2	569,4	271,7	641,8
24.10	Hüttenwerke Krupp Mannesmann GmbH	14.288	188,3	8,90	214,5	411,7	292,5	489,7
24.10	ROGESA Roheisen-gesellschaft Saar mbH	7.246	75,9	4,92	214,4	295,2	292,4	373,2
23.52	Rheinkalk GmbH	3.051	48,3	12,56	-	60,9	109,9	170,8
19.20	ConocoPhillips	3.503	42,2	0,10	12,3	54,6	21,6	63,8

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.8 Greece

Table 21 Additional profits (constant millions €) per sector, Greece, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	4,0	0,1	2,9	7,1	5,2	9,3
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	-37,6	6,0	150,4	118,8	263,2	231,6
20.11	Industrial gasses	-	-	-	-	-	-
20.13	Inorganic chemicals	0,0	-	0,0	0,1	0,1	0,1
20.14	Petrochemicals	-	-	-	-	-	-
20.15	Fertilizers	0,2	-	0,7	0,9	2,5	2,6
20.16	Manufacture of plastics in primary form	-	-	-	-	-	-
23.11	Flat glass	-	-	-	-	-	-
23.13	Hollow glass	0,6	-	1,2	1,8	2,2	2,8
23.14	Other glass	-	-	-	-	-	-
23.32	Manufacturing of bricks	38,6	0,3	6,9	45,8	9,2	48,1
23.51	Cement	273,0	11,8	120,6	405,4	235,2	520,0
23.52	Lime	36,0	0,6	-	36,6	14,6	51,2
24.10	Iron and steel	27,2	1,8	47,1	76,1	64,3	93,2
	Total	342,1	20,5	330,0	692,5	596,4	958,9

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Greece the top-5 companies can be seen in Table 22.

Table 22 Top-5 companies CO_2 Overallocation and additional profits, Greece, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Lafarge SA	16.886	189,1	6,42	57,1	252,6	111,3	306,8
23.51	Titan AE	6.370	71,6	4,90	57,5	133,9	112,0	188,5
23.51	Halyps Building Materials SA	1.252	11,7	0,46	6,1	18,2	11,8	23,9
23.52	CaO HELLAS Macedonian Lime SA	724	9,5	0,19	-	9,7	3,0	12,7
24.10	Larco GMMSA	436	7,7	1,05	33,9	42,6	46,2	54,9

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.9 Hungary

Table 23 Additional profits (constant millions €) per sector, Hungary, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	0,5	0,0	0,3	0,9	0,6	1,1
19.10	Manufacture of coke oven products	1,1	0,1	8,9	10,1	12,2	13,4
19.20	Refineries	-9,4	0,6	51,7	42,9	90,5	81,7
20.11	Industrial gasses	-0,4	-	-	-0,4	-	-0,4
20.13	Inorganic chemicals	1,9	-	1,4	3,4	3,4	5,3
20.14	Petrochemicals	5,1	0,6	20,1	25,8	60,2	65,9
20.15	Fertilizers	-1,5	0,0	2,4	0,9	8,0	6,5
20.16	Manufacture of plastics in primary form	2,0	0,1	2,9	5,0	4,8	6,9
23.11	Flat glass	1,5	0,3	-	1,7	4,5	6,3
23.13	Hollow glass	0,4	0,1	1,5	1,9	2,7	3,2
23.14	Other glass	0,2	-	0,1	0,2	0,1	0,3
23.32	Manufacturing of bricks	22,1	0,3	6,8	29,2	9,1	31,4
23.51	Cement	57,2	1,0	24,2	82,4	47,2	105,4
23.52	Lime	9,3	0,4	-	9,7	9,9	19,6
24.10	Iron and steel	-56,1	1,1	45,4	-9,6	61,9	6,9
	Total	33,8	4,6	165,7	204,1	315,1	353,4

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Hungary the top-5 companies can be seen in Table 24.

Table 24 Top-5 companies CO_2 Overallocation and additional profits, Hungary, 2008-2015

NACE	Company	CO_2 Over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	CPT Avg (constant millions €)	Total Avg (constant millions €)
23.51	Duna-Drava Cement Ltd	3.315	30,6	0,55	15,0	46,2	29,2	60,4
23.51	Holcim Ltd	2.285	24,8	0,48	7,7	33,0	15,0	40,3
23.32	Wienerberger AG	1.130	14,7	0,17	2,7	17,6	3,6	18,5
20.14	MOL Petrolkemia Zrt	189	5,3	0,55	18,9	24,8	56,8	62,7
23.52	Kalcinator Kft	435	4,9	0,11	-	5,0	2,1	7,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.10 Ireland

Table 25 Additional profits (constant millions €) per sector, Ireland, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	3,3	0,0	11,3	14,6	19,8	23,1
20.11	Industrial gasses	-	-	-	-	-	-
20.13	Inorganic chemicals	-	-	-	-	-	-
20.14	Petrochemicals	0,9	0,0	1,2	2,1	3,6	4,5
20.15	Fertilizers	-	-	-	-	-	-
20.16	Manufacture of plastics in primary form	-	-	-	-	-	-
23.11	Flat glass	-	-	-	-	-	-
23.13	Hollow glass	0,3	-	0,1	0,4	0,2	0,5
23.14	Other glass	-	-	-	-	-	-
23.32	Manufacturing of bricks	0,8	-	0,1	0,9	0,2	1,0
23.51	Cement	123,7	1,3	40,2	165,2	78,3	203,3
23.52	Lime	9,5	0,1	-	9,6	5,3	14,9
24.10	Iron and steel	-	-	-	-	-	-
	Total	138,5	1,5	52,9	192,9	107,3	247,3

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Ireland the top-5 companies can be seen in Table 26.

Table 26 Top-5 companies CO_2 Overallocation and additional profits, Ireland, 2008-2015

NACE	Company	CO_2 over-allocation kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	CRH Public Limited Company	8.000	90,0	-	21,7	111,8	42,3	132,4
23.51	Quinn Group Limited	2.186	23,2	1,31	12,0	36,5	23,3	47,9
23.51	Lagan	804	10,4	-	6,5	16,9	12,7	23,1
23.52	CRH Public Limited Company	572	7,7	0,08	-	7,8	4,5	12,2
19.20	Irving Oil Limited	180	3,3	0,03	11,3	14,6	19,8	23,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.11 Italy

Table 27 Additional profits (constant millions €) per sector, Italy, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-8,3	-	14,9	6,6	26,0	17,7
19.10	Manufacture of coke oven products	-0,8	0,2	6,6	5,9	9,0	8,3
19.20	Refineries	-428,2	9,6	751,8	333,2	1.315,6	897,0
20.11	Industrial gasses	0,5	0,0	-	0,5	-	0,5
20.13	Inorganic chemicals	19,0	0,5	5,5	24,9	12,8	32,3
20.14	Petrochemicals	126,5	1,2	74,1	201,8	222,4	350,1
20.15	Fertilizers	1,1	-	5,0	6,0	16,5	17,6
20.16	Manufacture of plastics in primary form	3,6	0,2	6,4	10,2	10,7	14,5
23.11	Flat glass	7,8	1,2	-	9,0	25,0	34,1
23.13	Hollow glass	-1,5	1,9	48,7	49,2	89,4	89,8
23.14	Other glass	3,7	0,2	1,7	5,5	3,4	7,3
23.32	Manufacturing of bricks	25,5	0,2	10,9	36,7	14,6	40,3
23.51	Cement	515,7	22,2	357,3	895,2	696,8	1.234,6
23.52	Lime	69,8	2,8	-	72,6	75,7	148,3
24.10	Iron and steel	8,1	13,0	596,2	617,3	813,1	834,1
	Total	342,3	53,2	1.879,1	2.274,6	3.331,0	3.726,5

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Italy the top-5 companies can be seen in Table 28.

Table 28 Top-5 companies CO_2 Overallocation and additional profits, Italy, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Italcementi	13.766	131,8	6,49	95,6	233,9	186,5	324,8
23.51	Buzzi Unicem	11.362	116,3	4,01	64,0	184,3	124,7	245,1
20.14	Versalis	7.690	92,1	-	60,9	153,0	182,7	274,8
23.51	Colacem	8.151	79,5	3,86	62,1	145,4	121,1	204,4
24.10	ILVA	11.840	49,8	6,26	419,5	475,6	572,1	628,2

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.12 Luxemburg

Table 29 Additional profits (constant millions €) per sector, Luxembourg , 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	-	-	-	-	-	-
20.11	Industrial gasses	-	-	-	-	-	-
20.13	Inorganic chemicals	-	-	-	-	-	-
20.14	Petrochemicals	-	-	-	-	-	-
20.15	Fertilizers	-	-	-	-	-	-
20.16	Manufacture of plastics in primary form	-	-	-	-	-	-
23.11	Flat glass	-0,4	0,5	-	0,1	7,9	8,0
23.13	Hollow glass	-	-	-	-	-	-
23.14	Other glass	-	-	-	-	-	-
23.32	Manufacturing of bricks	-	-	-	-	-	-
23.51	Cement	8,3	1,0	10,8	20,1	21,1	30,4
23.52	Lime	-	-	-	-	-	-
24.10	Iron and steel	4,8	0,6	11,8	17,2	16,1	21,5
	Total	12,7	2,1	22,6	37,4	45,1	59,8

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Luxembourg the top-4 companies can be seen in Table 30. Luxembourg has only 4 firms active in the chosen sectors that are regulated by the EU ETS.

Table 30 Top-5 companies CO_2 Overallocation and additional profits, Luxembourg, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Cimalux SA	0,6	8,3	1,0	10,8	20,1	21,1	30,4
24.10	ArcelorMittal	0,2	4,8	0,6	11,8	17,2	16,1	21,5
24.10	Primorec SA	0,0	0,0	0,0	0,0	0,0	0,0	0,0
23.11	Guardian Industries	-0,1	-0,4	0,5	0,0	0,1	7,9	8,0

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.13 Netherlands

Table 31 Additional profits (constant millions €) per sector, Netherlands, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	1,2	0,1	3,9	5,2	6,8	8,1
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	7,7	2,2	387,8	397,7	678,7	688,5
20.11	Industrial gasses	8,9	0,5	-	9,5	-	9,5
20.13	Inorganic chemicals	5,3	0,7	5,3	11,3	12,4	18,5
20.14	Petrochemicals	81,7	3,6	139,1	224,5	417,3	502,7
20.15	Fertilizers	20,2	0,1	20,4	40,7	68,1	88,4
20.16	Manufacture of plastics in primary form	2,6	0,7	16,3	19,5	27,2	30,4
23.11	Flat glass	-0,8	0,2	-	-0,5	3,2	2,7
23.13	Hollow glass	-0,4	0,3	10,6	10,5	19,4	19,3
23.14	Other glass	0,5	0,1	1,9	2,5	3,9	4,6
23.32	Manufacturing of bricks	5,6	0,3	11,6	17,5	15,4	21,3
23.51	Cement	14,8	0,2	9,6	24,6	18,7	33,7
23.52	Lime	-0,4	-	-	-0,4	0,3	-0,1
24.10	Iron and steel	15,2	19,5	297,9	332,5	406,2	440,8
	Total	162,2	28,6	904,3	1.095,1	1.677,6	1.868,4

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In the Netherlands the top-5 companies can be seen in Table 32.

Table 32 Top-5 companies CO_2 Overallocation and additional profits, Netherlands, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
19.20	SHELL Nederland Raffinaderij BV	997	28,7	-	156,2	184,9	273,4	302,1
24.10	Tata Steel IJmuiden BV	1.447	17,2	19,44	295,7	332,4	403,3	439,9
20.15	Yara Sluiskil BV	1.147	15,3	-	14,6	30,0	48,7	64,1
23.51	Enci BV	1.440	14,8	0,24	9,6	24,6	18,7	33,7
20.14	LyondellBasell Industries	1.323	7,9	-	0,0	8,0	0,1	8,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.14 Poland

Table 33 Additional profits (constant millions €) per sector, Poland, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	59,9	0,9	116,4	177,2	158,7	219,5
19.20	Refineries	11,2	2,2	116,7	130,1	204,1	217,6
20.11	Industrial gasses	-	-	-	-	-	-
20.13	Inorganic chemicals	12,5	0,0	1,6	14,2	3,7	16,3
20.14	Petrochemicals	22,0	1,4	26,0	49,4	78,1	101,4
20.15	Fertilizers	-32,2	-	32,9	0,8	109,7	77,6
20.16	Manufacture of plastics in primary form	0,3	-	0,3	0,7	0,6	0,9
23.11	Flat glass	7,6	0,9	-	8,4	17,4	25,8
23.13	Hollow glass	3,6	0,4	18,7	22,8	34,3	38,4
23.14	Other glass	0,5	0,1	1,0	1,6	2,1	2,7
23.32	Manufacturing of bricks	12,3	0,5	12,9	25,7	17,2	30,0
23.51	Cement	59,0	7,3	173,2	239,4	337,6	403,9
23.52	Lime	16,1	2,1	-	18,2	66,8	85,1
24.10	Iron and steel	-30,7	4,8	315,2	289,3	429,8	403,9
	Total	142,2	20,7	814,9	977,7	1.460,3	1.623,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Poland the top-5 companies can be seen in Table @@.

Table 34 Top-5 companies CO_2 Overallocation and additional profits, Poland, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
19.10	ArcelorMittal	2.832	31,4	-	67,3	98,8	91,8	123,2
23.51	CEMEX	2.019	22,4	0,59	25,5	48,5	49,7	72,7
23.51	Górażdże Cement S. A.	1.760	15,2	-	36,1	51,3	70,4	85,6
20.14	Polski Koncern Naftowy ORLEN SA	851	14,8	0,47	14,7	30,0	44,0	59,3
19.20	Polski Koncern Naftowy ORLEN SA	1.144	12,0	0,97	74,3	87,2	130,0	142,9

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.15 Portugal

Table 35 Additional profits (constant millions €) per sector, Portugal, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	8,3	-	101,7	110,0	178,0	186,3
20.11	Industrial gasses	-0,5	-	-	-0,5	-	-0,5
20.13	Inorganic chemicals	6,3	0,2	0,7	7,3	1,7	8,3
20.14	Petrochemicals	14,9	0,4	7,5	22,8	22,4	37,7
20.15	Fertilizers	2,0	0,3	0,9	3,2	3,1	5,3
20.16	Manufacture of plastics in primary form	1,1	0,1	1,7	2,9	2,8	4,1
23.11	Flat glass	2,6	-	-	2,6	0,9	3,5
23.13	Hollow glass	5,2	0,9	15,0	21,1	27,5	33,6
23.14	Other glass	-	-	-	-	-	-
23.32	Manufacturing of bricks	19,0	0,3	6,5	25,9	8,7	28,1
23.51	Cement	110,9	3,7	90,7	205,3	177,0	291,6
23.52	Lime	9,9	0,9	-	10,7	14,2	24,9
24.10	Iron and steel	13,6	0,7	8,7	23,0	11,9	26,2
	Total	193,4	7,4	233,5	434,3	448,1	648,9

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Portugal the top-5 companies can be seen in Table 36.

Table 36 Top-5 companies CO_2 Overallocation and additional profits, Portugal, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	CIMPOR	9.051	91,3	3,3	50	144,3	96,9	191,5
23.51	Secil	3.395	30,8	0,37	38,9	70,1	75,9	107,1
20.14	Repsol SA	1.609	18,6	0,38	6,6	25,6	19,8	38,8
19.20	Petróleos de Portugal - Petrogal SA	-1.249	15,2	-	99,2	114,3	173,4	188,6
24.10	SN Seixal Siderurgia Nacional SA	564	7,5	0,42	4,5	12,4	6,2	14,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.16 Slovakia

Table 37 Additional profits (constant millions €) per sector, Slovakia, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	29,2	-	49,1	78,3	85,9	115,1
20.11	Industrial gasses	-	-	-	-	-	-
20.13	Inorganic chemicals	-	-	-	-	-	-
20.14	Petrochemicals	8,4	0,2	7,5	16,1	22,5	31,2
20.15	Fertilizers	-2,4	0,1	3,6	1,4	12,2	9,9
20.16	Manufacture of plastics in primary form	-	-	-	-	-	-
23.11	Flat glass	-	-	-	-	-	-
23.13	Hollow glass	1,2	0,1	2,3	3,7	4,3	5,6
23.14	Other glass	1,8	-	1,0	2,8	2,1	3,9
23.32	Manufacturing of bricks	5,3	0,1	1,3	6,7	1,8	7,1
23.51	Cement	51,1	3,1	34,6	88,8	67,5	121,7
23.52	Lime	37,7	1,8	-	39,6	32,9	72,5
24.10	Iron and steel	89,7	8,1	413,7	511,5	564,1	661,9
	Total	222,1	13,5	513,2	748,8	793,2	1.028,8

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Slovakia the top-5 companies can be seen in Table 38.

Table 38 Top-5 companies CO_2 Overallocation and additional profits, Slovakia, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
24.10	U. S. Steel Košice sro	1.646	84,7	8,09	410,9	503,7	560,4	653,1
23.51	CRH	3.040	33,6	1,46	20,2	55,2	39,3	74,3
19.20	SLOVNAFT as	2.376	29,2	-	49,1	78,3	85,9	115,1
23.52	Carmeuse Slovakia sro	1.729	21,9	1,31	-	23,2	22,4	45,6
23.51	Považská cementáreň as	972	14,1	1,07	8,7	23,9	16,9	32,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.17 Slovenia

Table 39 Additional profits (constant millions €) per sector, Slovenia, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	-	-	-	-	-	-
20.11	Industrial gasses	1,6	0,1	-	1,7	-	1,7
20.13	Inorganic chemicals	0,2	0,0	0,2	0,4	0,5	0,7
20.14	Petrochemicals	-	-	-	-	-	-
20.15	Fertilizers	-	-	-	-	-	-
20.16	Manufacture of plastics in primary form	-0,0	-	0,3	0,3	0,6	0,5
23.11	Flat glass	-	-	-	-	-	-
23.13	Hollow glass	0,9	-	1,6	2,5	2,9	3,8
23.14	Other glass	0,2	0,0	0,2	0,5	0,5	0,7
23.32	Manufacturing of bricks	0,9	0,0	0,7	1,6	0,9	1,8
23.51	Cement	6,4	0,8	11,7	18,9	22,9	30,1
23.52	Lime	0,9	-	-	0,9	3,2	4,1
24.10	Iron and steel	-0,9	0,1	9,0	8,2	12,2	11,5
	Total	10,3	1,0	23,8	35,0	43,7	55,0

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Slovenia the top-5 companies can be seen in Table 40.

Table 40 Top-5 companies CO_2 Overallocation and additional profits, Slovenia, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	Lafarge SA	782	7,7	0,42	3,3	11,5	6,5	14,6
20.11	Nafta Strojna	163	1,6	0,07	-	1,7	-	1,7
23.13	STEKLARNA HRASTNIK DD	59	0,7	-	1,3	2,0	2,4	3,1
23.52	Opekarna	35	0,5	-	-	0,5	0,4	0,9
23.52	IGM Zagorje	122	0,4	-	-	0,4	2,8	3,2

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.18 Spain

Table 41 Additional profits (constant millions €) per sector, Spain, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	3,0	0,1	2,5	5,6	3,4	6,5
19.20	Refineries	133,1	9,5	473,3	615,9	828,3	970,9
20.11	Industrial gasses	-2,5	-	-	-2,5	-	-2,5
20.13	Inorganic chemicals	7,3	0,9	9,1	17,3	21,3	29,5
20.14	Petrochemicals	33,8	2,1	53,9	89,8	161,7	197,6
20.15	Fertilizers	-13,6	0,6	18,0	5,0	60,0	47,0
20.16	Manufacture of plastics in primary form	9,8	0,1	5,4	15,3	9,0	18,9
23.11	Flat glass	10,7	1,0	-	11,8	18,9	30,6
23.13	Hollow glass	8,6	1,3	28,4	38,3	52,1	62,0
23.14	Other glass	2,8	0,1	1,0	3,8	2,0	4,9
23.32	Manufacturing of bricks	176,6	1,9	39,4	217,9	52,5	231,0
23.51	Cement	797,8	16,8	309,5	1.124,1	603,5	1.418,1
23.52	Lime	28,0	1,8	-	29,8	72,0	101,8
24.10	Iron and steel	249,8	13,8	341,0	604,6	465,1	728,7
	Total	1.445,2	49,9	1.281,5	2.776,6	2.349,8	3.845,0

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Spain the top-5 companies can be seen in Table 42.

Table 42 Top-5 companies CO_2 Overallocation and additional profits, Spain, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-Allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
23.51	CEMEX	23.477	273,5	2,72	63,3	339,5	123,5	399,7
24.10	Arcelormittal	17.446	224,4	12,52	270,3	507,2	368,6	605,5
23.51	Cementos Portland Valderrivas SA	11.307	125,4	1,77	42,6	169,8	83,1	210,3
23.51	Lafarge SA	8.967	93,6	3,81	32,0	129,4	62,4	159,8
23.51	Holcim Ltd	6.743	84,5	0,07	33,7	118,2	65,6	150,2

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.19 Sweden

Table 43 Additional profits (constant millions €) per sector, Sweden, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	-	-	-	-	-	-
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	16,0	3,0	102,4	121,4	179,2	198,2
20.11	Industrial gasses	2,7	0,1	-	2,9	-	2,9
20.13	Inorganic chemicals	3,2	0,0	0,9	4,1	2,2	5,4
20.14	Petrochemicals	22,9	0,8	12,7	36,4	38,0	61,7
20.15	Fertilizers	0,6	-	0,1	0,7	0,4	1,0
20.16	Manufacture of plastics in primary form	3,1	0,1	2,4	5,6	4,1	7,3
23.11	Flat glass	0,3	0,2	-	0,4	4,3	4,7
23.13	Hollow glass	2,0	-	1,7	3,7	3,0	5,1
23.14	Other glass	0,1	0,1	0,5	0,7	1,1	1,2
23.32	Manufacturing of bricks	-0,0	0,0	0,2	0,2	0,3	0,3
23.51	Cement	14,7	1,0	37,9	53,5	73,9	89,5
23.52	Lime	15,3	0,7	-	16,1	25,1	41,1
24.10	Iron and steel	184,0	9,4	198,2	391,6	270,3	463,7
	Total	264,8	15,4	357,1	637,3	601,9	882,1

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In Sweden the top-5 companies can be seen in Table @@.

Table 44 Top-5 companies CO_2 Overallocation and additional profits, Sweden, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions €)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
24.10	SSAB AB	16.967	193,9	8,16	161,7	363,7	220,5	422,5
20.14	Borealis AB	1.205	18,5	0,75	10,9	30,1	32,6	51,8
23.51	Cementa AB	389	14,3	0,97	37,9	53,2	73,9	89,2
19.20	Preem AB	830	12,2	1,69	78,6	92,5	137,6	151,5
23.52	SMA Svenska Mineral AB	705	8,7	-	-	8,7	8,1	16,8

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

3.2.20 United Kingdom

Table 45 Additional profits (constant millions €) per sector, United Kingdom, 2008-2015

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	*CPT Avg*	*Total Avg*
06.10	Extraction of crude oil and gas	23,7	11,7	607,6	643,0	1.063,3	1.098,7
19.10	Manufacture of coke oven products	0,2	0,0	2,2	2,5	3,0	3,3
19.20	Refineries	103,9	4,5	543,7	652,1	951,5	1.059,9
20.11	Industrial gasses	-0,8	-	-	-0,8	-	-0,8
20.13	Inorganic chemicals	15,8	0,2	2,3	18,3	5,5	21,5
20.14	Petrochemicals	118,9	5,9	69,6	194,4	208,8	333,6
20.15	Fertilizers	9,5	0,1	7,2	16,8	24,1	33,7
20.16	Manufacture of plastics in primary form	0,9	0,2	5,3	6,4	8,9	10,0
23.11	Flat glass	19,7	1,0	-	20,7	19,2	39,9
23.13	Hollow glass	9,9	0,6	28,7	39,3	52,7	63,2
23.14	Other glass	7,8	0,1	2,6	10,5	5,3	13,2
23.32	Manufacturing of bricks	37,0	1,0	19,0	57,0	25,4	63,3
23.51	Cement	248,3	8,2	114,1	370,6	222,4	478,9
23.52	Lime	83,6	3,7	-	87,3	61,8	149,1
24.10	Iron and steel	28,7	23,1	819,7	871,6	1.117,8	1.169,7
	Total	707,2	60,4	2.222,1	2.989,7	3.769,6	4.537,2

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

In United Kingdom the top-5 companies can be seen in Table 46.

Table 46 Top-5 companies CO_2 Overallocation and additional profits, United Kingdom, 2008-2015

NACE	Company	CO_2 over-allocation (kiloton)	Over-allocation (constant millions €)	CERs (constant millions €)	CPT Min (constant millions €)	Total Min (constant millions€)	*CPT Avg (constant millions €)*	*Total Avg (constant millions €)*
24.10	Tata Steel UK Limited	4.866	105,2	21,82	743,1	870,1	1.013,3	1.140,4
23.51	Heidelberg Cement	8.232	103,6	1,05	27,1	131,8	52,9	157,5
23.51	Lafarge SA	7.005	100,5	4,98	43,3	148,7	84,4	189,9
20.14	SembCorp Utilities (UK) Limited	2.954	49,4	2,35	14,7	66,4	44,0	95,7
19.20	Phillips 66 Limited	2.984	37,2	0,25	66,3	103,8	116,0	153,5

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

Country	Verified	Allocated	O.w. waste gas transfers	Additional profits
	$MiotCO_2$			MioEur
AT	151.0	148.2	20.0	-226.3
BE	219.8	299.1	23.2	697.7
CZ	124.3	152.0	11.9	194.3
DE	916.3	1,081.9	100.8	1121.3
DK	42.8	51.7	0.0	110.1
ES	407.0	550.8	12.3	1672.5
FI	96.1	115.6	9.2	113.8
FR	507.3	603.1	30.4	817.6
GB	520.9	617.7	36.5	1,010.0
GR	92.4	120.3	0.0	359.4
HU	51.8	64.3	5.6	54.3
IE	34.0	46.8	0.0	162.9
IT	504.8	606.7	42.1	519.3
NL	254.8	304.5	32.8	236.2
PL	267.8	303.6	18.9	266.0
PT	74.4	92.5	0.0	227.3
SE	92.2	138.4	10.4	387.8
SI	12.4	14.3	0.0	15.1
SK	104.7	329.5	2.6	341.4

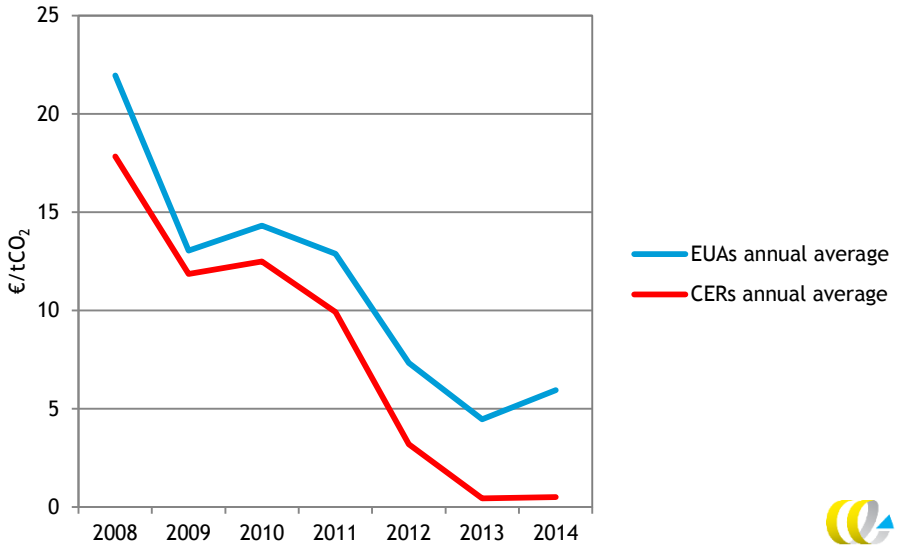
Sources: EUTL, IEA, EEX, own calculations.

3.3 Conversion of CERS to EUAs

3.3.1 Mechanisms

Industrial companies have not only profited from the overallocation. One additional source of revenue was provided by the EU ETS directive by allowing companies to hand in a limited amount of CERs for compliance.[9] As CERs were normally cheaper than EUAs, companies received an additional profit as they received EUAs for free and used CERs for compliance (see Figure 1 of the relative annual price difference between CERS and EUAs).

Figure 1 **Average annual prices of EUAs and CERs, 2008-2014**



Note: Own calculations based on ECX. With respect to CER, emission prices are based on the Futures contract (Futures are traded on the Intercontinental Exchange).

Up to 2012 companies could hand in CERs for compliance and this was recorded in the CITL/EUTL. Since 2013, CER/ERUs no longer count as compliance units within the EU ETS and need to be exchanged prior to compliance into EUAs. The extent to which that is feasible has been laid out in Commission Regulation No 1123/2013 (EC, 2013a). From 2013 and on, no information is provided in the EUTL regarding the surrendered ERU's and CER's. Therefore we did not calculate an additional value to this. We notice however, that in theory, an additional value could be calculated in future work.

[9] Article 11a of Directive 2003/87/EC (EC, 2003) provides for the use of certified emission reductions and emission reduction units from project activities before the entry into force of an international agreement on climate change, by setting up the possibility for operators to exchange such units against allowances. Directive 2004/101/EC (EC, 2004) regulated this in more detail. Commission Regulation 550/2011 of 7 June (EC, 2011) applied restrictions to the use of CERS from projects involving industrial gases.

3.3.2 Calculation

The general formula for assessing the additional profits from conversion of CERs has been calculated as:

$$Add.Profits\ Conversion_{i,j,t} = SE\_cer_{i,j,t} * (P_{EUA,t} - P_{CER,t})$$

Where SE_cer = surrendered CERs for compliance, P_{EUA} is the price for an emission allowances in the ETS, P_{CER} is the international price for CERs and subscripts i, j and t stand for company, sector and time {2008-2012] respectively. For the years 2013 and 2014 no additional profits from conversion have been calculated. Please also notice that we have not taken into account eventual profits from conversion of ERU's.

3.3.3 Results

The value of using CDM credits for compliance in the EU ETS has been calculated by us only for the top-15 sectors in the 19 countries under investigation for the years 2008-2012. In total, the additional profits mounted to over 630 million euro between 2008-2012. In absolute terms, most of the profits were generated in Germany, which gained 187 million euro from using cheaper CERs for compliance. In relative terms, industry in France profited most from using CERs for compliance.
French industry was capable of generating revenue equivalent to 25 eurocents per t/CO_2 from using CERs for compliance.

Although we have not calculated the exact amount of additional profits from converting CDM/JIs for 2013/14, the analysis in Annex A reveals that this source of income even increase in more recent years although quantitative information is not available at present.

3.4 Cost pass-through

3.4.1 General mechanism

Cost pass-through has been a heavily debated subject in the context of the EU ETS. The discussion refers to the question to what extent participants in the EU ETS have forwarded the opportunity costs of the freely obtained allowances forward in product prices. Many installations in the ETS receive all, or the majority, of their allowances for free. Companies use these allowances for compliances. However, they could also sell these allowances on the carbon exchange market. Economic theory predicts that companies would use these allowances up to the point where the marginal benefit of a unit additional production equals the marginal benefit of selling these allowances on the carbon markets. In other words, they would use the value of these allowances in their product prices rather than the cost of obtaining these allowances.
In many areas one can observe that value rather than costs drive economic decision making. The neoclassical economic literature shows that cost pass-through of freely obtained allowances is thus likely for profit-maximising firms. However, the question whether firms do this can only be answered empirically.

In the relatively scant empirical literature that has investigated this issue, three approaches have been chosen: ex-ante modelling, ex-post econometric analysis and surveys. Ex-ante modelling has been used by e.g. Vivid Economics (2014) and they make clear that cost pass-through of freely obtained allowances is likely for the majority of sectors they have been analysing. Such observations have been restated in empirical ex-post work. An overview by CE Delft and Öko Institut (2015) shows that cost pass-through has been

revealed in various ex-post studies although the exact sectoral cost pass-through rates differ between studies and are highly method-dependent. A third branch of studies has investigated common practice at companies by conducting surveys. Warwick & Ng (2012), for example, conclude that practices with respect to valuation of freely obtained allowances vary among EU firms where some firms value them (in financial accounts) with their opportunity costs, while others value them at nil value. However, as pointed out by CE Delft and Öko Institut (2015), the question is not if all firms adhere to opportunity cost pricing, the question is what competitors do if one firm raises prices because of opportunity cost pricing: do they follow the price in order to maximize profits, or do they ask a lower price to maximize market shares? Since the majority of firms, in questionnaires, regard themselves as price-takers instead of price-setters, it is more likely that they will follow eventually higher prices on product markets to obtain additional profits.

If opportunity costs are passed through in product prices, this may enhance the profitability of EU companies but come at the expanse of a potential loss in market shares since the products of EU manufacturers tend to become more expensive compared to foreign competitors from regions without carbon policies. It is important to notice that empirical work so far has not been capable to find evidence of such 'carbon leakage'. In an extensive analytical research study, Ecorys *et al*. (2013) were not able to find evidence of carbon leakage in the most energy-intensive sectors in the EU during Phase 1 and 2.

3.4.2 Quantitative Assessment

In the Impact Assessment accompanying the proposal for revision of the EU ETS (SWD(2015) 135 final) (EC, 2014), the European Commission has published a literature overview of available quantitative studies that have passed through the carbon costs. This literature review has later been further advanced in the study by CE Delft and Öko Institut (2015) on cost pass-through.
The EC literature review gives the following indicative values for cost pass-through.

Table 47 Overview of the range of average expected cost pass-through in selected sectors from literature according to the IA of the EC

Sector	Product	Minimum	Maximum	*# of studies*	Estimated in:
Iron and steel sector	Flat products	60%	100%	3	McKinsey(2006) Vivid Economics (2014) CE Delft (2010)
	Long products	66%	80%	2	McKinsey(2006) Vivid Economics (2014)
Cement	Portland cement, white cement	35%	70%	4	McKinsey (2006) Vivid Economics (2014) Walker (2008) Alexeevi-Talebi (2010)
Glass	Container glass	20%	50%	2	Vivid Economics (2014) Oberndorfer (2010)
	Hollow and other glass	30%	80%	3	Vivid Economics (2014) Oberndorfer (2010) Alexeevi-Talebi (2010)
Refineries	Petrol	60%	120%	5	McKinsey(2006) Vivid Economics (2014) CE Delft (2010) Alexeevi-Talebi (2011) Oberndorfer (2010)
	Diesel	40%	70%	3	McKinsey (2006) Vivid Economics (2014) CE Delft (2010) Oberndorfer (2010)
Petrochemicals	Plastics, PE, PVC, PS	25%	80%	3	CE Delft (2010) Alexeevi-Talebi (2010) Oberndorfer (2010)
Fertilizers	Fertilizer and nitrogen compounds	0%	75%	2	Alexeevi-Talebi (2010) Oberndorfer (2010)

Note: Minimum and maximum values have been determined as the average of minimum and maximum values found in the cited studies weighted by the number of products listed in the studies and our own interpretation of the quality of the estimates and assessment of the potential range.

In the report of CE Delft and Öko Institut (2015), this literature review is revised and updated with own estimations for Phase 2/3.
Table 48 gives these results.

Table 48 Overview of the range of average expected cost pass-through in selected sectors from CE Delft and Öko Institut (2015)

Sector	Product	Revised literature overview		New estimates Phase 2/3 (2015 EC Study)	
		Min	Max	Min	Max
Iron and steel	Flat products	60%	100%	55%	100%
	Long products	66%	80%		
Cement	Portland cement, white cement	30%	50%	90%	100%
	Total cement			20%	40%
	Clinker			35%	40%
Glass	Container glass	0%	50%		
	Glass fibres				
	Hollow and other glass	30%	60%	40%	100%
Refineries	Petrol	50%	>100%	80%	95%
	Diesel	40%	>100%	>100%	>100%
Petrochemicals	Plastics, PE, PVC, PS	25%	80%		
	PE, ethylene, butadiene, etc.			0%	>100%
Fertilisers	Fertiliser and nitrogen compounds	15%	75%	0%	>100%

From this table, and the earlier tables in de CE Delft and Öko Institut (2015) we have calculated the following minimum and maximum cost pass-through ranges for the sectors taken into account in this study.

Table 49 CPT rates used in this study

		Minimum	Average	Maximum
06.10	Extraction of crude petroleum and gas	*40%*	*70%*	*100%*
19.10	Manufacture of coke oven products	*55%*	*75%*	*100%*
19.20	Refineries	40%	70%	100%
20.11	Industrial gases*	0%	0%	0%
20.13	Inorganic chemicals**	10%	24%	37%
20.14	Petrochemicals	15%	50%	100%
20.15	Fertilizers	10%	50%	100%
20.16	Manufacture of plastics	42%	70%	100%
23.11	Flat glass***	0%	40%	80%
23.13	Hollow glass 23.13;	30%	55%	80%
23.14;	Other glass 23.14;	24%	50%	80%
23.32	*Manufacturing of bricks*^^	*30%*	*40%*	*80%*
23.51	Cement	20%	39%	58%^
23.52	Lime***	0%	40%	80%
24.10	Iron and Steel	55%	75%	100%

Notes: * Nowhere estimated in empirical work; ** Only estimated ex-post in one study for two different products; *** Only estimated in one ex-ante study which has been taken here as max. value. ^ Maximum value calculated as average from maximum values literature review and new empirical estimates for a range of products. ^^Only estimated in two studies with three results, as average value is now taken the mean value.

A few observations should be made to explain this table. For one sector, chemical industrial gases, we could not find any literature that has quantitatively estimated the amount of cost pass-through for this sector. For that reason we have set the cost pass-through for the entire sector equivalent to zero. Also for the extraction of crude petroleum and gas and the manufacture of coke oven products, there were no studies that empirically estimated the amount of cost pass-through. However, the analysis in CE Delft and Öko Institut (2015) of the iron and steel and refineries sectors showed that it is likely that emissions earlier in the chain have been passed through, otherwise the cost pass-through ranges of the iron and steel and refineries sectors would be out of range and far above what could be expected on the basis of carbon emissions of these sectors alone. Therefore, we have set the cost pass-through of the extraction of crude petroleum and gas as equivalent to that of the refineries, and for the manufacture of coke oven products equivalent to that of the iron and steel sectors.

For petrochemicals and fertilizer sector, the new empirical evidence has listed that in some cases the null hypothesis of no cost pass-through could not be rejected. Therefore, the minimum values have been slightly lowered compared to those reported in the IA of the EC (2015).

3.4.3 Calculation

The additional profits from passing through the costs into product prices have been calculated by us as follows:

$$Add.Profits\ Costpassthrough_{i,j,t,m} = cpt_{j,m} * VE_{i,j,t} * P_{EUA,t}$$

Where = verified emissions, P_{EUA} is the price for an emission allowances in the ETS, and subscripts i, j and t stand for company, sector and time {2008-2014] respectively and the subscript *m* stands for {*Minimum, Average*} to take account of the two variants for which the additional profits from cost pass-through have been calculated.

3.4.4 Results

The additional profits from passing through carbon costs has been calculated by us with the minimum and average variant only for the top-15 sectors under investigation for the years 2008-2014. For the total of 19 countries, the additional profits mounted to over 15 billion euro in the minimum between 2008-2014. If we assumed *average* cost pass-through rates, the total additional profits would increase to 26 billion euros between 2008-2014.

One should notice that this calculation does not include the potential loss in market share from higher EU product prices. As explained above, existing ex-post research (Ecorys *et al.*, 2013) has not been capable of finding empirical evidence of a loss in market shares during Phase 1 and 2. As more and more countries adhere to carbon pricing, it is unlikely that this situation has changed during Phase 3 of the EU ETS. However, if one wants to be prudent on the total profits from passing through the carbon costs, it would be safer to take the minimum values here rather than the average values.

3.5 Total additional profits

The total additional profits have been calculated by adding the three categories together. Since the additional profits from cost pass-through have been calculated in two variants, we have also calculated the total additional profits in two variants: *Minimum* and *Average*. These calculations have been performed for fifteen sectors in which the top-20 companies have been identified. We have not performed such calculations at the level of the total economy, or the whole industrial sector, except for the profits from overallocation.

References

Alexeeva-Talebi, V., 2010. *Cost Pass-Through in Strategic Oligopoly: Sectoral Evidence for the EU ETS. ZEW Discussion Paper,* Issue 10-056.

CE Delft & Öko-Institut, 2015. *Ex-post investigation of cost pass-through in the EU ETS : An analysis for six sectors* , Luxembourg: Publications Office of the European Union: Europeann Commission.

CE Delft, 2010. *Does the energy intensive industry obtain windfall profits thorugh the EU ETS?,* Delft: CE Delft.

CE Delft, 2015 *et al.. Study on the Impacts on Low Carbon Actions and Investments of the Installations Falling under the EU Emissions Trading System (EU ETS). ZEW, SQ Consult, CE Delft, ICF .*

CE Delft, 2016. Calculation of additional profits of sectors and firms from the EU ETS. Sander de Bruyn, Ellen Schep, Sofia Cherif, Publication code: 16.7H44.18.

EC, 2015. *Commission Staff Working Document Impact Assessment (SWD (2015) 135 final : Accompanying the document Proposal for a Directive of the European Parliament and of the Council amending directive 2003/87/EC to enhance cost-effective emission reductions,* Brussels: European Commission (EC).

Ecorys, Öko Institut, Cambridge Econometrics and TNO, 2013, Carbon Leakage Evidence Project: Factsheets for selected sectors, Rotterdam, 23 September 2013 (http://ec.europa.eu/clima/policies/ets/cap/leakage/docs/cl_evidence_factsheets_en.pdf).

Langeler, E.M., 2016. Ex-post analysis of firm-level effectiveness of the European Union Emissions Trading System (EU ETS): An empirical analysis of Dutch industrial firms. Eva Maria Langeler (s2583177). VU University Amsterdam, Institute for Environmental Studies, CE Delft.

McKinsey and Ecofys, 2006. *EU ETS Review: December 2006. Report on International Competitiveness.,* s.l.: McKinsey.

Oberndorfer, U., Alexeeva-Talebi, V. & Löschel, A., 2010. Understanding the competitiveness implications of future phases of EU ETS on the industrial sectors. *Zew Discussion paper,* Issue 10-044.

Walker, N., 2008. *An Empirical Approach to Quantify the Impact of EU Emissions Trading on Cement Industry Competitiveness,* Dublin: University College Dublin.

Warwick, P. & Ng, C., 2012. The 'Cost' of Climate Change: How Carbon Emissions Allowances are Accounted for Amongst European Union Companies. *Australian Accounting Review,* 22(1), pp. 54-67.