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Special report: Winners and losers of the EU-ETS, results from 2005 and 2006

Energy and Carbon Market Analysis
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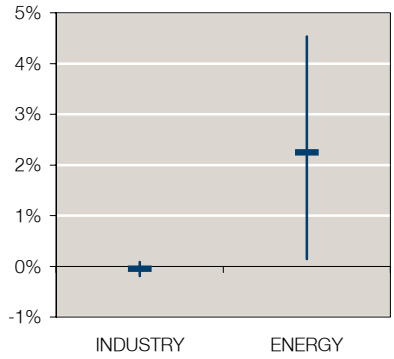
Impact of the EU-ETS on revenue of industry and energy sector in Belgium, relative to turnover; central scenario and worst/best case outcome for 2005 and 2006



Source: Fortis

Scope

The economic consequences of the EU emissions trading scheme, EU-ETS, for different sectors can be quantified by weighing the new benefits to the additional costs due to CO_2 valuation. Additional costs are the increase of the electricity price for industrial power consumers or the net purchase of EUAs for companies with a deficit in allowances. Benefits are the sale of EUAs for companies with a surplus in allowances and additional revenues for the power sector from the higher electricity price.

Main conclusions

In this special report, the changes in costs and benefits are assessed for 2005 and 2006 for different industrial sectors. The analysis is made for Belgium as a proxy for Europe because of its dense industrialisation and high energy intensity. The results apply to industrial sectors as a whole and may be quite different for individual companies or installations.

The energy sector faces additional costs because it was net deficit in emission allowances in 2005 and 2006. On the other hand, under the assumption that the power markets have fully internalised the value CO_2, the energy sector has been able to generate a larger producer surplus due to the increase of the market price for power. The net result for the Belgian energy sector is a revenue increase of, on average, 2.25%.

Industry turned out net long allowances in 2005 and 2006 which resulted in additional revenue. On the other hand, the higher electricity prices due to the internalisation of the value of CO_2 in the market price for power, is an additional cost for industry. The net result for Belgian industry as a whole is a revenue decrease of, on average, 0.05% of the total turnover. The results differ from sector to sector, ranging from an average revenue increase of 0.62% in the iron and steel sector to an average revenue decrease of 0.28% in the non-ferrous metals sector.

As the net economic outcome depends on timing of decisions, i.e. the time at which allowances are sold or bought or power contracts are concluded, the net change in revenue is presented as a range of possible outcomes.

The Carbon Trust on competitiveness

Before the start of the EU-ETS, the Carbon Trust[2] already studied the potential influence of emissions trading on sector's profitability. The study concluded that "The European Emissions Trading Scheme (EU ETS), properly implemented,

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[2] The Carbon Trust, 2004, The European Emissions Trading Scheme: Implications for Industrial Competitiveness.

will not significantly threaten the competitiveness of most industrial sectors in Europe, including most energy-intensive sectors". Table 1 shows the needed pass-through of additional costs in different sectors to maintain the same profit (EBITDA) level as in a situation without CO_2 valuation according to the Carbon Trust.

Table 1: Influence of EU ETS on sectors competitiveness (The Carbon Trust)

Price increase (%) required to maintain sector profits (EBITDA)	Scenario I: €5/tCO_2	Scenario II: €10/tCO_2	Scenario III: €25/tCO_2
Electricity	0.40%	5.60%	12.80%
Cement	0.70%	1.50%	17.40%
Paper (Newsprint)	0.10%	0.10%	1.30%
Steel	0.80%	1.50%	7.30%

Source: The Carbon Trust

Note: The aluminium sector was predicted not to be able to maintain their current level of profitability in any of the scenarios (under the assumption that electricity sector passes through 90% of the costs)

Now, data is available for the first two years of the EU-ETS. Therefore, it is possible to measure, calculate and quantify the impact on competitiveness. As focus is on industry here, a sample country is needed with a high level of industrialisation and a high energy intensity (inland energy consumption divided by GDP). In this report, Belgium is chosen as an example.

There are important fundamental differences between industry and the energy sector in this approach. In 2005 and 2006, industrial sectors as a whole had the opportunity to sell excess allowances whereas the energy sector, confronted with a deficit in allowances, had to buy additional credits. The main advantage for the energy sector is the internalisation of CO_2 in the market price for electricity and the higher producer surplus. Industry suffers from these higher electricity prices.

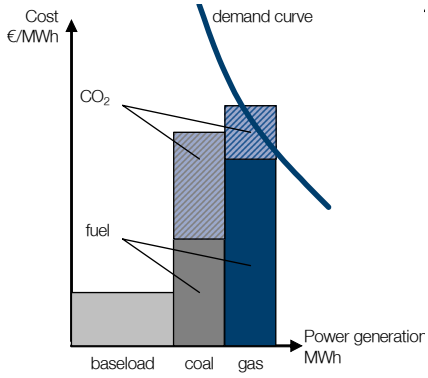
The effect of the EU-ETS in the power sector

CO_2 costs are taken into account in the electricity prices according to the marginal pricing principle, as shown in Figure 1. The merit order of power plants and the marginal costs of these plants (for simplicity here only fuel and CO_2 are considered) represent the supply curve in the power market. The price on the power markets is determined by the intersection of supply and demand.

This marginal electricity price applies to all power generated. All underlying power is sold at the same price, even if generated at lower marginal cost, resulting in 'producer surplus' for utilities. Figure 2 shows the potential changes in electricity price and producer surplus due to emissions trading. The first figure shows the situation without emissions trading. The second figure shows a situation with CO_2 prices, but without changes in merit order. The third figure is a situation with higher CO_2 prices where the coal plant shifts to a higher merit order and becomes the marginal plant. These figures demonstrate how CO_2 valuation impacts the marginal cost of power plants, the equilibrium price for power and the producer surplus of utilities.

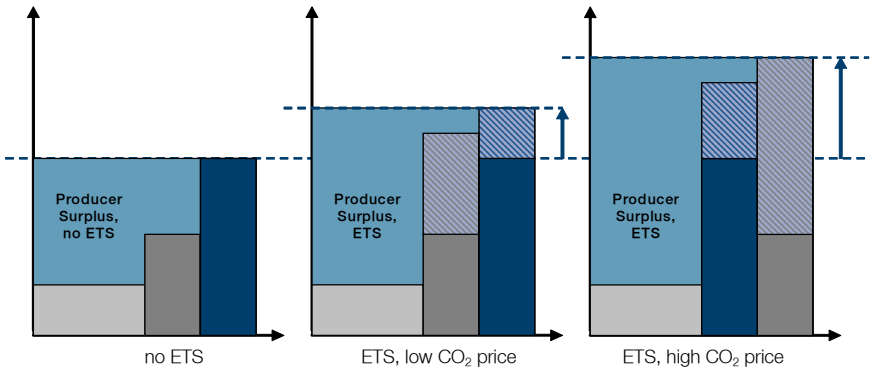
The change in revenue for the power sector is obtained by comparing the situation with and without emissions trading. Assuming that CO_2 is fully internalised according to the marginal pricing shown above, changes in revenue due to the EU-ETS are compared. On the one hand, there is a change in the producer surplus due to the change in the marginal cost as shown in Figure 2. The value of emission allowances, on the other hand, can be considered both a cost (for the allowances bought to cover the net short position) as a revenue (for the allowances granted free of charge).

Figure 1: Merit order of power plants and marginal price setting in power markets



Source: Fortis

Figure 2: Change in merit order due to EU ETS



Source: Fortis

Hence, for the power sector we have the formula to quantify the change in net revenue:

$$\Delta Revenue_{Power} = \text{Producer Surplus (ETS)} - \text{Producer Surplus (no ETS)} + \text{Allocation} * CO_2 \text{ price}$$

The value of the initial allocation is added as a net revenue because, in the logic of Figure 2, ALL emissions, even the part received free of charge, are incorporated in the marginal costs.

The effect of the EU-ETS in industry

Industry faces higher electricity prices as described above. On the other hand, many industrial installations had an opportunity to sell surplus allowances. Under the assumption that industry has not incorporated any CO_2 price in their product price, the net change in revenue in industrial sectors can be quantified as follows.

$$\Delta Revenue_{Industry} = + (\text{Allocation} - \text{Emissions}) * CO_2 \text{ price} - \text{Power Consumption} * (\text{Power Price increase due to ETS})$$

Data used for quantified impact assessment

In order to calculate the changes in net revenue in different sectors as described above, data is needed.

One piece of the puzzle is the CO_2 position of the different sectors as shown in Table 2 (source CITL[3]). The balance turns out as a deficit for the energy sector and a surplus for all industrial sectors. To find the economic impact, this surplus or deficit needs to be multiplied with the price of CO_2. As it is not known at what date each company bought or sold allowances, the analysis is done for the highest, the lowest and volume weighted averaged value of EUAs for every year. In 2005 the lowest CO_2 price was €6.7/tCO_2, the highest price was €29.1/tCO_2 and the average price was €20.7/tCO_2. In 2006 the lowest price was €6.4/tCO_2, the highest was €29.8/tCO_2 and the average price was €16.3/tCO_2 (source Reuters).

[3] Community Independent Transaction Log, URL:<http://ec.europa.eu/environment/ets/welcome.do>

Table 2: Allocated and verified emission rights per sector in 2005 and 2006 in Belgium [$MtCO_2/a$]

	2005		2006	
	Allocation	Emissions	Allocation	Emissions
Iron & steel	14.65	7.89	14.65	8.61
Non-ferrous metals	0.21	0.20	0.21	0.19
Chemical industry	5.11	4.41	5.14	4.40
Non-metallic mineral products	10.00	8.81	10.01	9.26
Ore-extraction (except fuels)	1.52	1.29	1.52	1.29
Food, drink and tobacco	1.75	1.54	1.75	1.45
Textile, leather and clothing	0.12	0.09	0.12	0.09
Paper and printing	0.88	0.75	0.88	0.77
Engineering and other metal	4.94	3.61	4.02	3.41
Energy sector	12.24	20.92	14.76	19.41

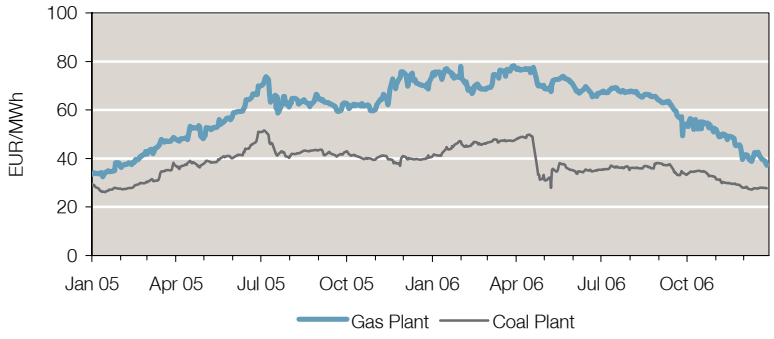
Source: Fortis, European Commission

To assess the increase in power prices due to the EU-ETS, as shown in Figure 2, the marginal price components are needed; i.e. the fuel component (gas or coal) and the CO_2 component.

The coal component is calculated using API#2 first year coal prices assuming a power plant efficiency of 35%. For the gas component of the power price, the average of the first two seasons of the NBP gas price is used assuming a power plant efficiency of 50%. Finally, the CO_2 component is calculated using the spot price of EUAs and the emissions from the plants used; i.e. $0.97tCO_2/MWh$ for the coal plant and $0.40tCO_2/MWh$ for the gas plant.

As such, the marginal costs (fuel and CO_2) of the coal and the gas plant can be established. According to the marginal pricing mechanisms, as shown earlier in Figure 1, the power generation plant with the highest marginal cost sets the price. Figure 3 shows the marginal costs of a coal and a gas power plant throughout 2005 and 2006. In the time span studied, the gas plant always set the price.

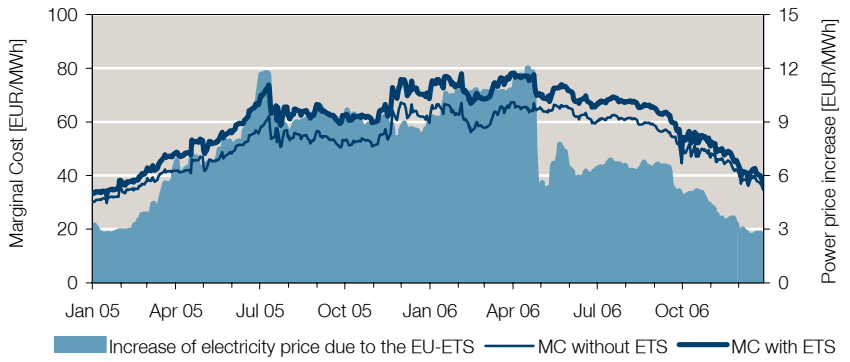
Figure 3: Marginal cost (fuel cost plus CO_2 cost) of a coal and gas plant based on year ahead commodity prices



Source: Fortis calculations using Reuters data

According to the logic shown in Figure 2, the increase in electricity prices due to CO_2 valuation can be calculated. The result is shown in Figure 4. As it is uncertain when companies bought or sold electricity, the lowest, highest and average increase in electricity price are again withheld. In 2005 these values are €2.7/MWhe, €11.7/MWhe and €7.3/MWhe, respectively. In 2006 these values are €2.6/MWhe, €12.0/MWhe and €7.0/MWhe, respectively.

Figure 4: Marginal power generation costs with and without CO_2 component and the increase of the electricity price due to the EU-ETS



Source: Fortis calculations using Reuters data

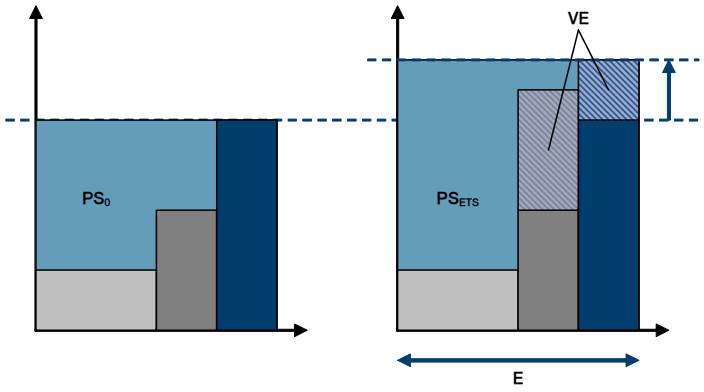
To assess the increase in electricity costs for industry, data on electricity consumption is retrieved from Eurostat[4]. This electricity consumption is multiplied with the increase in power price due to the ETS. Based on NACE sector classification[5], the industry sectors are the iron & steel sector, non-ferrous metals, chemical industry, non-metallic mineral products, ore-extraction (except fuels), food, drink & tobacco, textile, leather & clothing, paper & printing and engineering & other metal.

The change in producer surplus in the electricity sector, as schematically shown in Figure 2, cannot be calculated directly as the power mix is not completely known. Therefore, the following recalculation is made. As indicated on Figure 5, E is the total electricity generation, PS_0 is the producer surplus without ETS, PS_{ETS} is the producer surplus with ETS, ΔMC is the change in marginal cost equalling the increase in the power price and VE stands for the value of the verified emissions.

Producer Surplus (ETS) – Producer Surplus (no ETS)

$$= PS_{ETS} - PS_0 = PS_{ETS} + VE - PS_0 - VE = E*\Delta MC - VE$$

Figure 5: Producer surplus with and without CO_2 value



Source: Fortis

The annual electricity generation in Belgium was 85.8TWh in 2005 and 85.1TWh in 2006 (source Eurostat). The verified emissions come from the CITL.

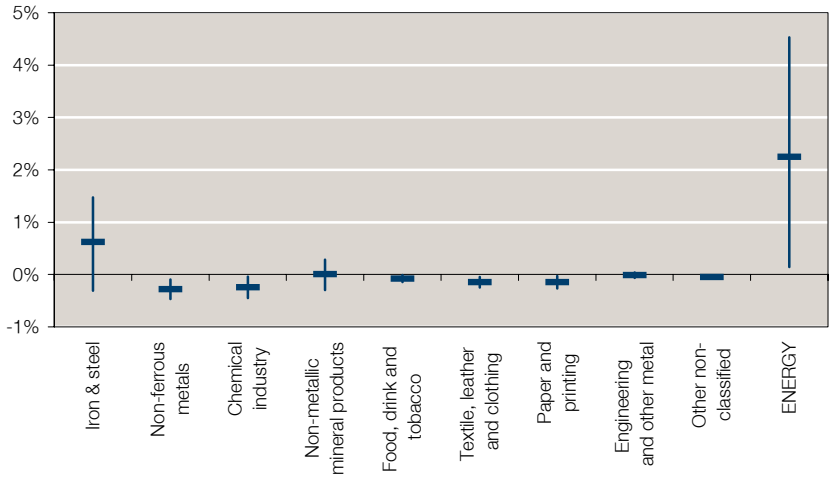
[4] Eurostat, http://epp.eurostat.ec.europa.eu/
[5] Nomenclature générale des Activités économiques dans les Communautés Européennes (standard in Europe to classify sectors)

Results and conclusions

The final results of the economic study are shown in Figure 6. To put the results into perspective, the impact is expressed in terms of sector's turnover (data taken from Eurostat). The absolute results are shown in attachment. As explained above, the timing of decisions (i.e. the date at which power and EUAs are sold/bought) is not known. E.g., a company could have locked in power when the CO_2 component in the power price was low but sold excess allowances at a time of high CO_2 price, resulting in a positive net outcome. As a consequence, we obtain a range for the net impact of the scheme on different sectors' profitability for the lowest, highest and average CO_2 price and the lowest, highest and average increase in electricity price. This range of potential outcomes is shown in Figure 6 as a min-max range.

The results apply to Belgium and to aggregate sectors. The outcome for individual companies or installations may be different.

Figure 6: Economic impact of the EU-ETS on the performance of sectors in Belgium; central scenario and worst/best case outcome, all relative to annual turnover



Source: Fortis

For industry, assuming none of the extra costs are internalised, the change in revenue due to the ETS ranges from a 1% deficit and 2% benefit in terms of turnover. For the central scenario (with the average CO_2 price and the average power price increase), the impact ranges from a turnover loss of 0.28% in the non-ferrous metals sector to a turnover increase of 0.62% in the iron and steel sector.

For the electricity sector, assuming CO_2 is fully internalised in the market price for power, the net change in turnover is positive, on average 2.2%, ranging from 0.14% to 4.5%.

The main observation is the discrepancy between the changes in the power sector, on average obtaining additional revenue from the EU-ETS, and energy intensive industry, facing additional costs in most cases.

The relative impact on the revenue of industry is limited. The loss in revenue on a sector level is well below 1% of the total turnover in all industrial sectors considered. Since the results are related to turnover and not to total profit, they don't automatically lead to conclusions on competitiveness. However, our results correspond to the conclusions of the study from the Carbon Trust from 2004 in quantification of the impact; small price increases in products from energy intensive industry should suffice to restore sector revenues.

Winners and losers

This study focuses on the impact of emissions trading on the revenue of sectors to identify winners and losers.

Under the assumptions made and for the time frame 2005 to 2006, the energy sector is clearly a winner in generating additional revenue. Industry as a whole is a moderate loser.

Moreover, since the marginal cost increase in the energy sector also applies to consumers other than industry, they should also be considered losers in term of total revenue.

The EU-ETS could also be considered a zero-sum game by also taking into account the benefits of the scheme; emission abatement as a public good. The additional revenue in a better environment and not having to bear the burden of mitigation to climate change turns everybody into winners.

A few remarks are in place here.

First of all, the estimation of the rise in producer surplus is possibly an overestimation as it was assumed that CO_2 was 100% passed through according to the marginal pricing principle. As power markets are in transition to liberalisation it is possible that the CO_2 price is only partly passed through. Similarly, the result for industry may be too negative since it is assumed that none of the additional costs are passed through there. This is probably a reasonable assumption for sectors in full global competition, but other sectors surely can pass through a share of these extra costs.

Another source of distortion of figures may be the peculiar allocation related to blast furnace gas. Steel producers generate blast furnace gas as a by-product. This gas is transferred to a power plant generating power with it. In the allocations, the allowances to burn the blast furnace gas are granted to the steel company that in turn hands them over to the utility when delivering the blast furnace gas. This situation partly explains the apparently generous allocation to the steel sector.

The results apply to Belgian industry, but the qualitative results may be considered a proxy for European industry because of the high level of industrialisation and a high energy intensity in Belgium.

The conclusions apply to 2005 and 2006 and may not be extrapolated beyond. The results strongly depend on the price of allowances (and a lesser extent also coal and gas), determining the price increase in the power sector and therefore the extra costs in industry, and the allocation method used, determining the net need to purchase or opportunity to sell allowances.

Attachment: Absolute results

Changes in revenue in different sectors due to the ETS assuming a 100% pass through of costs in the power sector and no pass through of costs in industry.

2005 [M€/a]

	Sector turnover	Net influence on sectors								
		Average increase in power price			Lowest increase in power price			Highest increase in power price		
		Lowest CO_2 price	Highest CO_2 price	Average CO_2 price	Lowest CO_2 price	Highest CO_2 price	Average CO_2 price	Lowest CO_2 price	Highest CO_2 price	Average CO_2 price
Iron & steel	*11,116*	-6.40	144.86	87.86	26.14	177.40	120.40	-37.75	113.52	56.51
Non-ferrous metals	*3,816*	-15.50	-15.41	-15.45	-5.72	-5.63	-5.66	-24.93	-24.84	-24.87
Chemical industry	*34,115*	-93.88	-78.28	-84.16	-31.80	-16.19	-22.07	-153.70	-138.10	-143.97
Non-metallic mineral products	*7,513*	-11.11	15.62	5.55	0.93	27.67	17.59	-22.72	4.02	-6.05
Ore-extraction (exept fuels)		-2.25	2.76	0.87	0.11	5.12	3.23	-4.53	0.48	-1.41
Food, drink and tobacco	*31,384*	-28.48	-23.85	-25.59	-9.66	-5.03	-6.78	-46.61	-41.98	-43.72
Textile, leather and clothing	*7,834*	-14.47	-13.93	-14.13	-5.25	-4.71	-4.92	-23.35	-22.81	-23.01
Paper and printing	*11,593*	-18.20	-15.16	-16.30	-6.16	-3.12	-4.27	-29.79	-26.75	-27.90
Engineering and other metal	*48,765*	-14.07	15.77	4.53	0.42	30.25	19.01	-28.02	1.81	-9.43
Energy	*21,006*	569.11	374.64	447.92	173.92	-20.55	52.73	949.85	755.38	828.66

Source: Fortis

2006 [M€/a]

	Sector turnover	Net influence on sectors								
		Average increase in power price			Lowest increase in power price			Highest increase in power price		
		Lowest CO_2 price	Highest CO_2 price	Average CO_2 price	Lowest CO_2 price	Highest CO_2 price	Average CO_2 price	Lowest CO_2 price	Highest CO_2 price	Average CO_2 price
Iron & steel	*12,011*	-3.15	137.91	56.50	23.16	164.22	82.82	-33.40	107.66	26.25
Non-ferrous metals	*5,871*	-11.92	-11.44	-11.72	-4.34	-3.86	-4.13	-20.64	-20.16	-20.44
Chemical industry	*35,609*	-91.23	-73.86	-83.88	-30.83	-13.46	-23.48	-160.67	-143.30	-153.33
Non-metallic mineral products	*7,916*	-11.43	6.00	-4.06	-1.23	16.20	6.14	-23.16	-5.73	-15.79
Ore-extraction (exept fuels)		-2.22	3.16	0.06	0.11	5.48	2.38	-4.88	0.49	-2.61
Food, drink and tobacco	*31,782*	-25.91	-18.90	-22.94	-8.40	-1.39	-5.43	-46.04	-39.03	-43.07
Textile, leather and clothing	*7,598*	-8.44	-7.90	-8.21	-3.03	-2.50	-2.81	-14.64	-14.11	-14.42
Paper and printing	*11,546*	-18.14	-15.38	-16.97	-6.25	-3.49	-5.08	-31.81	-29.05	-30.64
Engineering and other metal	*50,691*	-18.17	-4.02	-12.19	-4.30	9.86	1.69	-34.13	-19.98	-28.14
Energy	*21,875*	563.70	455.12	517.78	190.27	81.68	144.35	993.02	884.44	947.10

Source: Fortis

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