



»» CO₂ Barometer 2013 – Carbon Edition

The EU Emissions Trading Scheme:
Firm Behaviour During the Crisis

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KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

The EU Emissions Trading Scheme: firm behaviour during the crisis

1. Introduction

The KfW/ZEW CO₂ Barometer – developed as part of a cooperative project of KfW Bankengruppe and the Centre of European Economic Research (ZEW) – has been analysing the situation of German companies regulated under the European Union Emissions Trading System (EU ETS) on an annual basis since 2009. The study's objective is to closely monitor firm behaviour in carbon markets in order to regularly provide detailed information to policymakers, businesses and the research community. These are the main results of the KfW/ZEW CO₂ Barometer 2013 – Carbon Edition:

- In 2012, the market of European Union Allowances (EUAs) was characterised by a sharp downward movement in prices coupled with increasing trading volumes. The decrease in prices reflects the oversupply of allowances due to the extensive use of emission credits for compliance under the EU ETS and the economic crisis in the EU that caused strong emission reductions.
- Due to the weak economic conditions in the euro zone, the emissions of installations regulated by the EU ETS decreased in Europe by 2% in 2012. In contrast, the carbon emissions released by regulated companies in Germany increased by 0.5% in comparison to the previous year. The main reason for this development is the growing conversion of coal into electricity in Germany. Large-scale combustion installations increased their emissions whereas all other kinds of regulated installations decreased their emissions in comparison to 2011.
- During the last year, the regulated firms in Germany increased their CO₂ allowance trading activity in comparison to previous years. A higher share (66%) of firms was engaged in the market and firms traded more frequently. For the remaining inactive firms (34%) the main reasons not to trade EUAs were the sufficient free allocation of EUAs and in-house regulation to prevent speculation.
- Companies in Germany revised their price expectations for EUAs downwards. The average price expectations adjusted for inflation for December 2014 and December 2020 are approximately EUR 8 per tCO₂ and EUR 16 per tCO₂, respectively. By comparison, the price was about EUR 4 per tCO₂ during the time the survey was conducted in March 2013. Nevertheless, surveyed firms expect a market recovery and increasing prices in the future.
- Seventy-seven per cent of the surveyed firms have carried out investments or made changes to the production process that have brought about emission reductions. Despite this high proportion of firms, the results of the survey suggest that the EU ETS generated only weak incentives for firms to implement abatement measures: 89% of the active firms state that CO₂ abatement was only a side effect of a measure carried out for other reasons such as reducing energy and raw material costs.

The survey covers a broad range of topics such as carbon price expectations, carbon trading

strategies and abatement activities. For that purpose, all German firms regulated under the EU ETS, about 800 companies annually since 2009, are invited to participate in the survey every year. Approximately 30% of the firms operate more than one regulated installation. In order to avoid contacting a firm multiple times, only one responsible manager per firm is surveyed. On average, approximately 140 companies have responded to the questionnaire per year. Firm behaviour in carbon markets is analysed considering firm size, sector affiliation and allocation status. Therefore, current emission data from the Community Independent Transaction Log (CITL) and the European Union Transaction Log (EUTL) were aggregated and merged with the responses of the participating companies.¹

The KfW/ZEW CO₂ Barometer 2013 – Carbon Edition is structured as follows:

Section 2 gives a short review of recent regulatory and market developments. The development of CO₂ emissions in Germany is briefly summarised in section 3. Section 4 explores the current emission allowance trading behaviour and motivation of German companies regulated under the EU ETS. Section 5 analyses respondents' expectations concerning price movements. Finally, companies' abatement activities are described in section 6. Section 7 offers a conclusion.

As a complementary study, KfW Bankengruppe and the ZEW have developed a second annual survey in the framework of the KfW/ZEW CO₂ Barometer: the KfW/ZEW CO₂ Barometer – Manufacturing Industry Edition. The aim is to shed light on recent developments in the German manufacturing industry driven by European climate and energy regulations as well as the German energy transition in particular. The study is based on a survey among firms of the German manufacturing industry and the results will be published subsequent to the KfW/ZEW CO₂ Barometer – Carbon Edition.

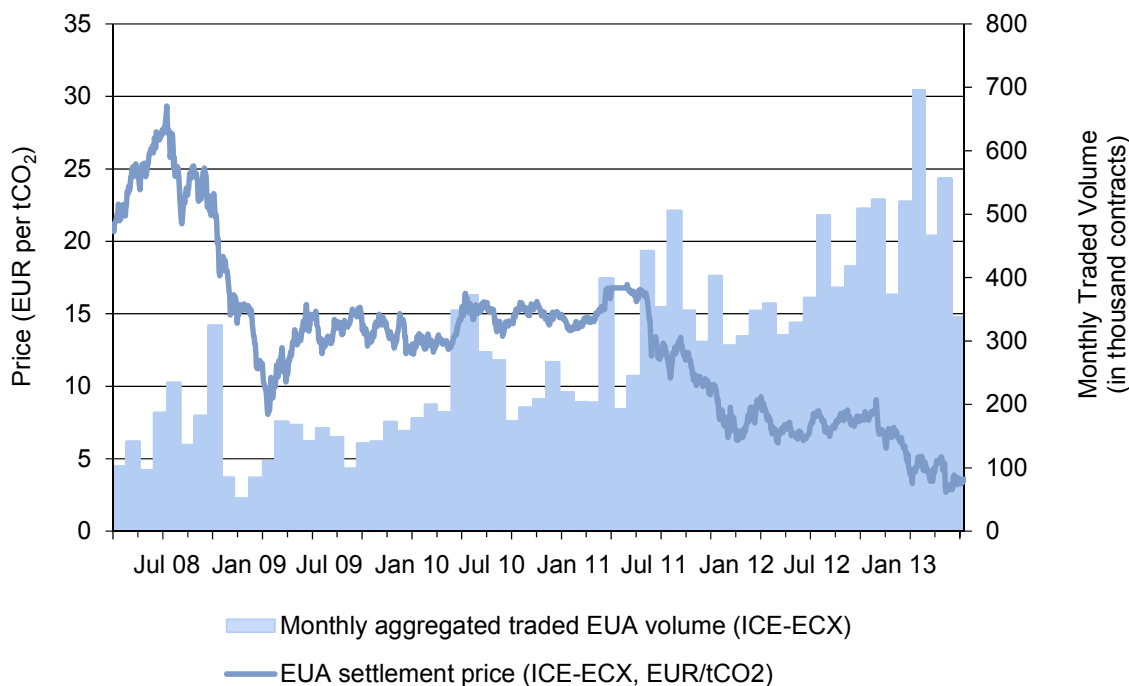
¹ A detailed description of the structure of the survey is given in the appendix.

2. Recent market developments

In 2012, emissions from installations regulated by the EU ETS decreased by 2% to about 1,867 million tCO₂ on European level. The overall surplus of allowances in the market doubled from 950 million certificates in 2011 to nearly 2,000 million certificates by the end of 2012 (EC 2013). The market for EUAs was characterised by a sharp downward movement in prices coupled with increasing trading volumes. Figure 1 shows EUA prices and volumes traded at the Intercontinental Exchange, London (ICE). During 2012, EUA prices ranged between EUR 5.74 and EUR 9.28 per tCO₂, with an average of approximately EUR 7.39 per tCO₂.² The average price of 2012 was about 43% below the average of 2011 (EUR 13.07 per tCO₂) and roughly 75% below the peak in EUA prices of EUR 29.33 per tCO₂ at the beginning of July 2008. In December 2012, the prices dropped and reached their lowest level in 2012 at EUR 5.74 per tCO₂. Since the end of December 2012, prices continued to decline and hit bottom in mid-April 2013 at about EUR 2.70 per tCO₂. Hence, during a period not exceeding five months, prices declined by more than 60% from over EUR 9 per tCO₂ in November 2012 to less than EUR 3 per tCO₂ in April 2013. The decrease in EUA prices reflects the oversupply of allowances due to the economic crisis in the EU that caused strong emission reductions. The extended usage of carbon credits from outside the EU ETS and the allocation of too many free certificates also favoured this development (cf. Box 1).

The low price for emission allowances in the year 2012 and, in particular, the significant plunge at the end of the year triggered a discussion about the effectiveness of the EU ETS and possible adjustments of this regulatory instrument. It is argued that the EUA price is too low to create incentives for companies to invest in CO₂ abatement measures (EC 2012). Among possible interventions to increase the price in the short run, the European Commission favoured postponing (backloading) the auctioning of 900 million EUAs within the third trading period from the years 2013–2015 until the years 2016–2020. In the second vote on 3 July 2013, the European Parliament approved this carbon market backloading proposal. At the time this report was written, the European Council had not yet taken the final decision on the backloading proposal. However, stakeholders from the areas of business and policy-making see the Parliament's decision as a positive signal for the future development of the EU ETS and a potential reform. At the beginning of July, energy and environmental ministers from 12 EU member states submitted an open letter co-signed by a coalition of 42 businesses calling for backloading approval and long-term structural reforms of the EU ETS (BMU 2013 and EURELECTRIC 2013).

² The prices and trading volumes displayed here refer to the year-ahead contracts traded at the ICE, London. The monthly trading volumes represent the sum of the year-ahead contracts traded during the corresponding month. One contract comprises 1,000 EUAs.



Source: Thomson Reuters Datastream 2013

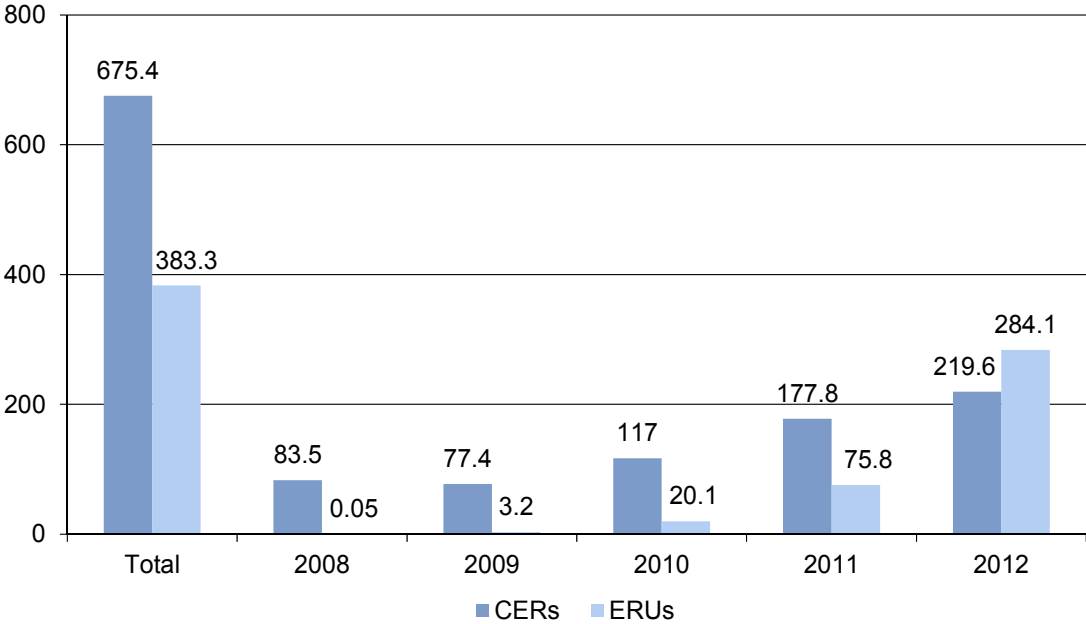
Figure 1: EU ETS 2008–2013: Prices and trading volumes

In contrast to prices, trading volumes showed a positive trend over time. In 2012, an average of approximately 18,300 futures contracts was traded per day at the ICE. Hence, the average traded volume increased by roughly 20% in comparison to 2011 (on average 15,100 contracts traded per day) and by more than 60% compared to the average trading volume in 2010 (on average 11,200 traded contracts per day). Since the end of last year, the positive trend in trading volumes has continued. The monthly aggregate of traded contracts reached its peak in February 2013 with a total of about 700,000 contracts.

The reasons for this development are manifold. The high volatility in prices during 2012 (Lutz et al. 2013) and the higher proportion of allocations via auctioning from 2013 onwards (Point Carbon 2013) might have led to rising trading volumes. Furthermore, the importance of the ICE as trading platform increased, since the BlueNext (Paris) closed spot and derivative trading operations in December 2012.

Box 1: Surrender of emission credits for compliance under the EU ETS

The increasing use of emission credits from the project-based mechanisms of the Kyoto Protocol, the Clean Development Mechanism (CDM) and Joint Implementation (JI), was a continuing trend during the last years. In 2012, European companies surrendered about 220 million Certified Emission Reductions (CERs) from CDM projects and 284 million Emission Reduction Units (ERUs) from JI Projects in order to comply with EU ETS obligations. In comparison to 2011, the use of CERs increased by 23.5%, and nearly four times as many ERUs were surrendered. In total, approximately one billion carbon emission offsets were used during the second phase of the EU ETS.



Source: EUTL (2013)

Figure 2: Surrender of CERs and ERUs (in million certificates)

3. Rising CO₂ emissions in Germany

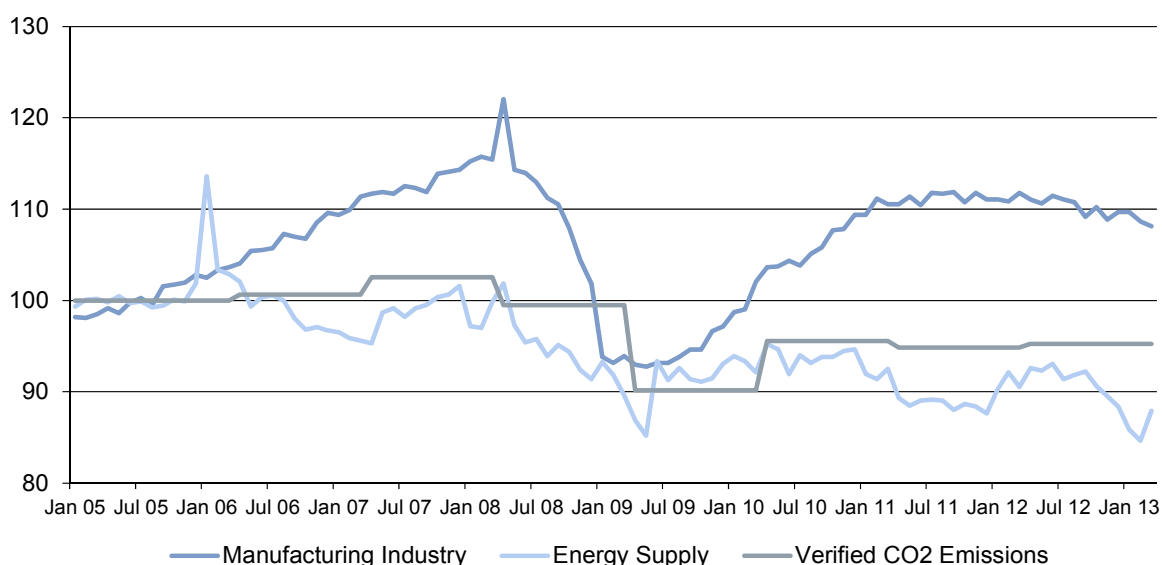
In 2012, the EU ETS regulated 1,629 German installations that released a total amount of 452.6 million tCO₂. Emissions increased again, but only slightly by 0.5% in comparison to the previous year (cf. Table 1). This development can be explained by a higher demand for heat due to the cold winter and the strengthened role of coal in electricity and heat production (DEHSt 2013, AGEB 2013). In contrast, production indices for the electricity sector and the manufacturing industry suggest a rather dampening effect of economic activity on overall CO₂ emissions (cf. Figure 3).

Table 1: Verified emissions and the EU ETS emission cap in Germany

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|
| Verified emissions (mn tCO ₂) | 475.0 | 478.1 | 487.2 | 472.6 | 428.3 | 454.9 | 450.3 | 452.6 |
| Change compared to the previous year | | +0.6% | +1.9% | -3.0% | -9.4% | +6.2% | +1.0% | +0.5% |
| Emission cap ³ | 499.0 | 499.0 | 499.0 | 451.9 | 451.9 | 451.9 | 451.9 | 451.9 |

Source: EUTL (2013), DEHSt (2013)

Of the regulated installations, 1,093 belong to the area of energy generation and emitted about 356.3 million tCO₂ (about 79% of overall emissions). In comparison to the previous year, the emissions released by the energy sector increased by about 1.4% (5 million tCO₂). Large-scale combustion installations increased their emissions, whereas small-scale combustion installations decreased their emissions (cf. Table 2).



Source: Destatis (2013a), EUTL (2013), DEHSt (2013)

Figure 3: Industrial production, power supply, and verified emissions in Germany (2005=100)

³ The figures provided here might differ from the actual amount of permits available since the regulating institutions establish a reserve for new entrants.

Despite the heavy expansion of renewable capacities in Germany from 20% to 23% of total electricity production, decreasing prices for coal and EUAs stimulated the electricity and heat production from coal and the associated emissions. While German primary energy consumption increased by 0.9% in 2012, the consumption of steam coal and lignite grew by 3.4% and 5.1%, respectively (AGEB 2013). As a consequence, the emission factor of German electricity generation increased from 570 g CO₂ per kWh in 2011 to 601 g CO₂ per kWh in 2012 (UBA 2013).

The remaining 536 industrial installations emitted about 96.3 million tCO₂ (about 21% of overall emissions) and thus decreased their emissions by 2.3% (2.3 million tCO₂) in comparison to the previous year. This development is mainly due to a slight slowdown in Germany's economic growth. While GDP growth declined from 3% in 2011 to 0.7% in 2012 (Destatis 2013b), production in many EU ETS regulated sectors decreased, for instance in the pulp and paper, ferrous and nonferrous metals or glass and ceramics industries (Destatis 2013c).

Table 2: Sectoral development of verified emissions in Germany in 2012

| Type of activity | Verified emissions in ktCO ₂ (2012) | Share of overall emissions (2012) | Change compared to the previous year | Long- / short position** in ktCO ₂ (2012) | Number of plants (2012) |
|--|--|-----------------------------------|--------------------------------------|--|-------------------------|
| Large-scale combustion installations (> 50 MW FWL*) | 348,298 | 77.0% | +1.5% | -62,920 | 525 |
| Iron / steel / coke ovens | 31,291 | 6.9% | -2.7% | +9,989 | 47 |
| Refineries | 21,072 | 4.7% | -3.1% | +4,022 | 26 |
| Cement | 19,856 | 4.4% | -0.6% | +1,209 | 38 |
| Lime | 7,650 | 1.7% | -5.2% | +2,635 | 67 |
| Small-scale combustion installations (20–50 MW FWL*) | 6,664 | 1.5% | -2.2% | +3,441 | 511 |
| Propylene, ethylene and carbon black | 5,848 | 1.3% | -1.3% | +973 | 13 |
| Pulp / paper | 5,229 | 1.2% | -5.7% | +1,955 | 131 |
| Glass | 3,977 | 0.9% | -5.2% | +928 | 94 |
| Main engines / turbines | 1,371 | 0.3% | -1.8% | +357 | 57 |
| Ceramics | 1,329 | 0.3% | -5.9% | +544 | 120 |
| Total | 452,586 | 100.0% | +0.5% | -36,867 | 1,629 |

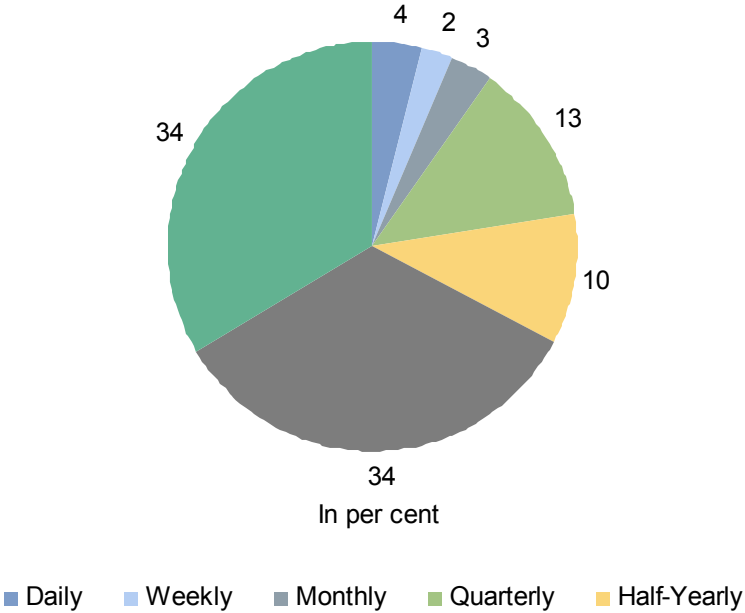
* Rated thermal input, ** incl. redistribution for byproduct gases (blast furnace gas)

Source: DEHSt (2013), status as of 31 May 2013

The German Emissions Trading Authority (DEHSt) states that the EU ETS regulated firms received 416 million EUAs for free in 2012. An additional 41 million EUAs were auctioned at the European Energy Exchange (EEX). The corresponding average price realised during the trading year 2012 was EUR 6.75 per tCO₂. As in previous years, the amount of freely allocated allowances exceeded the reported emissions of all types of activities except for large-scale combustion installations.

4. Trading of emission allowances and credits

In comparison to the results of the KfW/ZEW CO₂ Barometer 2012, both the proportion of companies that participate in the carbon market and the trading frequency have increased. Two thirds (66%) of all surveyed companies stated they had been trading emission allowances or credits (EUAs, CERs or ERUs) since February 2012 (cf. Figure 4). This corresponds to an increase of almost 10 percentage points compared to the results of the 2012 survey. Moreover, 33% of the respondents traded emission allowances at least biannually, which is an increase of approximately 7 percentage points on the previous year. Furthermore, the data shows that large companies (≥ 250 employees) are more likely to participate actively in the carbon market than small and medium-sized enterprises (SMEs < 250 employees). Forty per cent of the small firms stated that they had not been trading emission allowances nor credits (EUAs, CERs or ERUs) since February 2012. In comparison, only 31% of the large firms stated that they did not actively participate in the market. This is in line with previous research which showed that in contrast to small companies, large companies are able to revert to existing organisational structures and are therefore more likely to trade emission allowances frequently (Heindl and Lutz 2012).

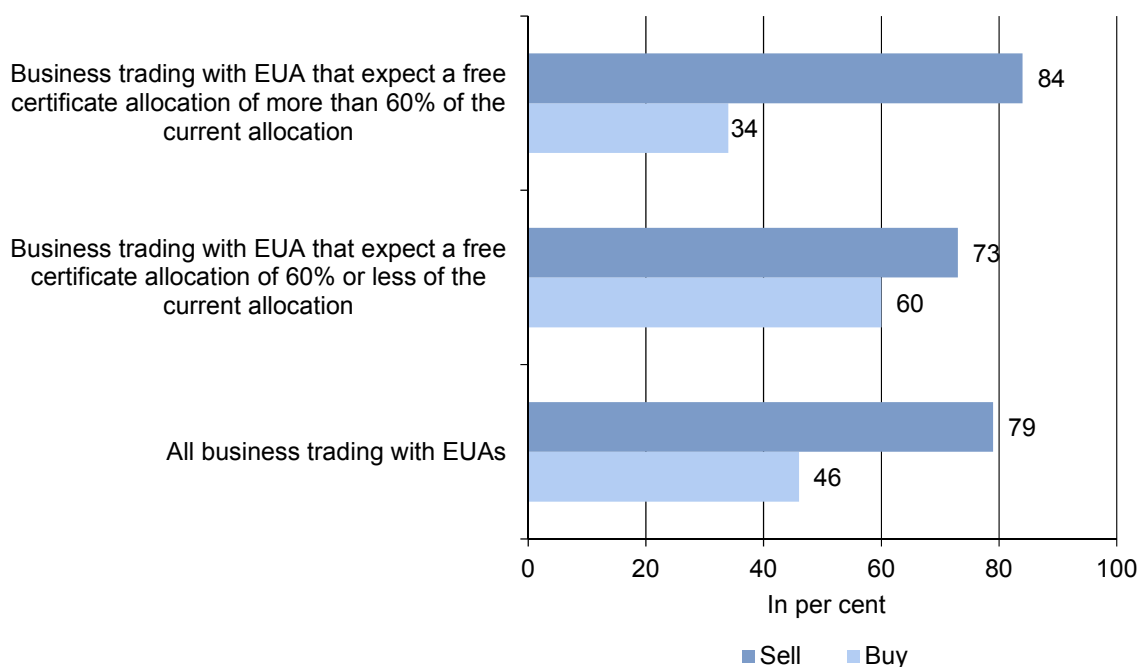


Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 4: How often has your company traded emission allowances (EUAs, CERs or ERUs) since February 2012?

Trading in EUAs is characterised by many companies selling and few buying EUAs. Conversely, many market participants are buying CERs while few companies are selling them. Ninety-six per cent of the active companies have traded EUAs since February 2012, of which 79% reported selling and 46% buying EUAs. A similarly high amount of respondents (90% of companies that were active on the market) traded CERs. Twenty-one per cent of these reported selling and 92% reported buying CERs. In the trade in ERUs, the level of activity was lower. Only 49% of companies that were engaged in the market have traded ERUs since February 2012, of which 24% reported selling and 95% buying ERUs. The trading activities

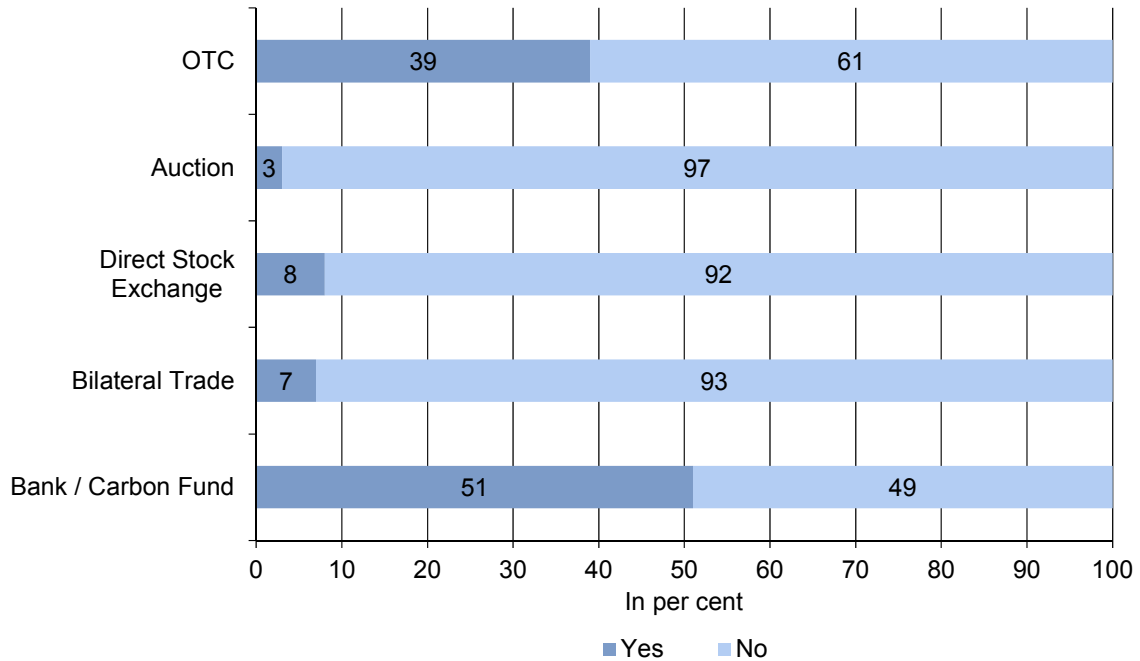
can be explained by the respondents' expectations on future free allowance allocation. Companies expecting an EUA allocation of less than 60% of their 2012 allocation for the years to come rather purchased EUAs (cf. Figure 5), 60% of them bought EUAs since February 2012. Of the companies expecting a free allocation of more than 60% of their 2012 allocation, only 34% bought EUAs.



Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 5: Purchases and sales of EUAs since February 2012

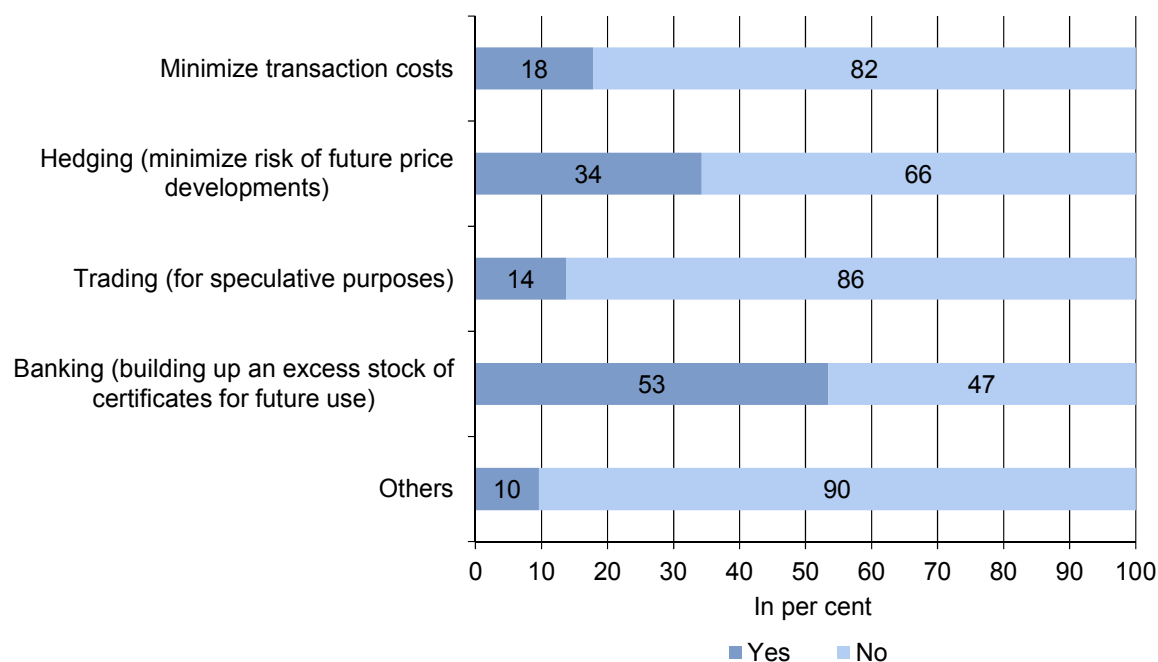
Most companies carried out their transactions via intermediaries or over the counter (cf. Figure 6). Fifty-one per cent of all surveyed companies relied on intermediaries (like banks, carbon funds) to trade emission allowances or credits. The majority of these companies (63%) even reported conducting all transactions only through this trading channel. Thirty-nine per cent of the respondents conducted their transactions over the counter. Also, the majority (70%) of these companies uses only one mode of trading emission allowances or credits. Only a few companies conducted their transactions via exchanges (8%) or bilateral transactions (7%) or purchased allowances on the primary market (3%).



Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 6: If your company has traded (bought or sold) emission allowances, which channels have you used?

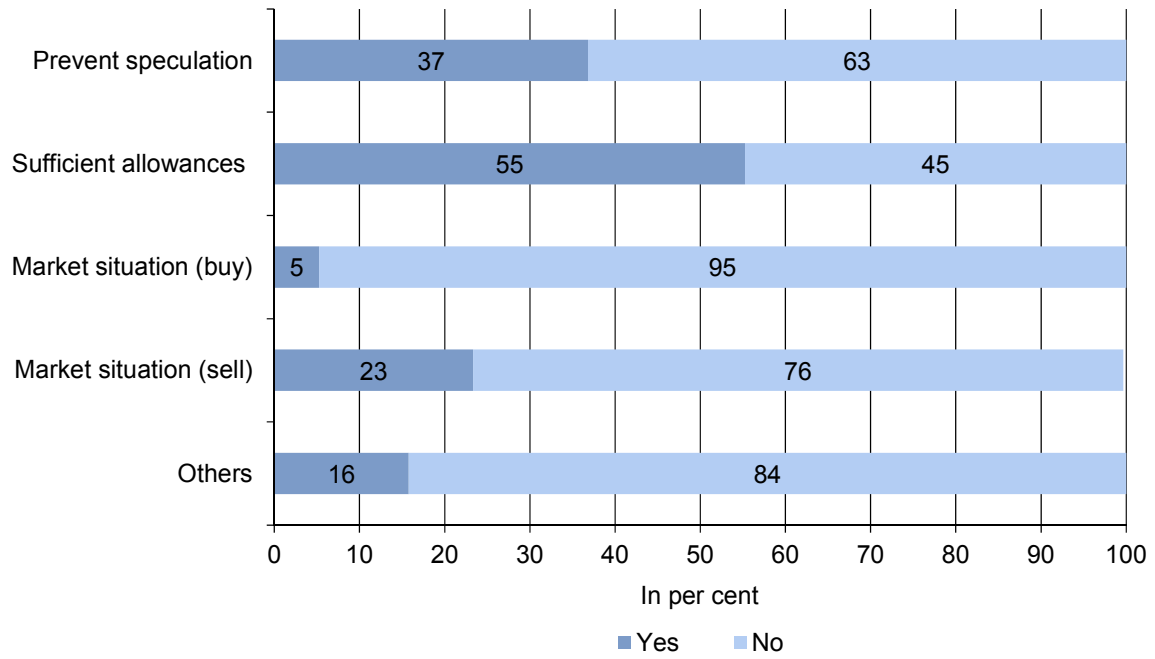
Concerning their trading strategy, the majority (53%) of all surveyed firms reported accumulating emission allowances for future use (cf. Figure 7). SMEs (< 250 employees) in particular used banking as a trading strategy, unlike large firms (≥ 250 employees). Sixty-eight per cent of all small firms reported banking emission allowances to build up an excess stock for future use. In comparison, only 47% of all large firms reported banking emission allowances. A large majority (78%) of the respondents has already built up a reserve of emission allowances. Moreover, according to our survey, these reserves are quite substantial. On average, respondents have already built up a reserve of about 123% of their verified emissions in the year 2012. The data shows that the reserves of power supply companies are lower than those of firms belonging to the industrial sector. The reserves of power supply companies are on average 75% of their verified emissions in the year 2012. Firms belonging to the industrial sector hold reserves of 147% on average.



Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 7: Which strategy has your company pursued regarding the trade of emission allowances since the end of February 2012?

Thirty-four per cent of all respondents have not traded emission allowances or credits since February 2012. According to our survey, there are essentially two reasons for companies not to participate actively in the carbon market: a sufficiently large free allocation and regulatory limits on speculation (cf. Figure 8). Most inactive respondents (55%) reported receiving a sufficiently large amount of free emission allowances to ensure compliance. Thirty-seven per cent of the inactive companies mentioned restrictions on speculation as a reason. These firms stated that they cannot be involved in transactions they regard as speculative businesses or not belonging to their core business activities. Furthermore, the sharp fall in prices seems to be a reason for companies not to sell emission allowances. Twenty-three per cent of the inactive companies indicated that they wait for a better market situation to sell emission allowances. Therefore, the number of companies active on the emission market could increase next year. Roughly 95% of all surveyed companies stated that they were planning to trade EUAs before February 2014.

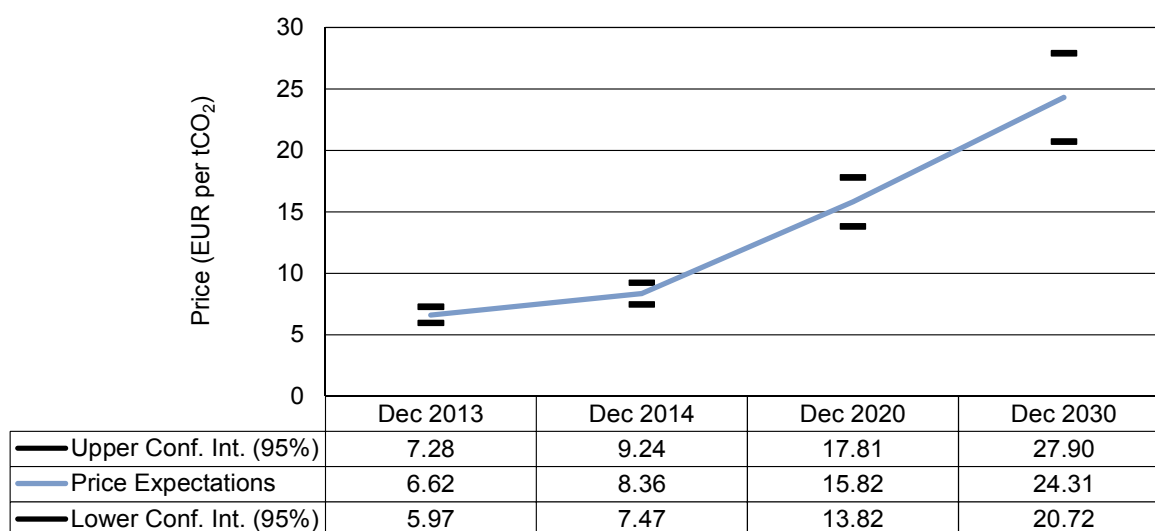


Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 8: Why did your company not trade emission allowances in 2012?

5. Price expectations

During the last year, the increasing oversupply of permits put pressure on the EUA price resulting in a plunge during the second half of the year. While the average price was EUR 13.07 per tCO₂ in 2011, prices fell below EUR 10 per tCO₂ in 2012. Against the backdrop of current market developments, surveyed companies once more revised their price expectations strongly downwards. Surveyed companies expect an average price adjusted for inflation of about EUR 6.62 per tCO₂ by the end of 2013 (cf. Figure 9). This is equivalent to a decrease in firms' price expectations by more than half since the last survey conducted in 2012 (companies on average expected a price of EUR 14.14 for December 2013). In the short run, carbon prices are expected to remain at relatively low levels and to rise moderately at best by the end of next year. Surveyed companies' expectations for the end of 2014 are on average EUR 8.36 per tCO₂. As indicated by the 95% confidence interval, there is considerable consensus in price expectations, at least in the short term. The respondents estimate that the price will range between EUR 7.47 and 9.24 per tCO₂ at the end of 2014.



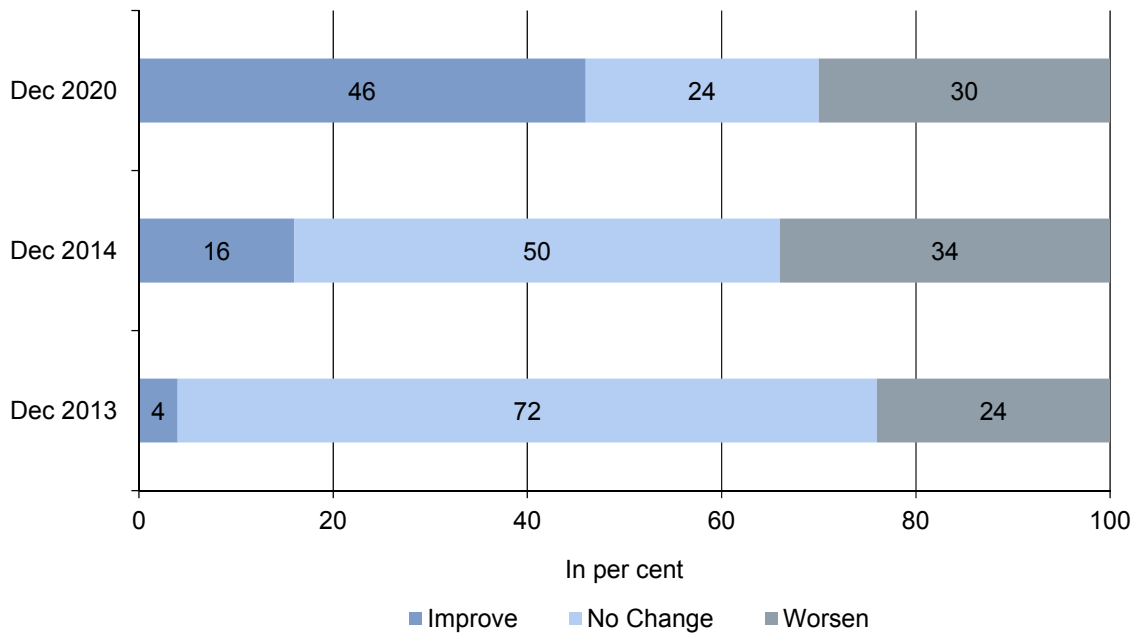
Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 9: Price expectations for EUAs (inflation adjusted)

In the medium term (2020), on the other hand, surveyed companies expect a market recovery combined with a substantial increase in prices. They expect that by December 2020, the last year of the current EU ETS trading period, the price will more than double to roughly EUR 15.82. Considering the 95% confidence interval, the respective range is between EUR 13.82 and EUR 17.81 per tCO₂. The majority of respondents expect prices to increase in the medium term, but the bandwidth of price expectations is higher in comparison to the short-term expectations.

It is notable that respondents expect this positive trend in EUA prices to continue even in the long run after the end of the third trading period in December 2020. On average, they expect a price of approximately EUR 24.31 (inflation adjusted) at the end of 2030, but the bandwidth of predictions is high. As indicated by the 95% confidence interval, respondents assume the price to be in a range between EUR 20.72 and EUR 27.90 per tCO₂. This illustrates that

– despite all uncertainties in the regulatory environment, especially after 2020 – companies in Germany expect emissions trading to continue to be an important instrument for addressing international climate protection targets. The positive trend in companies' medium- and long-term price expectations could be driven by their expectations about the macroeconomic development of the EU. The majority of surveyed companies are optimistic that the European economy will overcome the current crisis (cf. Figure 10).



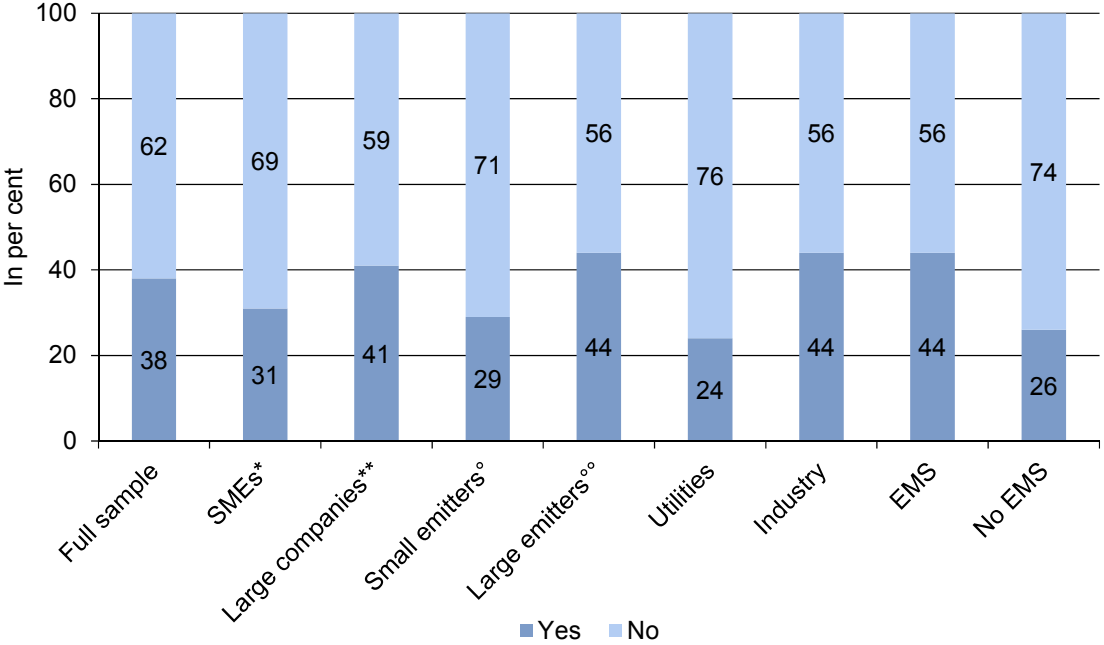
Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 10: Which development do you expect with regard to the macroeconomic situation in the European Union?

Regarding the carbon market, this implies an upward shift in demand for allowances due to higher aggregated demand for goods and services. For 2013 and 2014, the majority of surveyed companies are convinced that macroeconomic activity will remain at the same level. About 4% of all surveyed companies state that they expect the macroeconomic situation in the EU to improve by the end of 2013. Sixteen per cent state that they are convinced that the macroeconomic situation will improve by December 2014. In the medium and long term, companies are more optimistic about the macroeconomic situation within the EU, as 46% of the firms predict a recovery before 2020. The modest expectations about the short-term macroeconomic development are in line with companies' expectations about the development of their production capacity and their carbon emission levels. Roughly 14% of the surveyed firms expect their production capacity to increase in the next five years. Also, only 18% expect their carbon emissions to increase within the next five years.

6. Abatement

The results of the current survey support the hypothesis that the EU ETS has only generated weak incentives for taking measures to reduce carbon emissions. This applies not only to the abatement activities of the regulated firms but also to their awareness of abatement potential and abatement costs. It was found that 62% of the surveyed companies so far have neither assessed their individual abatement potential nor the associated costs. That means that only 38% of the firms are fully aware of costs and benefits of potential technical and organisational solutions for CO₂ abatement. Large companies (≥ 250 employees) and large emitters (≥ 25,000 tCO₂) are more active in assessing carbon abatement than SMEs (< 250 employees) and small emitters (< 25,000 tCO₂). Figure 11 illustrates that 41% of large companies and 44% of large emitters reported conducting a quantitative analysis of their carbon abatement potential and the associated costs. In contrast, only 31% of SMEs and 29% of small emitters so far have assessed their specific abatement potential and the associated costs. This can be explained by the fact that higher sums at stake stimulate the search for abatement solutions. Utilities are less active than firms operating in EU ETS regulated industrial sectors. Furthermore, the data shows that an established environmental management system (EMS) that develops, implements and maintains policies for environmental protection within the firm also increases the level of awareness with respect to abatement solutions. Forty-four per cent of the surveyed firms with an established EMS reported conducting a quantitative analysis of carbon abatement potential and the associated costs. Only 26% of the companies without an established EMS have so far assessed their abatement potential and costs.

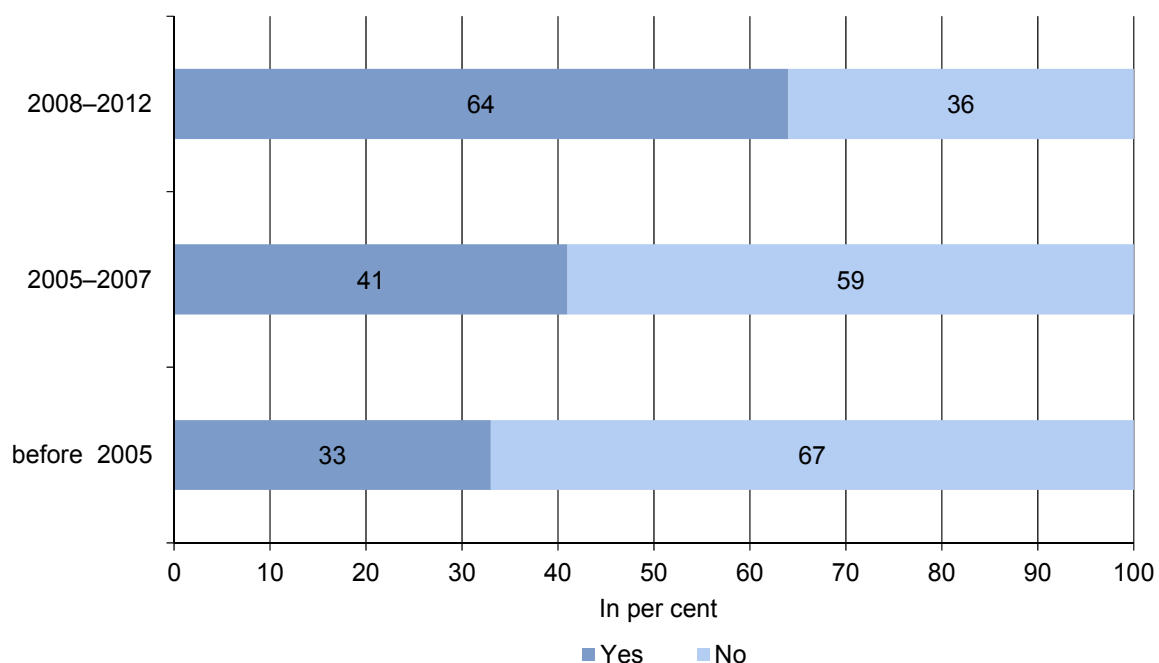


Note: * < 250 employees, ** ≥ 250 employees, ° < 25,000 tCO₂ (2012), °° ≥ 25,000 tCO₂ (2012)

Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 11: Assessment of abatement potential and abatement costs

Thus far, 77% of the surveyed firms have intervened in the production process or invested in order to reduce carbon emissions. Thirty-three per cent of the surveyed companies have already conducted abatement measures before the implementation of the EU ETS in 2005, while 41% of the companies have been active during the first phase of the EU ETS (2005–2007). The highest level of abatement activity has been recorded for the second phase of the EU ETS (2008–2012), during which 64% of the firms included in this study realised organisational or technical abatement solutions (cf. Figure 12). This pattern might be explained by two factors. First, the first phase of the EU ETS is widely seen as a trial period in which firms started to build up capacities in order to deal with this new kind of regulation. This might have also delayed the detection and implementation of carbon abatement solutions. Second, commodity prices peaked in 2008 and drove investments in energy efficiency that entailed carbon abatement.

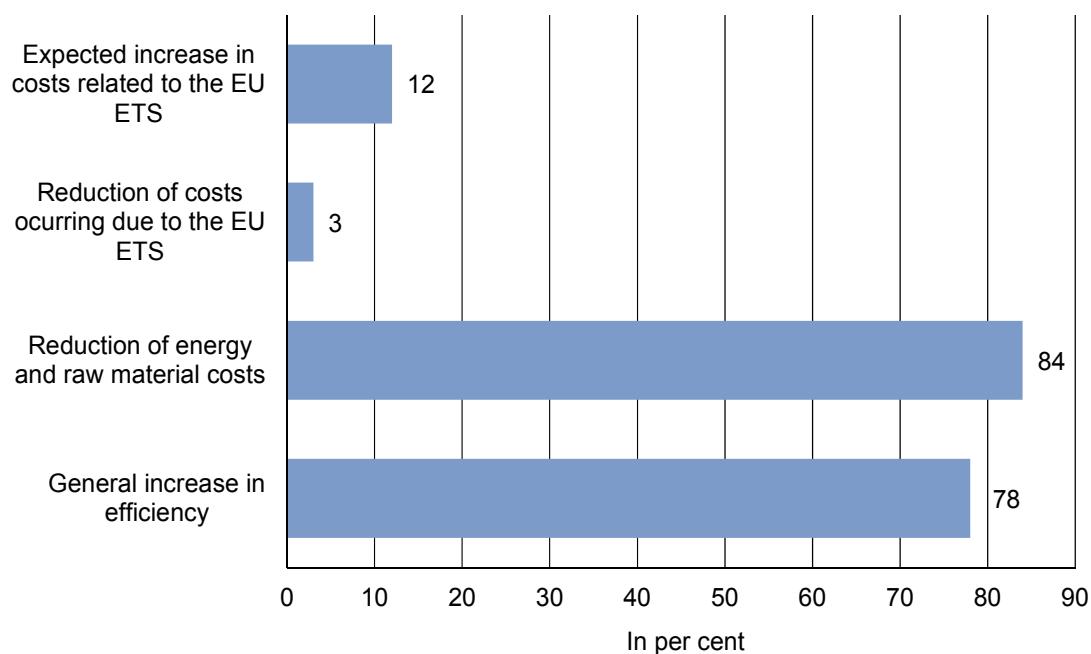


Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 12: When was the carbon abatement activity conducted?

Despite the fact that a high proportion of the firms included in the study have conducted abatement measures by now, the results of the survey suggest that in most cases carbon abatement was not the underlying motivation. Eighty-nine per cent of the active firms reported that carbon abatement was only a side-effect of a measure carried out for other reasons. The main impetus came from targets that focus on general efficiency and energy cost reductions, while costs caused by the EU ETS played a subordinate role (cf. Figure 13). Eighty-four per cent of the active firms rank the reduction of energy and raw material costs among the most important drivers for measures that bring abatement, while 78% see a general increase in efficiency as one of the main targets. Only 3% of the firms reported that reducing costs they incurred due to the EU ETS has been the main reason for being active. However, 12% so far have intervened in the production process or invested in order to be prepared for expected cost increases related to the EU ETS. Against the backdrop of the low

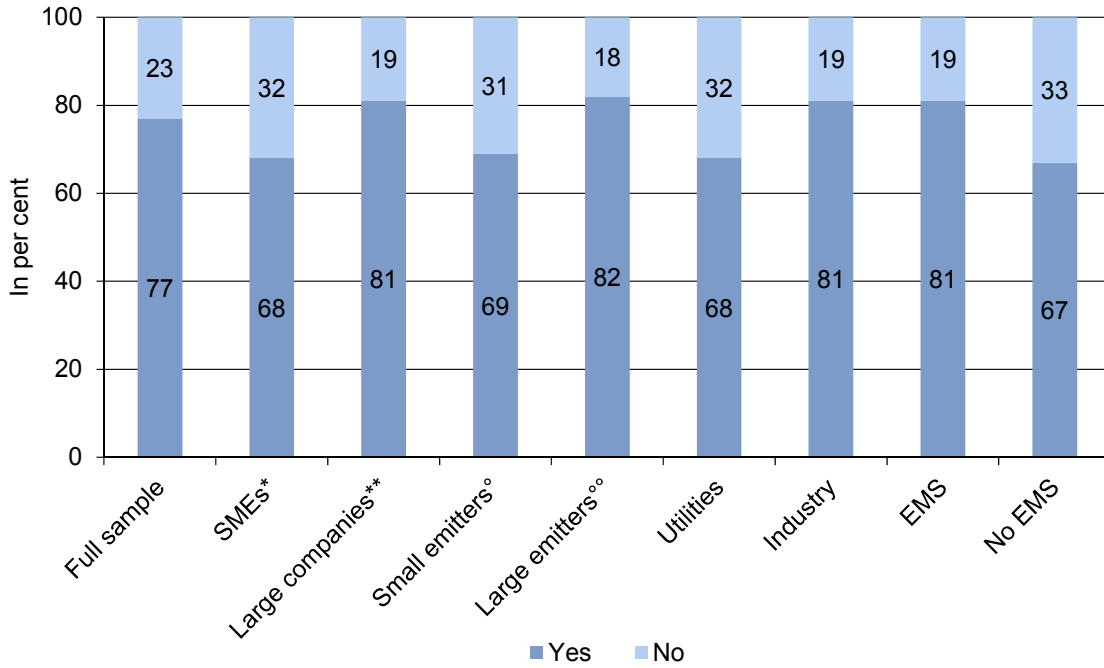
EUA price during the last years and the lack of mid-term goals for the European energy and climate policy, it is not surprising that the EU ETS creates only weak incentives for the regulated firms. The fact that energy prices seem to be an important driver for abatement activities might also explain the high activity during the second commitment period since the prices for primary fuels peaked in 2008.



Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 13: If your company conducted activities contributing to carbon abatement, please name the main reasons for their implementation.

The size of the firm in terms of emissions and number of employees is a factor influencing the decision to reduce carbon emissions (cf. Figure 14). Large companies are more active with respect to CO₂ abatement than smaller firms. In addition to size, sectoral affiliation affects the level of activity. Eighty-one per cent of the firms belonging to the industrial sector have conducted carbon abatement measures, while only 68% of the utilities have taken such actions. An established EMS does not only seem to foster the firms' awareness about technical and organisational measures to reduce carbon emissions, it also seems to increase abatement activities (cf. Figure 11 and Figure 14).

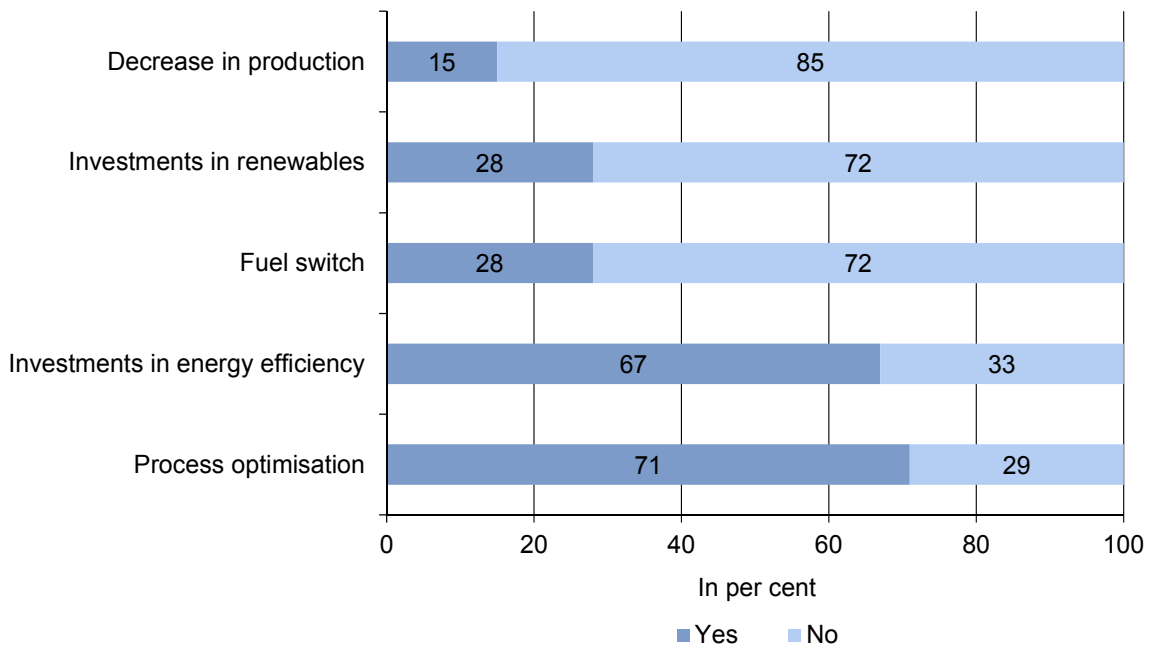


Note: * < 250 employees, ** ≥ 250 employees, ° < 25,000 tCO₂ (2012), °° ≥ 25,000 tCO₂ (2012)

Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 14: Carbon abatement activities

With respect to potential abatement options, process optimisation and investment in energy efficient machinery constitute the most important measures for abatement (cf. Figure 15). These results are in line with the outcomes of the surveys conducted during previous years. Process optimisation comes with relatively lower expenditure than other options. Thus, it is the most plausible action at low EUA prices.

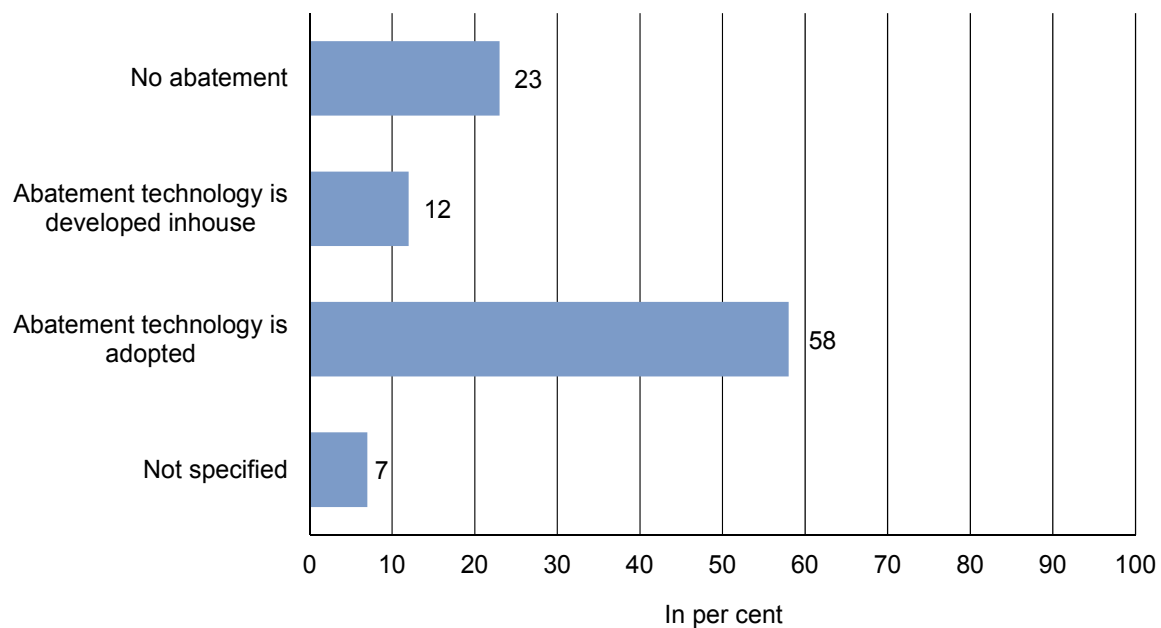


Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 15: Carbon abatement options

Figure 16 provides information on the innovation capacities of the surveyed firms. Fifty-eight per cent of the firms purchased technology that brings abatement to the market, while 12% of the companies implemented internal research and development projects. Accordingly, markets for preventive technologies are an important building block of the decarbonisation of the German economy.

In total, thus far 77% of the firms have conducted abatement measures. However, 66% of the firms plan to change processes or invest in measures that reduce carbon emissions over the next five years. In the past, only 11% of the firms have taken preventive measures during the last years mainly due to incentives created by the EU ETS. In the future, 19% of the firms plan to be proactive with the main target of carbon abatement.



Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

Figure 16: If your company conducted technical carbon abatement activities, did your company develop the corresponding technology in-house or purchase it on the market?

7. Conclusion

High amounts of free allocation, the economic crisis and the extensive purchase of external emission credits during the second phase of the EU ETS led to a high surplus of EUAs. Prices collapsed in late 2012, followed by a continuing decline in early 2013. In April 2013, EUA prices reached a level below EUR 3 per tCO₂.

Carbon emissions in 2012 decreased due to weak economic activity in the euro zone. In comparison to 2011 the emissions of installations regulated by the EU ETS declined by 2% to about 1,867 million tCO₂ in Europe. In contrast, carbon emissions of regulated installations in Germany increased slightly by 0.5% to 452.6 million tCO₂, as low coal prices favoured the burning of coal for electricity generation and the strong winter extended the heating period.

The accompanying increase in price volatility stimulated trading volumes and affected the firms' trading behaviour in 2012. The regulated companies increased their allowance trading activities in comparison to the previous year. The results of the survey show that a higher share of firms (66%) was engaged in the carbon market and that active firms traded more frequently. The remaining firms were inactive, mainly due to sufficient free allocation of EUAs. During the second phase of the EU ETS, the majority of the surveyed firms (78%) had already built up large reserves of EUAs, holding average amounts of about 123% of their verified emissions in 2012. Especially small firms that do not have the capacity to engage in the market actively use their reserves for compliance in order to minimise the frequency of transactions.

In light of recent market developments, companies in Germany have revised their price expectations for EUAs substantially downwards. Nevertheless, surveyed firms expect a market recovery and rising prices in the future. The average price expectations adjusted for inflation for December 2014 and December 2020 are approximately EUR 8 per tCO₂ and EUR 16 per tCO₂, respectively. Despite all uncertainties concerning the regulatory framework of the EU ETS after the end of the third trading period, respondents expect the positive trend to continue even after 2020.

The low EUA price raises doubts about the long-term effectiveness of the EU ETS. For example, at its current level the EUA price may not be able to create incentives for companies to invest in abatement technologies. The results of the survey show that so far about 77% of the firms included in the study carried out investments or changes in their production process that brought about emission reductions. However, high and uncertain energy and raw material costs were the main drivers for 89% of the respondents. Carbon abatement was a positive by-product. Firms intervened in the production process or invested mainly in order to increase their overall efficiency or to reduce energy consumption. Consequently, the EU ETS seems to have only generated weak incentives for taking measures to reduce carbon emissions.

References

- Arbeitsgemeinschaft Energiebilanzen e.V. (AGEB) (2013): "Energieverbrauch in Deutschland im Jahr 2012", March 2013, Berlin.
- Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU) (2013): „Gemeinsame Erklärung zum europäischen Emissionshandelssystem (EU ETS)“, [http://www.bmu.de/themen/klima-energie/emissionshandel/klima-emissionshandel-download/artikel/eu-umwelt-und-energieminister-fuer-reform-des-emissionshandels/?tx_ttnews\[backPid\]=2633](http://www.bmu.de/themen/klima-energie/emissionshandel/klima-emissionshandel-download/artikel/eu-umwelt-und-energieminister-fuer-reform-des-emissionshandels/?tx_ttnews[backPid]=2633), accessed on 19 August 2013.
- Deutsche Emissionshandelsstelle (DEHSt) (2013): "Kohlendioxidemissionen der emissionshandelspflichtigen stationären Anlagen und im Luftverkehr in Deutschland im Jahr 2012", May 2013, Berlin.
- European Commission (EC) (2003): "Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises", notified under document number C(2003) 1422, May 2003, Brussels.
- European Commission (EC) (2009): "Commission Decision No 2010/2/EU of 24 December 2009 determining a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage", notified under document C(2009) 10251, December 2009, Brussels.
- European Commission (EC) (2012): "Report from the Commission to the European Parliament and the Council: The State of the European Carbon Market in 2012", COM/2012/652, November 2012, Brussels.
- European Commission (EC) (2013): "Emissions Trading: 2012 Saw Continuing Decline in Emissions but Growing Surplus of Allowances", IP/13/437, Event Date: 16/05/2013, May 2013, Brussels.
- The Union of Electricity Industry (EURELECTRIC) (2013): "Joint Statement on the EU Emission Trading System", http://www.eurelectric.org/media/83839/BUSINESS%20PRESS%20STATEMENT%20endorsing%20the%202012%20Ministers%20letter%20on%20ETS_FINAL.pdf, accessed on 19 August 2013.
- European Union Transaction Log (EUTL) (2013): Data on Verified Emissions from the EUTL, Status as of 2 April 2013, http://ec.europa.eu/clima/policies/ets/registry/documentation_en.htm, accessed on 27 May 2013.
- Heindl, P. and Lutz, B. J. (2012): "Carbon Management: Evidence from Case Studies of German Firms under the EU ETS", ZEW Discussion Paper No. 12-079, Mannheim.
- Lutz, B. J., Pigorsch, U. and W. Rotfuss (2013): "Nonlinearity in Cap-and-Trade Systems: The EUA Price and its Fundamentals", Energy Economics, forthcoming.
- Point Carbon (2013): "Volume of global carbon market to grow by 14% this year", <http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.2236756>, accessed on 18 July 2013.

Statistisches Bundesamt (Destatis) (2013a): “Production Indices for the Electricity Sector and the Manufacturing Sector (Without Electricity Generation and Construction Industry)”, <https://www.destatis.de/DE/ZahlenFakten/Indikatoren/Konjunkturindikatoren/Konjunkturindikatoren.html>, accessed on 27 May 2013.

Statistisches Bundesamt (Destatis) (2013b): “Bruttoinlandsprodukt 2012 für Deutschland,” January 2013, Wiesbaden.

Statistisches Bundesamt (Destatis) (2013c): “Quarterly Production Survey in Manufacturing, Mining and Quarrying: Production Values”, <https://www-genesis.destatis.de/genesis/online>, accessed on 07 June 2013.

Thomson Reuters Datastream (2013): Thomson Reuters Datastream: Online Subscription Service, accessed on 19 August 2013.

Umweltbundesamt (UBA) (2013): “Entwicklung der spezifischen Kohlendioxid-Emissionen des deutschen Strommix 1990-2011 und erste Schätzungen 2012“, May 2013, Dessau.

Appendix: Structure of the KfW/ZEW CO₂ Barometer – Carbon Edition

The KfW/ZEW CO₂ Barometer has been analysing the situation of German companies regulated under the EU ETS since 2009. The objective of the study is to monitor firm behaviour in carbon markets. The underlying annual survey addresses a broad spectrum of topics related to firm behaviour such as expectations regarding commodity and carbon prices, carbon trading strategies or abatement activities. For that purpose all 884 German firms regulated under the EU ETS were invited to participate in the survey in March 2013. About 30% of the firms operate more than one regulated installation. In order to avoid contacting a firm multiple times, only one responsible installation manager per firm was surveyed. Of the 884 companies, 154 responded to the questionnaire, which corresponds to a response rate of 17%. Emissions data from the Community Independent Transaction Log (CITL) and the European Union Transaction Log (EUTL) were aggregated and merged with the responses of the participating companies. Table A. 1 summarises the most important characteristics of the respondents.

Table A. 1: Characteristics of respondents

| | Population | Respondents |
|---|---------------------------|---------------------------------|
| Companies | 884 | 154 (17%) |
| Installations covered by surveyed firms | 1,856 ⁴ | 550 (30%) |
| Verified emissions 2012 | 452.6 mn tCO ₂ | 298.2 mn tCO ₂ (66%) |

Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

The firms covered by the survey run 30% of the installations and are responsible for approximately 66% of verified emissions of all German companies participating in the EU ETS in 2012. The type of activity that is contained in the CITL/EUTL data base does not allow conclusions about sector classification, so the study surveyed the main goods or services produced by the firm. The results show that about 34% of the participating companies classified themselves as belonging to the energy sector, while about 76% belong to the industrial sector (cf. Table A. 2). Furthermore, the report differentiates between small and large emitters, and SMEs and large enterprises, respectively. Small emitters are firms that emit less than 25,000 tCO₂. This definition follows EU Directive 2009 / 29 / EC (EC, 2009). Large emitters are firms that emit 25,000 tCO₂ or more. Seventy per cent of the respondents are large-size companies with at least 250 employees and 57% are large emitters. The willingness of companies to participate in the survey was lower for small emitters than for large emitters. Twenty-three per cent of the large emitters participated in the survey, but only 13% of the small emitters. Therefore, small emitters are underrepresented in our sample. In total, the emission market is characterised by many small and only a few large emitters. About 90% of the overall verified emissions in 2012 were emitted by only 10% of the regulated firms.

⁴ Includes installations from sectors that are regulated from 2013 onwards (e. g. production and processing of nonferrous).

Table A. 2: Sector classification of surveyed firms (NACE)

| Sector | NACE-Rev. | Share |
|---|------------|-------|
| Energy and / or heat generation (e. g. power supply companies) | 40.1 | 33.6% |
| Food and animal feed, beverage industry | 15 | 6.9% |
| Textile, clothing, leather and leather goods | 17, 18, 19 | 0% |
| Pulp and paper, paper products, printing and publishing | 21, 22 | 10.3% |
| Manufacture of coke, refined petroleum products and nuclear fuel | 23 | 0.7% |
| Chemical industry | 24 | 13.7% |
| Rubber and plastic products | 25 | 0.7% |
| Manufacture of other non-metallic mineral products (glass, ceramics etc.) | 26 | 17.8% |
| Steel and non-ferrous metal production | 27 | 6.9% |
| Metal products | 28 | 0% |
| Manufacture of machinery and equipment | 29 | 0.7% |
| Automobile industry (incl. automobile suppliers) | 34, 35 | 1.4% |
| Office machinery, computers, electrical and optical equipment | 30–33 | 0% |
| Other | – | 7.5% |

Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition

In contrast, the criterion for the differentiation between SME and large enterprises is the number of employees. According to the European Union's definition of SMEs (EC, 2003), SMEs are defined as enterprises with fewer than 250 employees. In general, the sales revenue should also be considered, but the survey does not collect these figures. Table A. 3 shows that there is only a weak correlation between the size of the firms and the amount of carbon they release.

Table A. 3: Sample structure: emissions and number of employees

| | Large enterprises ≥ 250 employees | SME < 250 employees | Total (row) |
|---|--------------------------------------|------------------------|--------------|
| Large emitters ≥ 25,000 tCO ₂ p. a. | n=67 (45%) | n=18 (12%) | n=85 (57%) |
| Small emitters < 25,000 tCO ₂ p. a. | n=38 (25%) | n=27 (18%) | n=65 (43%) |
| Total (column) | n=105 (70%) | n=45 (30%) | n=150 (100%) |

Note: Four enterprises did not provide employment figures.

Source: KfW/ZEW CO₂ Barometer 2013 – Carbon Edition