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Free allocation of emission allowances and CDM/JI credits within the EU ETS

Analysis of selected industries and companies in Germany

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Executive Summary

The first two trading periods of the EU Emissions Trading Scheme (EU ETS) included extensive free allocation of emission allowances.

Since the carbon price is passed on – in an economically rational way – to the electricity price in the electricity production sector, electricity producers were able to reap substantial additional revenue, a significant amount of which results from the free allocation of emission allowances. Taking into account the nuclear fuel tax (to be introduced in Germany from 2011 onwards) which also aims to absorb additional revenue from the EU ETS, the additional revenue for electricity producers from the first and second trading periods of the EU ETS considered in this paper are estimated to amount to € 39 billion (without nuclear fuel tax) or approx. € 34.8 billion (with nuclear fuel tax). The following results arise for the electricity producers selected for this analysis:

- For E.ON the additional revenue amounts to approx. € 12 billion (without nuclear fuel tax) or € 10.3 billion (with nuclear fuel tax);
- For RWE the additional revenue amounts to approx. € 11.3 billion (without nuclear fuel tax) or € 10 billion (with nuclear fuel tax);
- For Vattenfall Europe the additional revenue amounts to approx. € 7.2 billion (without nuclear fuel tax) or € 6.9 billion (with nuclear fuel tax);
- For EnBW the additional revenue amounts to approx. € 6.4 billion (without nuclear fuel tax) or € 5.5 billion (with nuclear fuel tax);
- For Evonik the additional revenue remains unchanged by the introduction of the nuclear fuel tax and amounts to approx. € 2.1 billion for the period from 2005 to 2012.

In the first two trading periods the free allocation of emission allowances to plants of energy-intensive industries which do not fall under the electricity production sector or are not covered by the EU ETS sometimes substantially exceeded the emission levels of these plants. The profits that German companies are able to realise through the sale of surplus emission allowances allocated free of charge can be estimated for 2005 to 2012. The following four industrial companies have profited the most up to now:

- For ThyssenKrupp over-allocation amounts to € 384 million;
- For Salzgitter over-allocation amounts to € 243 million;
- For BASF over-allocation amounts to € 104 million;
- For Heidelberg Cement over-allocation amounts to € 43 million.

In the third trading period over-allocation to industry is to be avoided by means of ambitious benchmarks. In determining the benchmarks for free allocation from 2013 onwards, exceptions should be avoided in order to prevent renewed over-allocation and ensure incentives for structural decarbonisation.

With a view to the long-term transformation of energy-intensive industry and the energy industry it is important that a major share of emission reductions is realised within the EU ETS. As a result project-based credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) should only be used in addition to emission reduction measures in Germany and not instead of them.

In Germany the use of CDM and JI credits within the scope of emissions trading is currently very high. In the period from 2008 to 2020, more than 50% of the reduction effort can be realised using CDM/JI project credits under current regulations compared to 2005 levels. For this reason the option to use such credits within the scheme should not be increased in the transition of the EU to the target of reducing emissions by 30 % up to 2020.

It was possible for the companies considered here to reap extensive additional profits by selling the allowances which they were allocated for free and surrendering cheaper CDM credits to meet their obligation under the EU ETS. As a result the companies under discussion were able to garner profits totalling approx. € 42 million in 2008 and 2009. Based on the quantity of CDM rights that can still be used within the EU ETS, it can be estimated that the companies under discussion will make further profits of approx. € 1 billion by 2020.

Since it is permissible for CDM credits to be used under the EU ETS, plants are allowed to emit more greenhouse gases into the atmosphere in the EU. When environmentally questionable CDM credits are used to meet obligations under the EU ETS, it can lead to an increase in total emissions. It is estimated that at least 83 % of the CDM credits used by German companies in 2008 and 2009 were of questionable environmental integrity (CDM credits from HFC-23 and adipic acid projects). Thus, it is essential that there are tighter rules for CDM projects in the future.

In particular a ban on the use of N_2O and critical HFC-23 projects in the EU ETS should be agreed upon soon so that companies have planning security and can re-direct their investments to useful emission reduction projects in- and outside the EU. Alongside these aspects, assessment of the environmental integrity of CDM projects recognised within the EU ETS should address the question of the extent to which some CDM projects could contribute to the promotion of leakage effects via the de facto subsidisation of production plants geared to the world market.

The current legal regulation enabling companies to be allocated CDM rights free of charge is not useful or helpful. Should the EU decide to increase the quantity of CDM credits in its transition to the 30% reduction target, these rights of use should not be allocated free of charge. The option of the government buying high-quality CDM projects and auctioning off more EU allowances (EUAs) could also be considered.

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1 Introduction

Following its revision, the EU Emissions Trading Scheme (EU ETS), a comprehensive instrument of greenhouse gas pricing, constitutes a key regulatory instrument and a fundamental pillar of EU climate policy for 2012 onwards in terms of scope (almost half the greenhouse gas emissions in the largest economic area in the world) and its time frame (de facto long-term emission reduction targets stretching far beyond 2020).

At the same time the actual implementation of the EU ETS differs from a conventional textbook model of an emissions trading scheme in several key design features. Of the diverse design options the following two aspects are of substantial importance in the long term:

- Discussion of the impact of the EU ETS and particularly the burden of companies in Germany due to emissions trading often overlooks the fact that these companies have received substantial quantities of EU emission allowances (EUAs) for free in recent years within the scope of free allocation. For various reasons the amount of allowances allocated for free in the first and second trading periods of the EU ETS was – and is – sometimes substantially above the actual demand.
- The EU ETS is an open scheme, most notably as a result of incorporating credits from project-based mechanisms – certified emission reduction units (CERs) from the Clean Development Mechanism (CDM) and emission reduction units (ERUs) from Joint Implementation (JI) projects, which can be generated within the framework of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (hereafter UNFCCC). The use of CERs has been increasingly criticised on the basis of the ecological integrity of the projects in question and against the background of the necessary development of a zero emission economy (or more specifically, an ultra low carbon economy). When the use of CERs features too largely in the emission reduction commitments or strategies in Germany and the EU in the short and medium term, the incentives to invest in the transformation of industrial society (which is unavoidable in the long term) at an early stage decrease. As a result the long-term development of an ultra low carbon economy becomes either impossible or leads (later) to substantial additional costs.

Within the scope of this study, different analyses are presented on the two aspects mentioned above. The analyses are geared to the following questions:

- How does the amount of free allocation to important industries or representative companies of specific industries for the first two trading periods of the EU ETS (2005-2007 and 2008-2012) compare to the actual emission levels?
- How is free allocation to be classified in terms of the monetary value of emission allowances?

- In what quantity have CDM and JI credits been used by important industries and representative companies of certain industries to meet their obligations under the EU ETS?
- How is the use of project-based credits from the flexible mechanisms to be classified economically?
- What projects did the submitted credits stem from and how is the ecological integrity of these projects or the contribution of these projects to the sustainable transformation of the energy systems of developing countries to be classified?

For both analyses Öko-Institut's database for emissions trading was analysed. The comprehensive data found in this database includes the following:

- Allocation data for plants covered by the EU ETS from the European emissions trading register (Community Independent Transaction Log – CITL);
- Emission data for the plants covered by the EU ETS from the European emissions trading register (Community Independent Transaction Log – CITL);
- Data on the submission of credits from the flexible mechanisms of CDM and JI (CERs and ERUs) with regard to their submitted quantities and the serial numbers of the respective credits;
- Data from the CDM database of the UNFCCC Secretariat (incl. the projects connected to the serial numbers of the CERs);
- Data from the JI database of the UNFCCC Secretariat (incl. the projects connected to the serial numbers of ERUs);

All data used for analyses presented in this paper are therefore based on transparent and publicly available databases of the EU ETS and the UNFCCC.

2 Monetary value of free allocation within the framework of EU Emissions Trading Scheme

2.1 Monetary value of free allocation differentiated by EU ETS sector

The verified emissions data of all plants covered by the EU ETS for the previous year have been published by the European Commission in the CITL in the spring of each year since 2006. After the free allocation to plants covered by the EU ETS has been completed, the free allocation of emission allowances planned for each year of the trading period is published in the CITL at the beginning of that trading period.[1]

Table 1: Verified emissions of and free allocation to plants covered by the EU ETS in Germany, 2005 – 2009

Sector		Verified emissions					Free allocation					Difference
		2005	2006	2007	2008	2009	2005	2006	2007	2008	2009	2005-2009
		Mt CO_2 eq.					EUA (in millions)					
1	Combustion installations	372.5	373.7	380.0	368.3	338.6	381.0	382.5	384.8	257.5	259.9	-167.5
2	Refineries	29.7	28.8	28.7	27.2	26.5	28.7	28.9	28.4	27.7	27.7	0.7
3	Coking plants	2.9	3.2	3.3	3.2	2.7	3.6	3.6	3.6	1.9	1.9	-0.6
4	Roasting & sinter plants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Iron and steel	30.5	32.1	33.0	33.2	24.4	33.6	33.7	33.7	58.5	58.5	64.8
6	Cement clinker and limestone	28.5	29.2	31.1	29.0	25.5	32.3	32.5	32.9	29.9	30.6	15.0
7	Glass	4.0	4.0	4.0	4.3	3.9	4.7	4.7	4.7	4.4	4.6	2.9
8	Ceramics	1.8	1.9	1.9	1.4	1.2	2.5	2.5	2.2	2.0	2.0	3.0
9	Paper and pulp	5.1	5.3	5.3	6.0	5.4	7.1	7.1	7.1	6.8	7.1	8.1
99	Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		**475.0**	**478.0**	**487.1**	**472.7**	**428.2**	**493.5**	**495.5**	**497.3**	**388.8**	**392.3**	**392.3**

Source: European Environment Agency (2010b)

In Germany approx. 470 Mt CO_2 are covered by the EU ETS (Table 1). Differentiated according to the ten emission trading sectors in the CITL, the following results arise:

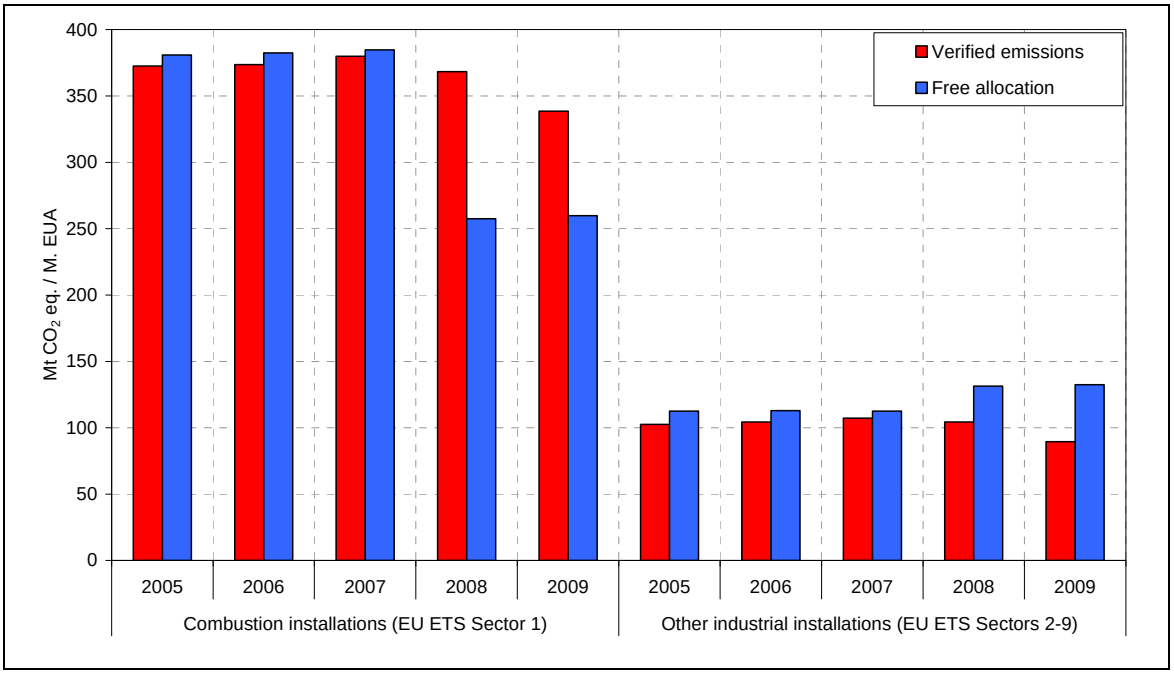
- Almost 80% of emissions stem from combustion installations, including electricity production plants.

[1] As a rule the total quantity of emission allowances allocated for free in the trading period overall are distributed equally over the years of the trading period and are issued to the plant operators in yearly instalments.

- Approx. 6% of emissions come from the iron and steel, cement and lime, and refinery sectors respectively.
- The shares of the remaining sectors are under 1% in each case.

Following a slight increase in the CO_2 emissions covered by the EU ETS in Germany between 2005 and 2007, emissions substantially decreased in the course of 2008 and 2009. It is likely that this fall in emissions, which was strongest in 2009, is chiefly due to the economic crisis. All sectors covered by the EU ETS are affected by the decrease in emissions, though to different degrees.

Figure 1: Free allocation and verified emissions of combustion installations (EU ETS Sector 1) and other industrial sectors (EU ETS Sectors 2 – 9) in Germany, 2005 – 2009



Source: European Environment Agency (2010b)

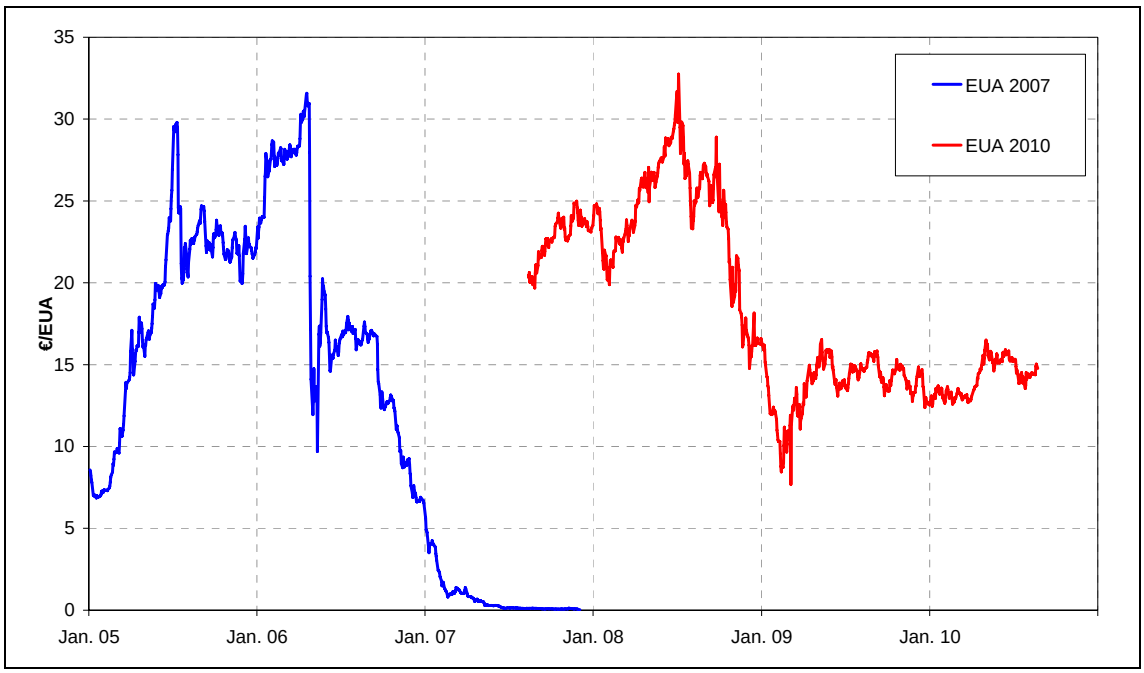
In the above-mentioned sectors of the EU ETS, the plant operators received allowances via free allocation for the first two trading periods of the scheme (Figure 1). The quantity and spread of free allocation amongst the sectors sometimes differ radically between the first (2005-2007) and the second (2008-2012) trading periods:

- In particular free allocation to combustion installations decreases from 2008 onwards as the quantity of free allocation to electricity production plants (which feature strongly in this sector) was substantially reduced when new allocation rules were introduced for the second trading period of the EU ETS.
- By contrast free allocation to the industrial sectors in Germany (according to the sector structure of the EU ETS) has largely remained constant. The only excep-

tion is the iron and steel sector, for which free allocation significantly changed in the case of blast furnace gases in the second trading period.[2]

The free allocation of emission allowances has a monetary value for the respective plant operators. This value is derived from the quantity of free allocation and the price of emission allowances.

Figure 2: Price development of emission allowances in the EU ETS, 2005 – 2010



Source: Point Carbon

There have sometimes been substantial fluctuations in the allowance price in the past (Figure 2). The high volatility of allowance prices in the first emissions trading period above all stems from the substantial over-estimation of emission levels under the EU ETS (which led in turn to an over-allocation of emission allowances). After verified emissions data were published for the first time in April 2006, there was a huge collapse in the price of carbon as a result. Within a few days it fell from above 30 €/EUA to approx. 15 €/EUA. At the end of the first trading period an emission allowance cost –

[2] Blast furnace gases arising as a by-product in iron and steel production (i.e. EU ETS Sector 5) are sometimes used in plants falling under Sector 1 (combustion installations) or Sector 3 (coking plants) of the EU ETS. In the first trading period free allocation for blast furnace gases was issued to the plants in which CO_2 emissions from the use of blast furnace gas are released (emitted) into the atmosphere (i.e. to the combustion installations and coking plants). In the second trading period the free allowances were issued to the plants in which the blast furnace gases arise (i.e. above all to blast furnaces, and therefore the iron and steel sector). As a result the quantity of free allowances allocated free to the iron and steel production sector in the second trading period increases significantly.

against the background of the lack of banking options to the second trading period – only a few EUR cents.

Since the emission allowances of the first trading period could not be carried over to the second, the allowance prices developed in the second trading period independently of the development undergone in the first period. The price fluctuations observed in 2008 were greatly influenced in the beginning by the general boom of the commodity markets and the nascent economic crisis. Many industrial companies curbed production in the last quarter of 2008, which in turn led to substantial decreases in emissions; in 2009 emissions were lower than in previous years. These developments naturally led to falling or strongly reduced carbon prices.

Table 2: Average prices of emission allowances in the EU ETS (EUAs) and CDM project-based credits (CERs), 2005 – 2010 and projections for 2011 and 2012

	Historic prices						Projection	
	2005	2006	2007	2008	2009	2010	2011	2012
	€							
EU allowance (EUA)	22.09	17.33	0.66	17.38	13.21	14.02	15.00	15.00
CDM credit (CER)				15.72	12.16	9.67	10.00	10.00
Difference				1.66	1.05	4.35	5.00	5.00
Comment: The historic average prices revert to the spot closing price at the end of each trading day. The average for 2010 includes all prices until mid-September 2010.								

Source: EEX, Point Carbon, estimations by Öko-Institut

To calculate the monetary value of free allocation, the average spot market prices for emission allowances between 2005 and 2010 were applied (Table 2). For 2011 and 2012 the price is assumed to be € 15, which is slightly above the average price of the last six years (€ 14.11).

The overview of the monetary value of free allocation shows that in eight years of the EU ETS plant operators are allocated allowances worth approx. € 50 billion free of charge (Table 3). Approx. 70 % of free allocation (€ 35 billion) is granted to combustion installations; the second largest allocation in monetary terms (€ 6 billion) goes to the iron and steel industry (12 %).

Table 3: Monetary value of free allocation, 2005 – 2012

Sector		2005	2006	2007	2008	2009	2010	2011	2012	Total
		€ (in millions)								
1	Combustion installations	8 416	6 628	252	4 475	3 432	3 644	3 898	3 898	34 643
2	Refineries	635	501	19	482	366	389	416	416	3 224
3	Coking plants	79	62	2	34	26	27	29	29	288
4	Roasting & sinter plants	0	0	0	0	0	0	0	0	0
5	Iron and steel	743	583	22	1 016	773	821	878	878	5 715
6	Cement clinker and limestone	713	563	22	520	403	428	458	458	3 566
7	Glass	103	81	3	77	61	65	69	69	528
8	Ceramics	55	44	1	35	26	28	30	30	249
9	Paper and pulp	157	124	5	118	93	99	106	106	807
99	Other	0	0	0	0	0	0	0	0	0
Total		**10 902**	**8 586**	**326**	**6 756**	**5 181**	**5 501**	**5 884**	**5 884**	**49 022**

Comment: For the years 2010 to 2012 the free allocation for the year 2009 was used.

Source: EEA (2010b), EEX, estimations by Öko-Institut

2.2 Monetary value of free allocation for selected companies in Germany

In the following the analysis will concentrate on the economic dimension of free allocation granted to the companies selected for this study. The five largest electricity production companies in Germany and the two companies with the highest emissions within each of the four industrial sectors were chosen. The selected companies are as follows:

- **Electricity production**: E.ON, EnBW, RWE, Vattenfall and Evonik.
- **Iron and steel**: ThyssenKrupp and Salzgitter AG.
- **Refineries**: Shell and Ruhr Oel/BP.
- **Chemical products**: BASF and EvonikDegussa.
- **Cement**: Heidelberg Cement and Dyckerhoff.

For the analysis only the plants located in Germany belonging to the specified companies are considered. The emissions of and free allocation to joint venture power plants such as those in Veltheim, Mehrum and Kiel are attributed to the companies according to their share of ownership in each case. Similarly, the companies Hüttenwerk Krupp-

Mannesmann (HKM) (50% ThyssenKrupp, 30% Salgitter AG)[3], the refineries in Schwedt (37.5% Ruhr Oel and 37.5% Shell), Karlsruhe (32.25% Shell, 24% Ruhr Oel) and Bayernoil Ingolstadt (25.5% Ruhr Oel, 10% BP)[4] are also categorised according to the respective shares of ownership.[5]

In the context of iron and steel production, there is the particular problem of blast furnace gases to consider. Such gases are chiefly produced in blast furnaces. However, the release of CO_2 emissions into the atmosphere (according to the legal definition of "emission" applied within the framework of the EU ETS) sometimes occurs first in the power plants to which the blast furnace gas is transferred where it is used as a fuel to produce electricity. For the second trading period (2008 to 2012) the blast furnace operators received both free allocation for their own emissions as well as allocation for the blast furnace gas utilised in the (external) power plants. If only the direct plants of the iron and steel production (i.e. usually blast furnaces) are taken into account, it can be seen that this rule is leading to a distortion in the iron and steel production sector. Therefore the power plants in which the blast furnace gas is used are consistently considered together with the blast furnaces in the analyses undertaken here. For this reason two power plants which are actually operated by RWE are added to the balances for ThyssenKrupp and HKM.

Overall the 13 selected companies represent two thirds of the CO_2 emissions in Germany covered by the EU ETS, amounting to 320 Mt CO_2 on average each year (Table 4). The majority of emissions – more than 100 Mt CO_2 – are attributed to RWE. All five electricity producers were granted free allocation that is below the verified emission levels; they had and have to purchase additional CO_2 credits on the market as a result. In contrast the allowances allocated to industrial companies for free exceeded the respective emissions overall. The only exception in this regard is Ruhr Oel/BP, for whom the total quantity of free allocation was slightly below historical emissions.

The allocation to companies falling under Sectors 2 - 9 of the EU ETS has largely remained constant. This also holds for the two companies of the iron and steel industry for which there are no further differences in the systematically consistent categorisation of plants according to the site of blast furnace gas production. The lower allocation to the two cement companies in the second trading period is chiefly explained by the shutdown of cement plants which were then no longer eligible for free allocation.

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[3] http://www.hkm.de/download/hkm-steel-das-sind-wir.pdf

[4] http://www.mwv.de/cms/front_content.php?idcat=24

[5] Ruhr Oel GmbH is a joint venture of BP and Petronas, Venezuela's state oil company. BP is sometimes the sole owner of refineries, e.g. the Emsland refinery in Lingen, Germany. BP also holds production capacities indirectly over a share in Ruhr Oel. In order to simplify the analysis the outright ownership of BP was analysed in conjunction with its ownership share in Ruhr Oel and summarised under "Ruhr Oel / BP".

Table 4: Verified emissions and allocation of companies subject to the EU ETS in Germany, 2005 – 2009

Sector/Company	Verified emissions					Free allocation					Difference
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009	2005-2009
	Mt CO_2 eq.					EUA (in millions)					
Electricity production											
E.ON	42.1	43.9	45.9	42.8	37.0	41.3	41.3	43.5	29.9	29.9	-25.8
ENBW	16.6	16.8	16.4	14.6	13.0	15.5	15.5	15.5	11.0	11.0	-8.9
RWE	109.8	108.4	112.6	105.6	101.5	109.8	109.8	109.3	57.4	57.8	-93.8
Vattenfall	69.8	67.9	68.8	67.1	65.3	71.5	71.5	71.5	42.6	42.7	-39.0
Evonik	28.3	29.8	32.3	26.1	22.1	27.1	27.1	27.1	20.5	20.7	-16.1
Iron and steel											
ThyssenKrupp	21.7	21.5	22.2	22.6	15.6	24.0	24.3	23.8	24.0	24.0	16.6
Salzgitter	9.3	9.8	10.0	10.0	7.3	10.2	10.2	10.2	12.0	12.0	8.1
Refineries											
Shell	9.7	9.3	9.3	9.4	8.9	9.5	9.5	9.5	9.5	9.5	0.7
Ruhr Oel / BP	9.3	9.0	8.9	9.0	9.0	9.1	9.1	8.9	9.0	9.0	-0.1
Chemical											
BASF	3.4	4.1	4.1	4.5	4.2	4.3	5.2	5.1	5.1	5.1	4.4
Evonik Degussa	0.4	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.5
Cement											
Heidelberg Cement	4.5	4.7	4.9	4.6	4.4	5.5	5.5	5.5	4.9	4.6	2.8
Dyckerhoff	2.2	2.2	2.3	2.2	1.9	2.8	2.8	3.1	2.2	2.2	2.3
Total	**327.2**	**328.0**	**338.1**	**319.1**	**290.6**	**331.0**	**332.2**	**333.5**	**228.8**	**229.1**	**-148.3**

Source: CITL, classification by Öko-Institut

Table 5: Monetary value of free allocation to selected companies in Germany, 2005 – 2012

Sector/Company	2005	2006	2007	2008	2009	2010	2011	2012	Total
	€ (in millions)								
Electricity production									
E.ON	912	716	29	520	395	420	449	449	3 889
ENBW	342	268	10	191	146	155	165	165	1 442
RWE	2 426	1 903	72	998	763	810	866	866	8 704
Vattenfall	1 580	1 240	47	741	564	599	641	641	6 051
Evonik	599	470	18	357	273	290	310	310	2 628
Iron and steel									
ThyssenKrupp	529	421	16	418	318	337	361	361	2 760
Salzgitter	224	176	7	209	159	169	181	181	1 306
Refineries									
Shell	209	164	6	164	125	133	142	142	1 085
Ruhr Oel / BP	201	158	6	156	119	126	135	135	1 036
Chemical									
BASF	96	89	3	88	67	71	76	76	566
Evonik Degussa	11	9	0	10	7	8	8	8	62
Cement									
Heidelberg Cement	121	95	4	85	61	65	70	70	570
Dyckerhoff	61	48	2	38	29	31	33	33	276
Total	**7 313**	**5 757**	**219**	**3 976**	**3 026**	**3 213**	**3 437**	**3 437**	**30 377**
Comment: For the years 2010 to 2012 the free allocation for the year 2009 was used.									

Source: CITL, EEX, estimations by Öko-Institut

The monetary value of allocation was determined on the basis of the average prices of emission allowances (Table 2) and the allocation to the companies concerned. Overall the 13 companies under consideration received allowances amounting to just above € 30 billion in total, approx. € 23 billion of which were allowances allocated to the five largest electricity suppliers (Table 5).

2.3 Additional revenue and windfall profits

Based on the combination of the substantial free allocation of emission allowances and marginal cost pricing on the electricity markets, the introduction of the EU ETS (and therefore of carbon pricing) has substantially led to windfall profits - especially in the electricity production sector. The costs arising from the obligation to surrender emission allowances under the EU ETS are – from the perspective of opportunity costs and independently of any free allocation – passed through to the wholesale electricity price on the competition-based electricity markets, thereby increasing revenues from electricity production. When a share of the demand for emission allowances is allocated free of charge, the plant operators reap additional profits. In the following "windfall profits" are understood as additional profits resulting from the difference between the (additional) revenue induced by the EU ETS and the actual costs of the purchase of emission allowances.

Diverse assessments have shown that the full CO_2 costs of the marginal power plant are taken into account in pricing on the wholesale electricity market, independently of the level of free allocation (see, for example, Matthes (2008)).

As a result additional profits arise. Further additional profits come about from the additional revenue of existing CO_2-free electricity production plants (above all, renewable energies and nuclear power plants) subject to competition. The introduction of the EU ETS has led to increased revenue for the electricity producers as a result of the pass-through of the CO_2 costs of the price-setting marginal power plant. At the same time the plant operators experienced increased costs resulting from the need to purchase further credits to fulfil their obligation (provided that the quantity of credits to be submitted exceeds the number of allowances allocated for free). The net additional revenue for the electricity producers derives from the balance of the increased turnover and the cost of purchasing additional CO_2 credits. Using Öko-Institut's calculation model (Matthes 2008) the additional revenue was estimated for the first and second trading periods of the EU ETS. The calculations are based on company data for 2008 and 2009 and corresponding CITL data. A typical hedging model is used for the selling of electricity production of the power plants owned by the selected companies.[6] For 2010 to 2012 a continuation of the current electricity production structure is assumed for the selected companies and the price of the average CO_2 credit is assumed to amount to 15 €/EUA.

[6] It is assumed that 5 % of power plant production is sold on spot markets, 20 % in future contracts for the following year, 40 % in future contracts for the year after the next, and 35 % in future contracts for the third succeeding year. This corresponds to the data of Eurelectric (2009) on the typical hedging structure of the Continental European electricity market.

Table 6: Additional revenue accrued by the five largest German electricity producers from the EU ETS (excluding nuclear fuel tax), 2005 – 2012

	Actual data					Projection			
	2005	2006	2007	2008	2009	2010	2011	2012	2005-2012
	€ (in billions)								
E.ON	0.31	0.99	1.87	2.08	1.97	1.96	1.69	1.32	12.17
RWE	0.37	1.09	1.84	2.00	1.65	1.75	1.47	1.08	11.25
Vattenfall Europe	0.22	0.81	1.53	1.09	1.06	1.03	0.86	0.63	7.23
EnBW	0.18	0.52	0.92	1.05	1.07	1.03	0.91	0.74	6.43
Evonik	0.08	0.24	0.46	0.34	0.26	0.28	0.24	0.18	2.08
Total	**1.15**	**3.65**	**6.62**	**6.56**	**6.00**	**6.06**	**5.16**	**3.96**	**39.16**

Source: Estimations and calculations by Öko-Institut

In Table 6 the results of these calculations are summarised. In the first and second trading periods of the EU ETS the five largest German electricity producers are expected to accrue additional revenue amounting to approx. € 39 billion. In the first trading period, the development of additional revenue is influenced both by the high free allocation to electricity production plants (approx. 97 % on average overall) and by the high share of production capacities sold prior to the start of the EU ETS (for which carbon pricing cannot be assumed or only assumed in part). Free allocation falls from 2008 onwards (to an industry average of approx. 65 %), but the substantial price levels for future deliveries of CO_2 credits also have an impact when the hedging model is applied. It is likely that the additional revenue from the EU ETS reached an apex in 2007, when it rose to approx. € 6.6 billion. Nevertheless, the additional revenue still amounts to more than € 5 billion a year in the years up to 2011 and is expected to fall in 2012 – as a result of the carbon price remaining stable at approx. 15 €/EUA up to then – to just under € 4 billion.

For the specified companies in Germany the additional revenue for 2005 to 2012 is estimated at approx. € 12 billion for E.ON, approx. € 11 billion for RWE, approx. € 7 billion for Vattenfall Europe, approx. € 6 billion for EnBW and approx. € 2 billion for Evonik.

These windfall profits were – together with efficiency considerations – a key motivation for the transition to full auctioning of emission allowances for the electricity production sector. As a reaction to the windfall profits of nuclear power plants in Germany, the taxation of nuclear fuel is also planned from January 2011 onwards (this has not been considered in the above calculations). This nuclear fuel tax will absorb approx. € 2 billion in 2011 and a further € 2 billion in 2012 from nuclear power plant operators in Germany (Matthes 2010). Taking into account this fuel tax (which can be regarded as an absorption of windfall profits accrued by nuclear power plants from the introduction of the EU ETS), the following additional revenues result for 2005 to 2012:

- The additional revenue of all electricity producers under consideration decreases from approx. € 39 billion (without nuclear fuel tax for 2011 and 2012) to approx. € 34.8 billion (with nuclear fuel tax in 2011 and 2012);
- The additional revenue accrued by E.ON falls from approx. € 12 billion to € 10.3 billion;

- The additional revenue for RWE falls from approx. € 11.3 billion to € 10 billion on the basis of the introduction of the nuclear fuel tax;
- The additional revenue for Vattenfall Europe decreases from € 7.2 billion to € 6.9 billion due to the nuclear fuel tax;
- The additional revenue accrued by EnBW falls from € 6.4 billion to approx. € 5.5 billion for the total period from 2005 to 2012, taking into account the German nuclear fuel tax;
- The additional revenue for Evonik remains unchanged by the introduction of the nuclear fuel tax and is expected to amount to approx. € 2.1 billion from 2005 to 2012.

The implementation of the EU ETS entailed additional revenue of a significant magnitude for the electricity production sector. However, as a result of the extensive revision of the EU ETS which applies from the third trading period (the cessation of free allocation for electricity production from 2013 onwards) and of the introduction of a nuclear fuel tax in Germany (in 2011), the additional revenue will extensively diminish in the future.

On the basis of current data and information it is much more difficult to determine whether and to what extent the CO_2 costs can be passed through to the prices for the different industry products. Particularly in markets where there is strong price competition with producers from countries outside of the EU, the CO_2 costs can not be included or not entirely be included in the price in all cases. However, even in these cases there can be additional revenue from the EU ETS when the free allocation of emission allowances exceeds the actual emissions.

From 2005 to 2009 the industrial companies considered here (with the exception of Ruhr Oel/BP and Shell in 2005) received free allocation of emission allowances which exceeded the verified emissions of the plants they owned. Overall the selected German companies were able to sell surplus emission allowances worth € 824 million in these years since they did not need them to fulfil their obligation under the EU ETS (Table 7).

Table 7: Monetary value of over-allocation of emission allowances for selected industrial companies, 2005 – 2012

Sector/Company	Basis for calculation of over-allocation								
	Difference of free allocation and emissions					Difference of free allocation 2008/2009 and average emissions 2005-2009			
	2005	2006	2007	2008	2009	2010	2011	2012	Total
	€ (in millions)								
Iron and steel									
ThyssenKrupp	50	48	1	25	112	47	50	50	384
Salzgitter	19	6	0	35	62	38	41	41	243
Refineries									
Shell	-5	3	0	1	7	2	2	2	13
Ruhr Oel / BP	-4	2	0	-1	1	-1	-1	-1	-3
Chemical									
BASF	20	18	1	10	12	14	15	15	104
Evonik Degussa	1	1	0	2	2	2	2	2	12
Cement									
Heidelberg Cement	21	13	0	5	3	0	0	0	43
Dyckerhoff	12	10	1	0	4	1	1	1	30
Total	**114**	**102**	**3**	**78**	**203**	**103**	**110**	**110**	**824**

Source: CITL, Point Carbon, estimations by Öko-Institut

Against this background the balance for the companies under consideration during the first two trading periods of the EU ETS shows that substantial additional revenue was generated (which had a stabilising effect, particularly in economically difficult years with low order levels and therefore also low production).

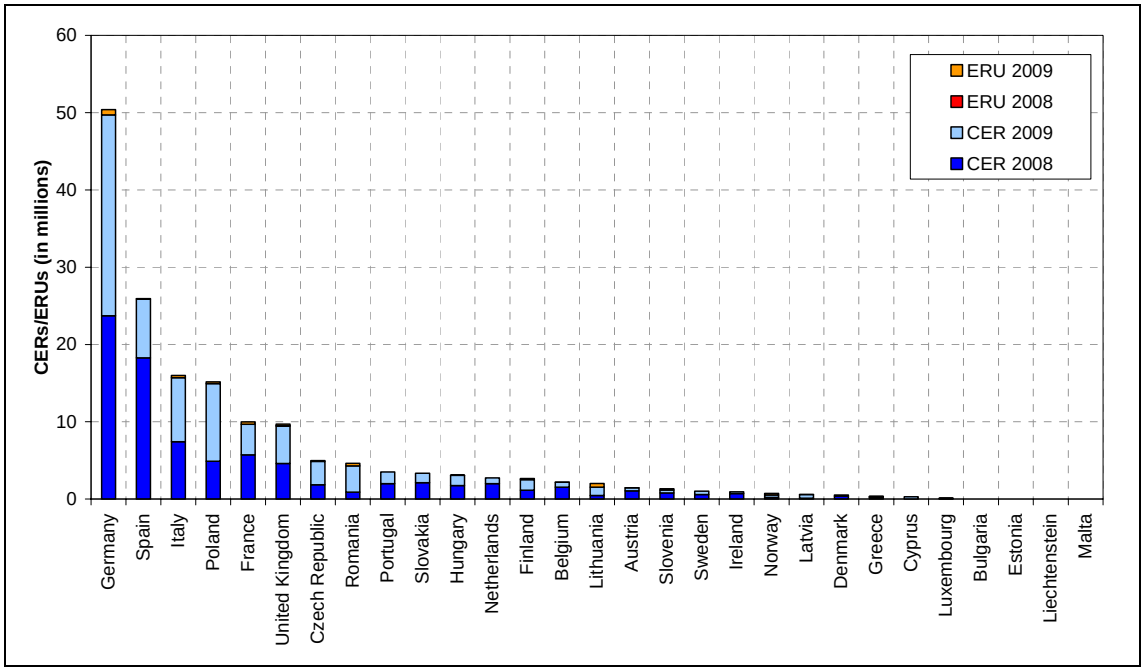
The results of these analyses show the difficulty of determining ex ante a credible allocation level for the free allocation of emission allowances geared to the original objective of free allocation (which was to avoid unfair economic burdens of companies, and thereby also leakage effects). In this context, then, the transition to allocation based on ambitious benchmarks – prescribed within the revision of the EU Emissions Trading Directive – is especially important for the future design of free allocation, provided that no exceptions, partial or otherwise, to the ambitiousness of the benchmarks are permitted for particular industries.

3 The use of credits from project-based mechanisms in the EU ETS

3.1 Use of CDM and JI credits differentiated by EU ETS sector

From the beginning of the second trading period onwards, companies falling under the EU ETS are permitted to use not only emission allowances (EUAs) but also credits from CDM and JI projects (CERs and ERUs) to meet their obligation under the scheme. Compared with other EU countries plant operators in Germany used the largest quantity of credits from project-based mechanisms, submitting in total approx. 50 million CERs and 0.7 million ERUs in 2008 and 2009 (Figure 3). The quantity of credits which companies are permitted to submit in Germany amounts to a share of 22 % of free allocation for 2008 to 2012, which is also the highest share allowed in a Member State.

Figure 3: Use of CDM and JI credits to fulfil the obligation under the EU ETS, 2008 and 2009



Source: CITL

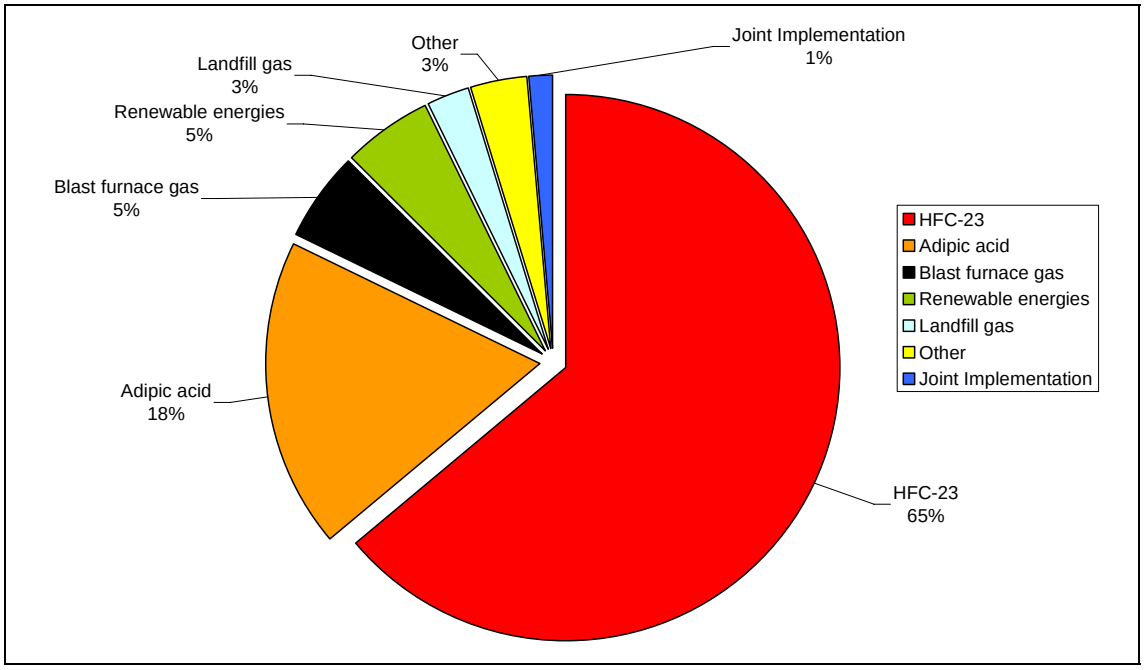
The use of CERs and ERUs by plant operators in Germany increased slightly from 2008 to 2009, rising from 24 million CERs in 2008 to 27 million CERs and ERUs in 2009 (Table 8). The largest increase occurred in the case of combustion installations (EU ETS Sector 1). In the same time frame emissions fell in all emissions trading sectors and allocation remained at the same level (see chapter 2.1). The majority of credits from the project-based mechanisms that were used within the framework of the EU ETS stemmed from CDM projects.

Table 8: Use of CDM and JI credits to fulfil the obligation under the EU ETS, 2008 and 2009

Sector		2008		2009	
		CER	ERU	CER	ERU
1	Combustion installations	10 863 742	0	18 282 355	278 651
2	Refineries	2 410 990	0	533 283	205 723
3	Coking plants	100 000	0	0	0
4	Roasting & sinter plants for metal production	0	0	0	0
5	Iron and steel	6 744 921	0	3 844 340	182 500
6	Cement clinker and limestone	2 550 401	0	2 380 467	0
7	Glass	469 284	0	135 893	4 116
8	Ceramics	134 026	0	328 885	0
9	Paper and pulp	448 377	0	510 221	0
99	Other	0	0	0	0
Total		**23 721 741**	**0**	**26 015 444**	**670 990**

Source: CITL

Figure 4: CERs and ERUs used within the EU ETS according to project type, 2008 and 2009



Source: CITL, UNFCCC

Each credit submitted by companies within the framework of the EU ETS to fulfil their obligation is documented in plant registers. Based on the credit's serial number, the project in which the credits were generated can be identified in the CDM database of the UNFCCC. The entries in the CDM database contain such information as project title, the host country, the method of reduction used and the level of emission reduction. Similarly, the surrendered ERUs can also be tracked in the UNFCCC database for JI projects.

Table 9: Use of CDM and JI credits by emission trading sectors according to project type, sum of 2008 and 2009

Sector		Chemical		Steel	Energy	Waste	Other	Joint Implementation	Total
		HFC-23	Adipic acid	Efficiency improvement	Renewable Energies	Landfill gas			
		CERs/ERUs (in millions)							
1	Combustion installations	**19.44**	**4.57**	**1.39**	**1.75**	**1.16**	**0.84**	**0.28**	**29.42**
2	Refineries	0.84	1.28	0.48	0.04	0.00	0.31	0.21	3.15
3	Coking plants	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.10
4	Roasting & sinter plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Iron and steel	7.20	2.36	0.45	0.30	0.07	0.21	0.18	10.77
6	Cement clinker and limestone	3.47	0.58	0.19	0.48	0.05	0.16	0.00	4.93
7	Glass	0.45	0.13	0.00	0.01	0.00	0.01	0.00	0.61
8	Ceramics	0.31	0.03	0.00	0.01	0.01	0.11	0.00	0.46
9	Paper and pulp	0.35	0.34	0.09	0.10	0.00	0.07	0.00	0.96
99	Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		**32.17**	**9.29**	**2.60**	**2.68**	**1.28**	**1.71**	**0.67**	**50.41**
Share		64%	18%	5%	5%	3%	3%	1%	100%

Source: CITL, UNFCCC

In Germany credits from 233 different CDM projects and 6 JI projects were used in total. These were organised into groups according to the methods applied. A clear pattern can be observed (Figure 4 and Table 9):

- Two thirds of credits originate from HFC-23 projects.
- A fifth of credits stem from adipic acid production plants.
- Approx. 5% of credits stem from the use of blast furnace gases in the steel sector and the increase of the use of renewable energies respectively.

The most important project types in which the credits used by German plant operators under the EU ETS were generated are:

- **Projects geared to abatement of HFC-23 emissions**: HFC-23 is a waste product arising in the production of the refrigerant HCFC-22. HFC-23 is a greenhouse gas which is very harmful to the climate, the specific Global Warming Potential (GWP) of which is 11 700 compared to CO_2 (reference period of 100 years). The corresponding abatement measures are very low-cost; the costs of emission reduction are given as less than 0.5 to 1 €/CER for HFC-23 (Green 2008, Jaeger 2010, CEC 2010b).

- **Projects geared to the abatement of N_2O emissions in adipic acid production**: In the production of the chemical adipic acid, N_2O – a gas harmful to the climate – arises as a by-product. In these projects it is thermally destroyed by an additionally built-in catalyst or by post-combustion. N_2O is also a greenhouse gas that is very harmful to the climate and has a GWP of 310. Green (2008) states that the costs of emission abatement in N_2O projects amount to between 0.3 and 1.8 €/CER.
- **Projects geared to efficiency improvements in steel production**: Energy containing blast furnace gases arise in steel production, which can be captured and used for electricity and heat production. The objective of the projects is to use blast furnace gases for electricity production. According to Green (2008) the abatement costs of these projects lie between 0.5 and 4.4 €/CER. This methodology to use waste heat can also be used for projects in other industrial sectors. However, since the main share of credits submitted in Germany came from the steel industry, the term “blast furnace gases” will be deployed in the following.
- **Projects based on renewable energies**: Within the scope of these projects wind parks, biomass plants, hydroelectric dams or hydroelectric power plants are constructed. Emission-free electricity production replaces fossil electricity production, thereby reducing CO_2 emissions. Green (2008) gives the costs of emission abatement of wind and hydropower projects as approx. 10 €/CER.
- **Landfill gas projects**: Landfill gas arises on landfills due to the decomposition process of sealed waste (methane). This methane is captured and used for electricity production. The costs for landfill gas projects amount to between 1 and 6 €/CER (Green 2008).
- The remaining projects are brought together in the category “**Other**”. Some examples of these projects are:
    - the use of methane from oil sources that would otherwise be flared or released into the atmosphere;
    - the abatement of N_2O emissions in the production of nitric acid and caprolactam;
    - the use of coal mine methane capture, i.e. electricity production on the basis of methane derived from coal mining; and
    - emission abatement in cement plants by changing the mixture of clinker and substitutes, the use of waste heat and less emission-intensive fuels.

3.2 Use of CDM and JI credits by selected companies in Germany

The 13 companies considered in this analysis submitted approx. two thirds of the CDM and JI credits used in Germany, corresponding to a total of 31 million CERs and ERUs for 2008 and 2009. However, two of the 13 companies – Evonik Degussa and Heidel-

berg Cement – have not submitted any CERS or ERUs within the framework of the EU ETS to date.

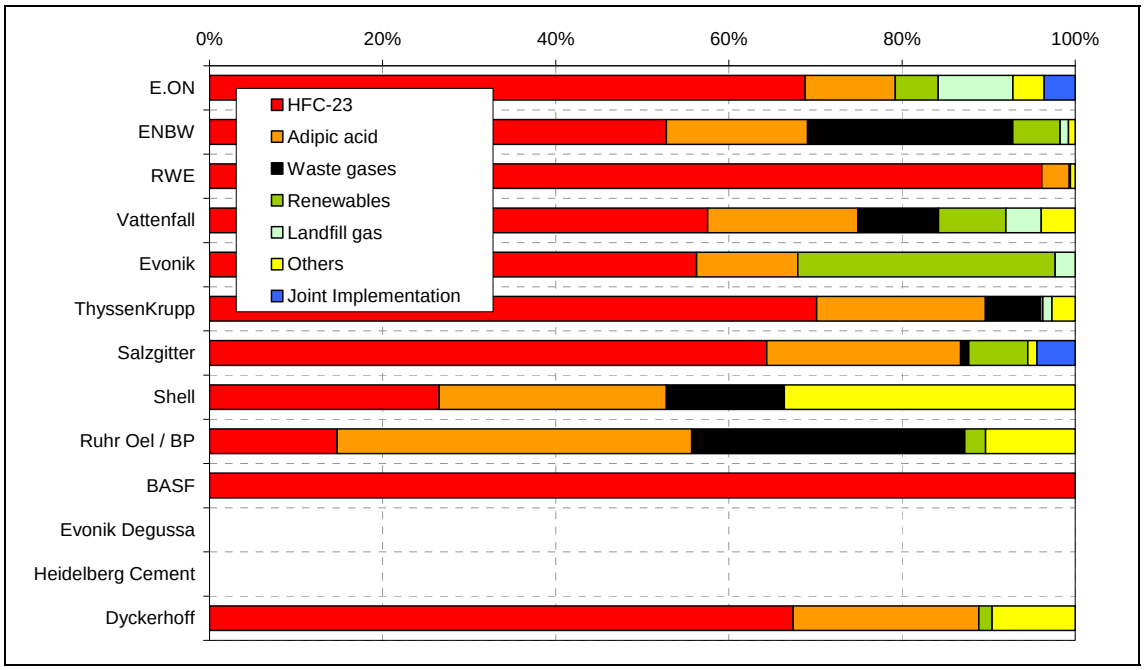
Table 10: CDM and JI credits used by selected German companies within the EU ETS, differentiated according to project type, 2008 and 2009

Sector/Company	Chemical		Steel	Energy	Waste	Other	Joint Implementation	Total
	HFC-23	Adipin acid	Efficiency improvement	Renewable	Landfill gas			
	CERs/ERUs (in millions)							
Electricity production	**12.24**	**2.16**	**1.25**	**0.99**	**0.60**	**0.43**	**0.12**	**17.78**
E.ON	2.23	0.34		0.16	0.28	0.12	0.12	3.24
ENBW	1.35	0.42	0.61	0.14	0.02	0.02		2.56
RWE	4.42	0.15		0.01		0.02		4.59
Vattenfall	3.96	1.19	0.64	0.53	0.28	0.27		6.89
Evonik	0.29	0.06		0.15	0.01			0.51
Iron and steel	7.04	2.14	0.44	0.30	0.07	0.21	0.18	10.38
ThyssenKrupp	4.37	1.21	0.40	0.02	0.07	0.17		6.24
Salzgitter	2.67	0.93	0.04	0.28		0.04	0.18	4.14
Refineries	0.25	0.59	0.44	0.03	0.00	0.21	0.00	1.51
Shell	0.06	0.06	0.03			0.07		0.22
Ruhr Oel / BP	0.19	0.53	0.41	0.03		0.13		1.29
Chemical	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.12
BASF	0.12							0.12
Evonik Degussa								
Cement	0.78	0.25	0.00	0.02	0.00	0.11	0.00	1.15
Heidelberg Cement								
Dyckerhoff	0.78	0.25		0.02		0.11		1.15
Total	20.43	5.13	2.12	1.34	0.67	0.96	0.30	30.94
Share	66%	17%	7%	4%	2%	3%	1%	100%

Source: CITL, UNFCCC

Over half of CDM credits submitted by the companies under consideration (approx. 17.7 million CERs) came from the five electricity producers (Table 10). Vattenfall used the most credits overall by submitting 6.9 million CERs, followed by RWE with 4.6 million CERs. Both of the iron and steel producers considered in this analysis submitted credits in the same order of magnitude: ThyssenKrupp surrendered 6.2 million CERs and Salzgitter 4.1 million CERs. Compared to emissions covered by the EU ETS, i.e. the quantity of credits submitted overall (EUAs, CERs and ERUs), the share of CERs in the iron and steel industry is much higher than for electricity producers: Salzgitter covers 24 % and ThyssenKrupp covers 16 % of the total demand with CERs and ERUs. Of the selected electricity producers EnBW has the highest share of CERs (9 %) surrendered overall in Germany. The company with the highest share of project-based credits related to its own emissions is the cement manufacturer Dyckerhoff with a share of 28 %.

Figure 5: Use of CDM and JI credits according to project type and company in Germany, 2008 and 2009



Source: CITL, UNFCCC

The project types in which the CERs surrendered by the selected companies were generated are very comparable in structure to those surrendered by German companies overall (Table 9). This is of course first and foremost due to the high share of CDM and JI credits surrendered by the selected companies. But even if only those plants not owned by the selected companies are considered, HFC-23 projects are still the most common project type, even though the share (60 %) is a little below that of the plants operated by the selected companies (66 %). The second most common project type is adipic acid production (17 % in the case of plants owned by the selected companies, 21% in the case of other plants in Germany). While blast furnace gas projects are the third most common project type of credits surrendered by the selected companies (7 %), they are ranked the fifth most common project type in the case of other plants in Germany (2 %).

If the surrendered CERs are differentiated by company and analysed, a more heterogeneous picture emerges: there are very large differences between the project types from which the companies in Germany derived their CERs. Overall (i.e. including plants not owned by the selected companies) HFC-23 projects are the most common project type amongst the CERs submitted in Germany. However, amongst the selected companies the share of CERs from HFC-23 projects ranges from 15 % for Ruhr Oel/BP to 96 % for RWE and 100 % for BASF (Figure 5).

The selected German companies derived 17 % of their submitted CERs from adipic acid projects overall. However, considered individually, they did so to very different extents: approx. 41 % of the credits submitted by Ruhr Oel/BP originated from adipic

acid projects while only 3 % of the credits submitted by RWE came from such projects. The shares for the remaining companies lie between 10 % and 26 %.

Likewise, there are very different shares for credits generated within projects geared to the use of blast furnace gas in steel plants. Of the credits submitted by Ruhr Oel/BP and EnBW 32 % and 24 % respectively came from projects in the steel sector. Approx. half of the selected companies drew no credits at all from this sector. For the large steel producers ThyssenKrupp and Salzgitter between 1 % and 6 % of the credits submitted originated from the steel sector. Since these CDM projects ultimately promote the competitiveness of potential competition sites in the steel sector, their use by steel producers within the EU ETS is particularly noteworthy.

In the case of credits derived from renewable energy projects it should be emphasised that Evonik drew 30 % of its demand for credits from CERs generated within renewable projects, while the remaining companies either barely used such credits or did without them all together when fulfilling their obligation. Similarly, there were low shares for the use of CERs generated within landfill gas projects; the largest user of such CERs is E.ON at approx. 9 %.

The use of project-based credits generated within the category “Other” is barely observable for most companies. When they are used, the credits chiefly originate from small projects geared to the efficiency improvement of industrial processes. Shell’s use is salient in this regard: 34 % of their demand is met by such credits, stemming from projects on methane reduction in Mexican pig farms.

The share of projects which satisfy the ecological and social sustainability criteria of the CDM Gold Standard is extremely small. Only two of the companies selected for this analysis (Vattenfall and Dyckerhoff) surrendered credits from two Gold Standard projects. These were both wind power projects in China, each with a capacity of 45 MW.[7] Related to the total quantity of project-based credits submitted by all selected companies, these two CDM Gold Standard projects only correspond to 0.0027 % of the total quantity of credits submitted by the selected companies. In comparison: The HFC-23 project in China with the UNFCCC Ref. Number 306 alone covers a little more than 11 % of the project-based credits submitted in 2008 and 2009.

[7] These are project no. 1318 (Fujian Zhangpu Liuao 45 MW Wind Power Project, China) and no. 1592 (Huadian Ningxia Ningdong Yangjiayao 45 MW Wind Farm Project, China).

Info box: The Gold Standard

The aim of the Gold Standard is to ensure that CDM projects genuinely lead to a reduction in greenhouse gases and contribute to sustainable development in the CDM host country. To this end the additionality assessments are stricter than in the standard procedure for registering CDM projects. Only projects focusing on renewable energy and energy efficiency are incorporated since they contribute to sustainable economic development. Their contribution to sustainable development is assessed on the basis of the possible impact on the environment, and social, economic and technological development. Local stakeholders are extensively informed and engaged during the stakeholder consultation process.

Overall the quantity of credits generated per project is particularly high for HFC-23 projects. At the same time, the number of projects based on renewable energies is substantially higher, yet the respective share of surrendered credits is low overall.

3.3 Monetary value of CDM and JI rights of use

In the second trading period of the EU ETS the plants covered by the EU ETS are allowed to use CDM/JI credits proportionate to a share of 22 % of their free allocation of emission allowances in Germany (ZuG 2012). Since the industrial companies receive higher free allocation than energy providers in relation to emissions, they are also permitted to use more CDM/JI credits.

Of the companies considered in this study, only the electricity producers needed to purchase additional credits in 2008 and 2009 to meet their obligation. For all of the selected industrial companies, free allocation exceeded the emissions subject to the obligation under the EU ETS. EnBW met almost 50 % of their demand for additional credits with CERs in 2008 and 2009 while RWE only covered 5 % of this demand with CERs (Table 11).

Compared to emission levels the shares of project-based credits used within the framework of the EU ETS are far higher for industrial companies than for electricity producers in Germany. In electricity production between 1 % and 10 % of emissions are covered by CERs and ERUs. In industry the share goes up to 28 %. However, two of the industrial companies analysed here (Evonik Degussa and Heidelberg Cement) have not used any CERs or ERUs to meet their obligations under the EU ETS.

Overall German companies have already used a significant share of the budget of project-based credits permitted under the EU ETS up to 2020. In the first two years Dyckerhoff used 47 % of the budget available up to 2020. Similarly, Salzgitter (31 %), ThyssenKrupp (24 %) and EnBW (21 %) have also substantially tapped their respective budgets. The levels are below 15 % for all other companies under consideration.

Table 11: Comparison of use of project-based credits with the demand for additional allowances, verified emissions and the total possible use of project-based credits, 2008 and 2009

Sector/Company	Demand for add. credits for 2008 & 2009	CER/ERU use in 2008 & 2009	Maximum CER/ERU use from 2008 to 2020	Share of CERs/ERUs in demand for add. credits 2008 & 2009	CER/ERU use as share of emissions, 2008 & 2009	Share of CER/ERU budget used to date
	EUA (millions)	CERs / ERUs (in millions)		%		
Electricity production						
E.ON	20.0	3.2	32.9	16%	4%	10%
ENBW	5.6	2.6	12.1	46%	9%	21%
RWE	91.9	4.6	63.4	5%	2%	7%
Vattenfall	47.1	6.9	46.9	15%	5%	15%
Evonik	7.0	0.5	22.7	7%	1%	2%
Iron and steel						
ThyssenKrupp	0.0	6.2	26.5	-	16%	24%
Salzgitter	0.0	4.1	13.3	-	24%	31%
Refineries						
Shell	0.0	0.2	10.4	-	1%	2%
Ruhr Oel / BP	0.0	1.3	9.9	-	7%	13%
Chemical						
BASF	0.0	0.1	5.6	-	1%	2%
Evonik Degussa	0.0	-	0.6	-	-	0%
Cement						
Heidelberg Cement	0.0	-	5.2	-	-	0%
Dyckerhoff	0.0	1.2	2.4	-	28%	47%
Total	171.6	30.9	251.8	18%	5%	12%

Source: CITL, UNFCCC

In the past a difference of € 3 to € 5 can be observed between the prices for EU emission allowances and CDM credits on the carbon markets (Table 2). Over time this price spread has become larger. In Table 12 the economic gain made in 2008 and 2009 by the German companies on the basis of the price spread between EUAs and CERs is shown. Based on the price spread in 2010 and the expected price spread in 2011 and 2012, the revenue which can be made by the companies through their remaining right to use CDM and JI credits will be estimated.

Due to the allocation of the right to use CDM credits to companies, plant operators can generate additional revenue. On the electricity market the electricity price has risen since the implementation of the EU ETS and the full pass-through of the CO_2 costs of the respective marginal power plant. The pricing is based on the value of emission allowances of the EU ETS (EUAs). Electricity producers which surrender cheaper CERs can thereby draw additional revenue from the difference between the price of an EUA and a CER.

Although none of the selected industrial companies were subject to under-allocation in 2008 and 2009 (in which case they would have had to purchase additional credits to meet their obligation under the EU ETS), some of the industrial companies nevertheless submitted a substantial quantity of CERs (Table 11). Therefore it is to be assumed that these industrial companies sold EUAs and purchased CERs at cheaper prices (so-

called “swaps”). This means that industrial companies were also able to draw additional revenue from the (free) allocation of the right to use CDM credits.

Table 12: Quantification of the value of CDM and JI rights of use, 2008 – 2020

Sector/Company	CER / ERU use in 2008 & 2009	Quantity of CERs/ERUs not yet used	Total CER/ERU use, 2008 - 2020	Value of CER/ERU spread realised in 2008 & 2009	Value of CER/ERU spread not yet used	Total
				1.35 € / CER	4.78 € / CER	
	CERs/ERUs (in millions)			€ (in millions)		
Electricity production						
E.ON	3.2	29.7	32.9	4.4	141.9	146.3
ENBW	2.6	9.6	12.1	3.5	45.8	49.2
RWE	4.6	58.8	63.4	6.2	281.1	287.3
Vattenfall	6.9	40.0	46.9	9.3	191.5	200.8
Evonik	0.5	22.2	22.7	0.7	106.0	106.7
Iron and steel						
ThyssenKrupp	6.2	20.2	26.5	8.4	96.7	105.1
Salzgitter	4.1	9.1	13.3	5.6	43.6	49.2
Refineries						
Shell	0.2	10.2	10.4	0.3	48.7	49.0
Ruhr Oel / BP	1.3	8.6	9.9	1.7	41.2	42.9
Chemical						
BASF	0.1	5.4	5.6	0.2	26.1	26.2
Evonik Degussa		0.6	0.6		2.9	2.9
Cement						
Heidelberg Cement		5.2	5.2		25.0	25.0
Dyckerhoff	1.2	1.3	2.4	1.6	6.1	7.7
Total	30.9	220.9	251.8	41.9	1 056.6	1 098.5

Source: CITL, calculations by Öko-Institut

Overall the companies selected for the analysis were able to realise approx. € 42 million of additional revenue in 2008 and 2009 by purchasing cheaper CERs and selling the higher-priced EUAs or by profiting from pricing on the electricity market determined by the price of EUAs. Up to 2020 it can be assumed that the German companies under consideration will be able to generate further profits totalling approx. € 1 billion based on the use of project-based credits within the EU ETS.

3.4 Qualitative categorisation of CDM projects

3.4.1 Basic issues of the CDM mechanism

The Clean Development Mechanism was introduced within the framework of the Kyoto Protocol to the United Nations Framework Convention on Climate Change in order to support sustainable development in developing countries and for industrialised countries to tap low-cost greenhouse gas abatement options. Accordingly the quality of CDM projects can and must be assessed against the background of the mechanism's twin aims:

- To reduce greenhouse gas emissions on a global level, and
- To contribute to sustainable development in the host country.

The emission reduction achieved by a CDM project is inevitably always hypothetical since the actual emissions of a CDM project are compared with a hypothetical reference scenario (baseline) without the CDM project. These hypothetical savings can then be recognised as counting towards actual emission reductions in industrialised countries. Therefore the question of additionality is crucial to the integrity of projects and project-based credits generated on this basis. When a project would have been implemented without the CDM and is nevertheless registered as a CDM project, it ultimately leads to increased emissions on a global level (Schneider 2007). This situation is exacerbated by the interests on the supply and demand side. Neither the seller of CER credits nor the respective buyer has an interest in an overly ambitious baseline; both sides are primarily interested in the low-cost generation of project-based credits. Strict monitoring of projects by third parties is therefore essential.

Fulfilment of the second goal – a contribution to sustainable development of the host country – does not entail financial added value for the investors. No sanctioning is in place to penalise the investors if no contribution is made and as a result the CDM project developers have no financial incentive to support sustainable development (Jaeger 2010). Strict monitoring by an external authority is also necessary here. Such testing lies in the hands of the host countries. Many countries have published testing criteria for sustainable development. However, there are some substantial differences between these criteria and it is often regarded as sufficient when only one criterion is fulfilled.

In the host countries accredited certifying companies – so-called Designated Operational Entities (DOEs) – are responsible for monitoring whether CDM projects are complying with all rules laid down in the Conferences of the Parties to the Climate Change Convention and the CDM Executive Board.

Notwithstanding this, the DOEs are contracted and paid by the project developers. In practice the quality of monitoring carried out by the DOEs is very varied. Intense competition between DOEs and the associated pricing pressure mean that the DOEs have an incentive to keep monitoring costs low (Schneider 2007). The CDM Executive Board has increased its monitoring in recent years and the share of monitored and rejected projects has risen slightly. Of the registration applications received between April 2008 and March 2010, 36 % of projects were automatically registered by the CDM Executive

Board, 57 % of projects were required to make improvements, and 7 % of projects were rejected (Schneider/Mohr 2010). The main reason for these rejections was insufficient proof of the additionality of projects.

Furthermore the CDM can lead to counter-productive incentives for governments to create none of their own rules on the promotion or flanking of projects which are also eligible for registration under the CDM. In the case of such regulations the additionality of the respective projects would no longer apply; the (international) companies interested in CDM project development would naturally try to influence the governments accordingly. A similar situation arises when the governments of CDM host countries levy taxes on all or some CDM credits: the additionality of CDM projects is rendered redundant by national climate protection measures, thereby leading to a decrease in tax revenues.

Finally it should be noted that the generation of CDM credits represents in economic terms an investment subsidy for the respective plants. For those industries subject to international competition CDM projects can result in a counter-productive leakage effect. The aim is to avoid or reduce leakage effects by means of free allocation of emission allowances in the EU ETS or other measures. At the same time leakage trends can, in some sectors at least, be intensified by the de facto subsidisation of corresponding plants in countries not regulated by the EU ETS.

3.4.2 Qualitative categorisation of the most common CDM project types in emissions trading

The use of CDM and JI credits in the EU ETS is quantitatively limited. However, some project types are exempt (EU Directive 2004/101/EC)[8]: CERs and ERUs stemming from nuclear plants and from projects geared to land use, land use change and forestry (LULUCF). Hydroelectric power production project activities with a capacity of over 20 MW are only permitted when the “relevant international criteria and guidelines, including those contained in the World Commission on Dams November 2000 Report "Dams and Development A New Framework for Decision-Making", will be respected during the development of such project activities” (Directive 2004/101/EC).

HFC-23 projects have recently come under criticism from different sides; this criticism has triggered in turn a revision of the baseline methodology (CDM Meth Panel 2010, DNR 2010, eia/CDM watch 2010, Schneider 2007, Jaeger 2010). Nevertheless, 65 % of CDM credits surrendered in Germany in 2008 and 2009 stemmed from this project

[8] Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms.
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:338:0018:0023:EN:PDF

type. HFC-23 is a by-product arising in the production of the refrigerant HCFC-22, which damages the ozone layer and is also a potent greenhouse gas. Under the Montreal Protocol it is now prohibited for HCFC-22 to be produced in industrialised countries; for developing countries a step-wise phase-out of HCFC-22 production by 2040 applies.

The key criticisms levelled against HFC-23 projects are as follows:

- **Counter-productive incentives to increase HCFC-22 production:** Since the costs of HFC-23 destruction are low, the revenue from CDM credits exceeds the revenue from the sale of the refrigerant three to fivefold (eia/CDM Watch 2010). Current assessments show that through these CDM projects an incentive arises to produce more gas harmful to the climate so that more CERs can be subsequently generated. As only those plants built prior to 2000 are eligible under the CDM methodology applied, the production in older plants is supported although it can be assumed that the relation of HCFC-22 to its by-product HFC-23 is worse in older plants than it is in modern plants (CDM Meth Panel 2010). Furthermore HFC-23 projects under the CDM counter-act the aim of the Montreal Protocol since the CDM creates counter-productive incentives to increase the production of HCFC-22.
- **No contribution is made to sustainable development in the host country and to the necessary long-term transformation of the energy system:** Since HFC-23 is not an air pollutant, the abatement of HFC-23 does not contribute to an improvement of the local environment. Added social benefits are also not expected. Moreover, no significant employment opportunities are created and the competitiveness of industry is also not improved. Although a new technology is used, it is in most cases neither innovative nor unfamiliar to the host country.

Through the abatement of N_2O emissions in **adipic acid production** (18 % of CDM credits surrendered in Germany in 2008 and 2009 originated from this project type) no significant contribution is made to sustainable development in the host country. Neither the local environment, not the competitiveness of local industry is enhanced; significant employment opportunities are also not created (Schneider 2007, Jaeger 2010). Like HFC-23 destruction, N_2O emissions can also be abated at very low cost. As a result of the CDM, substantial additional revenue can be realised, thereby lowering production costs in newly industrialising countries compared to the production costs in the EU. During the economic crisis companies in the EU complained of problems with capacity utilisation and a plant was shutdown in Great Britain, yet the production in plants of newly industrialising countries did not fall (BASF 2009). Schneider et al (2010) show that there is a high probability that the CDM has led to the re-location of production from the EU to countries without comparable emission reduction targets. This leads to an increase in global emissions. In the context of adipic acid production, credits have been issued for reductions that were not real because without the CDM project the production probably would have occurred in a country with a fixed cap on emissions. In one of its communications the EU Commission has also addressed the problem of the

relocation of HCFC-22 and adipic acid production from Annex 1 countries to Non-Annex 1 countries in an effort to generate revenue through the CDM (CEC 2010b).

The efficient use of **blast furnace gases** arising in steel production is a given in Germany and the EU (5 % of CDM credits surrendered in Germany in 2008 and 2009 stemmed from this project type). On the basis of blast furnace gases electricity is produced which can be sold; thus, it has an economic value. As a result it is questionable whether these measures would not have been implemented in India and China without the CDM. Since the question of additionality is a very difficult one, there is inevitably a danger that more credits are being issued than emissions additionally reduced. It is striking that both companies from the iron and steel sector selected for this analysis – ThyssenKrupp and Salzgitter – surrendered CDM credits from steel plants since they are thereby improving the competitiveness of plants in newly industrialising countries with which they themselves are in competition.

Projects based on the use of **renewable energies** generally have substantial advantages (5 % of the CDM credits surrendered in Germany in 2008 and 2009 originated from this project type). They make a contribution to the transformation of energy supply in the host country and thereby also to sustainable development. However, as is the case with all CDM projects, it is difficult to prove whether these projects would have been implemented without the CDM. Currently almost all projects involving the building of new wind power plants and hydroelectric and gas power plants in China apply to be registered as CDM projects. If additionality was a given in all cases, it would mean by implication that in the absence of the CDM there would be no investment at all in these projects – an assumption which does not seem very plausible given, for example, China's current dynamism in this area (Jaeger 2010). In addition, the CDM can lead to a situation where newly industrialising countries do not introduce their own policies and measures on the increase of renewable energies since, for instance, a Chinese support program would mean that no further CDM projects would be possible in this sector.

With the revised Emissions Trading Directive some projects are exempt from use under the EU ETS from 2013 onwards. The EU Commission is preparing to publish its proposals for these exemptions at the end of 2010 and will focus above all on "industrial gas projects" (presumably all projects involving HFC-23 and some N_2O). A comitology decision will then be passed. In comitology a regulation is passed by the Member States on the basis of the EU Commission's proposal. Further restrictions on project types may apply. More CDM project types should be excluded in the future to improve the environmental integrity of the EU ETS and the CDM. In particular the promotion of the building of new coal-fired power plants (so-called supercritical coal-fired power plants are eligible under the CDM as of 2008) by the CDM does not seem useful. Furthermore stricter assessment of additionality generally (e.g. in the case of large hydroelectric power plants, the use of blast furnace gas capture, the use of landfill gas capture, other renewable energies) seems helpful and necessary.

4 Estimation of the total use of project-based credits up to 2020

In this chapter the possible use of CDM and JI credits is estimated up to 2020. In Article 11a of the revised Emissions Trading Directive 2009/29/EC a complex mechanism was established by means of which the right to use CDM credits is allocated to plants. Using a model developed by Öko-Institut on the basis of CITL data, the CDM credits surrendered by German plant operators up to 2020 are calculated (Table 13).[9] Three groups of plants can be distinguished: incumbents, new entrants commencing operation in the second trading period and new entrants commencing operation in the third trading period.

Table 13 Use of CDM and JI credits within the EU ETS in Germany, 2008 – 2020

Group of installations	**Explanation**	**Total possible use of project-based credits, 2008 - 2020** CERs/ERUs (in millions)
Incumbents	22 % of free allocation	430
New entrants 2nd period	22 % of free allocation (= reserve)	24
New entrants 3rd period	4.5 % of emissions	12
Total		**466**

Source: CITL, calculations by Öko-Institut

Incumbents who commenced operation prior to 2008 are allowed to use CDM/JI credits between 2008 and 2020 corresponding to 22% of their allocation in the second trading period. In the following the allocation for the second trading period is projected on the basis of allocation for 2008 and 2009 as published in the CITL.

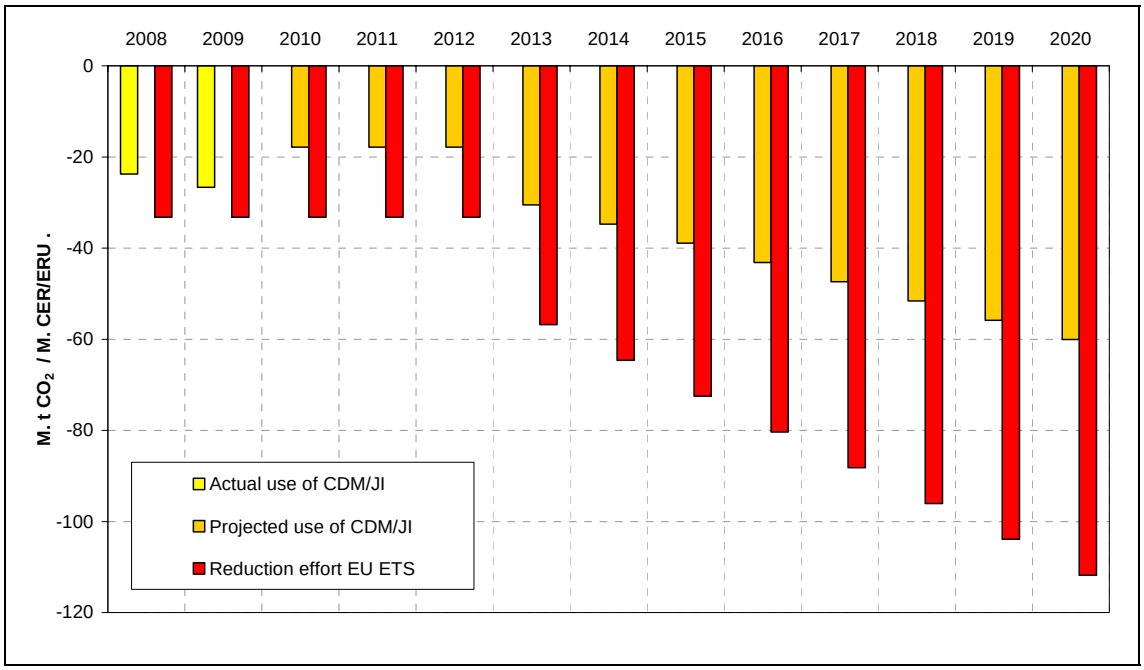
New entrants in the second trading period are also permitted to use CDM and JI credits up to 2020 proportionate to a maximum share of 22 % of their allocation in the second trading period. The allocation to new entrants in the second trading period in Germany is estimated on the basis of the size of the reserve. In accordance with the German Allocation Act 2012 (*Zuteilungsgesetz 2012* or *ZuG 2012*) the reserve in Germany for the second trading period amounts to 110 million EUAs in total. As a result new entrants of the second trading period can use a total of 24 million CERs/ERUs within the EU ETS up to 2020.

New entrants in the third trading period can cover 4.5 % of their emissions with CDM/JI credits after they commence operation. The emissions of new entrants in the third trading period are estimated at 264 million t CO_2 for 2013 to 2020, based on a linear con-

[9] Only the scope of the EU ETS in the second trading period is taken into account. From 2012 onwards the aviation sector and from 2013 onwards additional gases are to be covered by the EU ETS. Since there are still uncertainties about the data on these new sectors, the present analysis shall focus on the current scope of the EU ETS, which encompasses in any case the majority of emissions covered by the scheme from 2012/2013 onwards.

tinuation of the size of the reserve for the second trading period (for 5 years). A share of 4.5 % corresponds to 12 million CERs/ERUs.

Figure 6: Reduction effort of the EU ETS compared to actual and projected use of CERs and ERUs within the EU ETS, 2008 - 2020



Source: Calculations by Öko-Institut

To facilitate better categorisation of the possible use of CDM and JI credits (CERs and ERUs), the share of the reduction effort compared to 2005 which can be achieved on the basis of CDM/JI credits is calculated (Figure 6). The following aspects are shown in Figure 6:

- The red bars in Figure 6 show the reduction effort of the EU ETS for each year up to 2020 compared to 2005 emissions. To determine the reduction effort, the difference between the emissions of 2005 and the EU ETS cap is calculated. In the second trading period Germany's reduction effort amounts to 33 million t CO_2 per year. Up to 2020 the reduction effort increases to 112 million t CO_2 per year. This reduction is realised by decreasing the overall cap using an annual linear reduction factor of 1.74 % (related to the annual average emission target of the second trading period).
- The two yellow bars in Figure 6 show the use of CDM and JI credits by German plant operators for 2008 and 2009. In 2008 24 million and in 2009 27 million project-based credits were surrendered under the EU ETS.
- Under the above-mentioned assumptions plant operators use credits from the flexible mechanisms to cover 54 % of their reduction effort each year. It is estimated that 60 million CDM/JI credits will be used under the EU ETS in 2020.

Table 14: Share of reduction effort brought about by the use of CDM/JI credits within the EU for Germany in 2020

		Emissions (coverage of the 2nd period) 2005	**Cap and reduction effort 2020**	**CER / ERU use 2020**	**Share of reduction effort through use of project certificates**	**Explanations**
		Mt CO_2	EUA (millions)	(in millions)	%	
a	Emissions in 2005	485				
b	Expected CER use in 2020			60		
c	Cap in ETS in 2020 in the 20% case		373			
d	Reduction effort in the 20% case (a-c)		112		54%	Line b / line d
e	Cap in the ETS in 2020 in the 30% case		305			
f	Reduction effort in the 30% case (a-e)		180		33%	Line b / line f

Source: Calculations by Öko-Institut

The results are summarised in Table 14. The EU has committed itself to reducing emissions by 20% up to 2020 compared to 1990. Plants in Germany covered by the EU ETS can bring about 54 % of the reduction (from 2005) through the use of CDM and JI credits. If the EU tightens its climate protection targets and opts for a 30 % reduction in emissions up to 2020 compared to 1990, the cap of the EU ETS would likewise be tightened. Based on current communications of the EU Commission (CEC 2010a) it is assumed that the cap in the EU ETS will be tightened each year by 3.6 % instead of 1.74 %. The reduction effort of the EU ETS would thereby increase. Notwithstanding this, 33 % of the reduction effort could still be made by using CDM/JI credits.

5 Summary and conclusions

5.1 Free allocation of emission allowances

The first two trading periods of the EU Emissions Trading Scheme featured substantial free allocation of emission allowances.

In the first trading period electricity producers received emission allowances via free allocation which largely corresponded to the emission levels and thereby also to their demand for emission allowances. For the second trading period the legislator introduced ambitious benchmarks for the electricity industry and a far lower free allocation. For German electricity producers the demand for extra credits to meet their obligations under the EU ETS amounted to 15 - 44 % of the emissions covered. Since the carbon price is passed through – in an economically rational way – to the electricity price in the electricity production sector, electricity producers were able to reap substantial additional revenue, a significant amount of which results from the free allocation of emission allowances.

Taking into account the nuclear fuel tax (to be introduced in Germany from 2011 onwards), which also aims to absorb additional revenue from the EU ETS, the additional revenue from the first and second trading periods of the EU ETS are estimated to amount to € 39 billion (without nuclear fuel tax) or approx. € 34.8 billion (with nuclear fuel tax) for the selected electricity producers for this analysis. The following results arise for these electricity producers:

- For E.ON the additional revenue amounts to approx. € 12 billion (without nuclear fuel tax) or € 10.3 billion (with nuclear fuel tax);
- For RWE the additional revenue amounts to approx. € 11.3 billion (without nuclear fuel tax) or € 10 billion (with nuclear fuel tax);
- For Vattenfall Europe the additional revenue amounts to approx. € 7.2 billion (without nuclear fuel tax) or € 6.9 billion (with nuclear fuel tax);
- For EnBW the additional revenue amounts to approx. € 6.4 billion (without nuclear fuel tax) or € 5.5 billion (with nuclear fuel tax);
- For Evonik the additional revenue remains unchanged by the introduction of the nuclear fuel tax and amounts to approx. € 2.1 billion for the period from 2005 to 2012.

From the third trading period (2013 to 2020) no free allocation is planned for the electricity production sector. Electricity producers will have to cover all their demand for emission allowances by purchasing them on the market. There will only be windfall profits for CO_2-free electricity production options (nuclear power and electricity production from renewable energies that is subject to competition), which will be substantially absorbed in Germany by the nuclear fuel tax (at least during the time frame – currently up to 2016 – in which this tax is to apply).

In the first two trading periods the free allocation of emission allowances to plants of energy-intensive industries which do not fall under the electricity production sector or are not covered by the EU ETS sometimes substantially exceeded the emission levels of these plants. German industrial companies were able to reap huge profits, particularly during the economic crisis, from the monetary value of emission allowances allocated to them for free. As a result free allocation had a stabilising effect on the revenues of these companies during the economic crisis. For the period from 2005 to 2012 the profits that German companies realise from the sale of surplus emission allowances can be estimated. The following four industrial companies have profited the most up to now:

- For ThyssenKrupp over-allocation amounts to € 384 million;
- For Salzgitter over-allocation amounts to € 243 million;
- For BASF over-allocation amounts to € 104 million;
- For Heidelberg Cement over-allocation amounts to € 43 million.

The companies of German industry considered in this analysis were able to reap huge profits by tapping the economic potential of surplus allowances allocated free of charge.

In the third trading period it is intended that by applying ambitious benchmarks this over-allocation to industry will be avoided. In determining the benchmarks for free allocation from 2013 onwards, exceptions should be avoided in order to prevent renewed over-allocation and ensure incentives for structural decarbonisation. An example of the continued efforts of industry to bring about over-allocation is the steel industry's current demand to receive allowances via free allocation for the share of emissions attributable to electricity production in blast furnace gas-fired power plants (EUROFER 2009).

First assessments show that a pass-through of CO_2 costs was also possible outside of the electricity production sector, e.g. in the case of the prices of different industrial products (de Bruyn et al. 2010). For the industries windfall profits can be generated from both this pass-through of CO_2 costs to customers and the free allocation of emission allowances. However, the precise scale of these additional windfall profits will need to be determined in further research.

5.2 Use of CERs and ERUs within the EU ETS

With a view to the long-term transformation of energy-intensive industry and the energy industry it is important that a major share of emission reductions is realised within the EU ETS. In the long term it will be necessary that Germany reduces its greenhouse gas emissions by 95 % up to 2050 compared to 1990. As a result project-based credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) should only be used in addition to emission reduction measures in Germany and not instead of them.

In Germany the use of CDM and JI credits within the framework of the EU ETS is already very high. In the period from 2008 to 2020, more than 50 % of the reduction effort compared to 2005 can be realised using CDM/JI credits under current regulations. For this reason the option to use such credits within the scheme should not be expanded in the EU's transition to the target of reducing emissions by 30 % up to 2020.

It was possible for the selected companies to reap huge additional profits by selling the allowances which they were allocated for free and surrendering cheaper CDM credits to fulfil their obligation under the EU ETS. As a result the companies considered were able to garner profits totalling approx. € 42 million in 2008 and 2009. Based on the quantity of CDM rights that can still be used within the EU ETS, it can be estimated that these companies will make further profits of approx. € 1 billion by 2020. The current legal regulation enabling companies to be allocated the right to use CDM credits free of charge is not useful or helpful. Should the EU decide to increase the quantity of CDM credits in its transition to the 30 % reduction target, these rights of use should not be allocated free of charge. The possibility of the government buying high-quality CDM projects and auctioning off more EU allowances (EUAs) could also be considered.

Since it is permissible for CDM credits to be used under the EU ETS, plants are allowed to emit more greenhouse gases into the atmosphere in the EU. When environmentally questionable CDM credits are used to meet obligations under the EU ETS, it can lead to an increase in total emissions. It is estimated that at least 83 % of the CDM credits used by German companies in 2008 and 2009 were of questionable environmental integrity (CDM credits from HFC-23 and adipic acid projects). Thus, it is essential that there are tighter rules for CDM projects in the future.

In particular a ban on the use of N_2O and critical HFC-23 projects in the EU ETS should be agreed upon soon so that companies have planning security and can re-direct their investments to useful emission reduction projects in- and outside the EU. Alongside these aspects, assessment of the environmental integrity of CDM projects recognised within the EU ETS should address the question of the extent to which some CDM projects could contribute to the promotion of leakage effects via the de facto subsidisation of production plants geared to the world market.

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