

The impact of the EU Emissions Trading Scheme on power – The price to be paid for CO₂ abatement?

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Abstract

It is often questioned if the carbon price set by the EU Emissions Trading Scheme leads to any abatement of CO₂ and if the induced carbon price influences other markets such as the power wholesale or retail prices. The paper comes to the conclusion that the EU ETS does curb emissions with the cap on CO₂ a priori, thereby incentivising compliance through short-term effects (e.g. fuel switching), investments in cleaner technologies, and indirectly via effects on other markets. In addition, it can be concluded that wholesale power prices across Europe have somewhat risen with the introduction of a carbon trading scheme in 2005. However, carbon prices had not a highly significant effect on electricity prices for end customers, households and industry as other factors like energy prices and the component of state induced costs have taken their share as well.

1) The EU ETS in the context of an UN Carbon Market

The emergence of the EU Emissions Trading Scheme (EU ETS) has to be seen in the context of international climate negotiations. The Kyoto Protocol was agreed in 1997 by UN member states at a meeting of the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan. It was ratified in 2005 after its adoption by 55 contract parties which are responsible for at least 55% of the total greenhouse gas (GHG) emissions of the Annex I Parties (industrialised nations). The Kyoto Protocol set fixed GHG emission reduction targets on all 'Annex I' countries, who had ratified. Under Kyoto, industrialized countries agreed to reduce their collective GHG emissions by 5.2% compared to the year 1990 by 2008-2012. National limitations range from 8% reductions for the European Union (EU-15), 6% for Japan, and 0% for Russia. The EU-15 agreed on a burden sharing amongst its member states. This resulted (for example) in an increase of GHG emissions for Spain and Portugal and a 21% reduction target for Germany. The United States should have adopted a reduction target of 6% but the US Administration never signed the Kyoto Protocol.

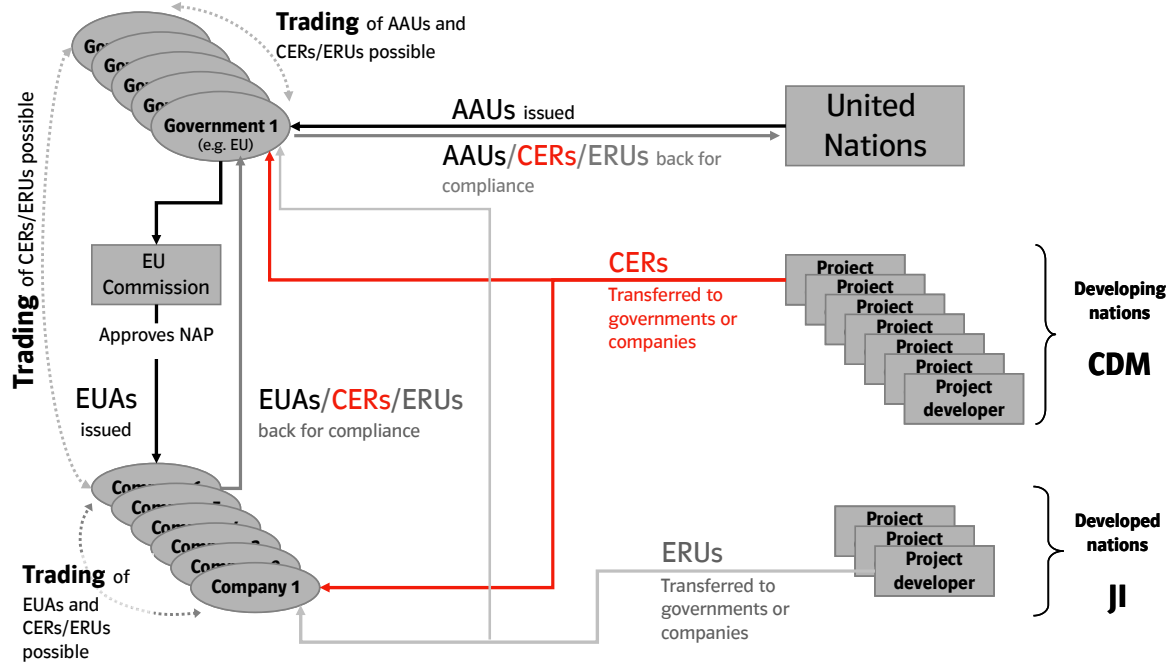
Each Annex I country will be given a number of Assigned Amount Units (AAUs) based on their reduction target. One ton of CO₂ equivalent represents the face value of one AAU. After the first commitment period Annex I countries are obliged to submit a number of AAUs equal to their GHG production over the period 2008-12. Countries having excess AAUs can either bank them into future periods or sell them to other countries. Countries being short against their Kyoto target have either to reduce emissions domestically, buy AAUs, or purchase certificates generated by project based mechanisms:

- The Clean Development Mechanism (CDM) generates Certified Emission Reductions (CERs) in Non Annex I countries which have no binding targets but ratified the Kyoto Protocol.
- The Joint Implementation (JI) creates Emission Reduction Units (ERUs) from projects hosted in Annex I countries.

The EU ETS forms the core of the European Union's climate policy. It was implemented in 2005 with the purpose of assisting the EU member states to achieve compliance with the Kyoto targets. The first phase (2005-2007) of the EU ETS was designed as a pilot phase. Major sectors of the industry and the power sector were included in the scheme. It was decoupled from the other Kyoto flexible mechanisms such as CDM and JI. Although Phase I had already been designed in the wake of EU's Kyoto compliance targets (an emissions cap for individual EU countries which was in line with the binding Kyoto targets of the countries) it turned out that the overall cap was not stringent enough to avoid an oversupply of the market (see also section 2).

Non-Annex I economies do not face any binding GHG emission restrictions, but instead have financial incentives to develop GHG emission reduction projects to receive "carbon credits" that can then be sold to Annex I buyers, encouraging sustainable development. Annex I entities typically want to acquire carbon credits as cheaply as possible, while Non-Annex I entities want to maximize the value of carbon credits generated from their domestic GHG projects.

Figure 1: Structure of the Carbon Market



The most important point from an EU ETS perspective regarding the CDM/JI is that companies participating in the EU ETS can buy CERs and ERUs up to certain national import limits. With the emergence of the CDM/JI market the EU ETS became coupled to the global UN driven CER/ERU market as governments can buy CERs and ERUs as well in order to secure compliance with their Kyoto targets (for an overview of the carbon market context and the currencies traded wherein please refer to Figure 1).

Even though, the EU ETS is the biggest such scheme in the world by an order of economic magnitude, the scheme is still relatively small regarding emission coverage: with 2.1 billion tons annually it represents roughly 5.5% of annual global GHG emissions (38.7 billion tons in 2005).

2) Status report on past and recent developments of the EU ETS

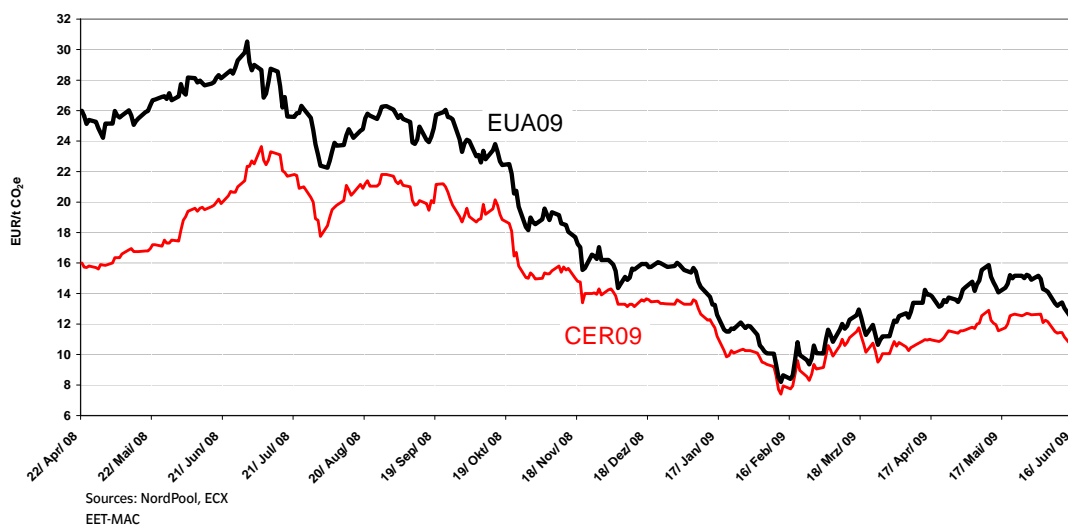
As mentioned above, the EU ETS cap in Phase I (2005-07) was not stringent enough to avoid an oversupply of the market. When 2005 verified emissions were released for the first time in April 2006, actual emissions turned out to be much lower than expected and the CO₂ price collapsed. However, leading analysts expected a shortage at the beginning of the phase and forward prices went up to nearly €30/t in 2006 on the back of the European Commission tightening the proposed National Allocation Plans, high summer temperatures and increasing energy prices. Shortly after the release of 2005 verified emissions

data the EC announced changes to base allocations for Phase II on verified emissions data. In Phase I, emissions data had only partly met good benchmarking principles and was not based on completely independent validated historical data. The announcement of the EC led to a decoupling of Phase I and Phase II prices with Phase II forwards being relatively stable and significantly higher than the devalued Phase I prices. Also, the market for UN credits, especially CERs, started to emerge with first issuances.

The second phase (2008-12) of the EU ETS is very different to Phase I. Most importantly, Phase II certificates can be banked into future periods thereby protecting the EUA price from deteriorating to the low levels seen at the end of Phase I. As the EU had already committed to a reduction of GHGs to at least -20% by 2020 (compared to 1990 baseline), it is obvious that the EU ETS will have to reduce emissions further post 2012. The adopted EU Directive already states clearly that further reductions are to come post 2020. If the current UN climate negotiations lead to an ambitious international agreement, the 2020 target for the EU could increase to a 30% reduction target in 2020 (base year 1990) whereby further affecting the cap of the EU ETS.

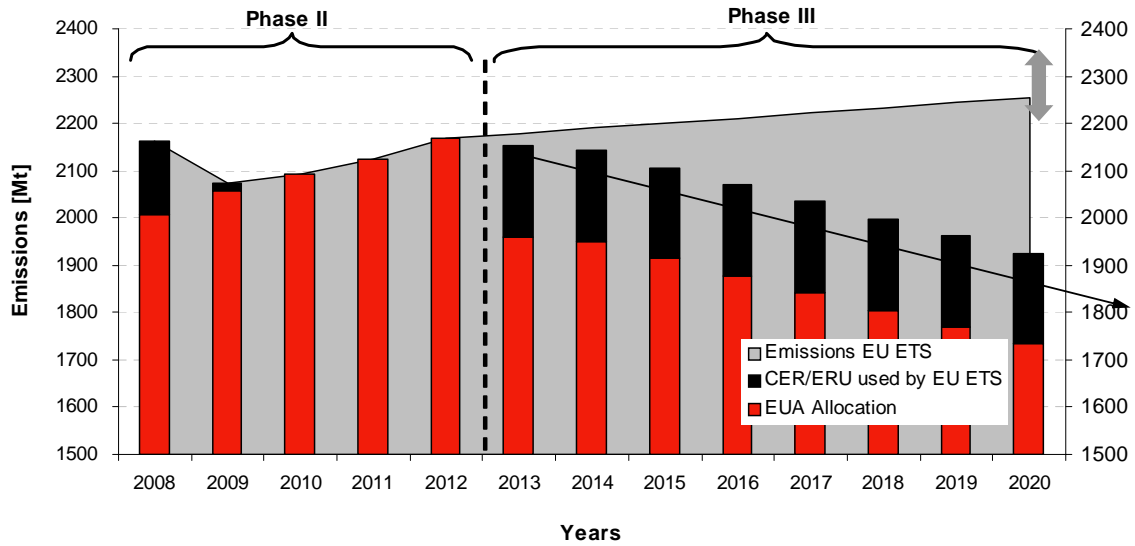
With the beginning of the economic crisis, Phase II allowance prices deteriorated from a high of about €30/t in July 2008 to €8/t in February 2009. But with expectations of a tight Phase III (or even Phase IV) and better prospects for the EU economy, EUA prices had recovered to €13/t by mid June (see Figure 2).

Figure 2: Price development of Phase II EUA allowances and CERs



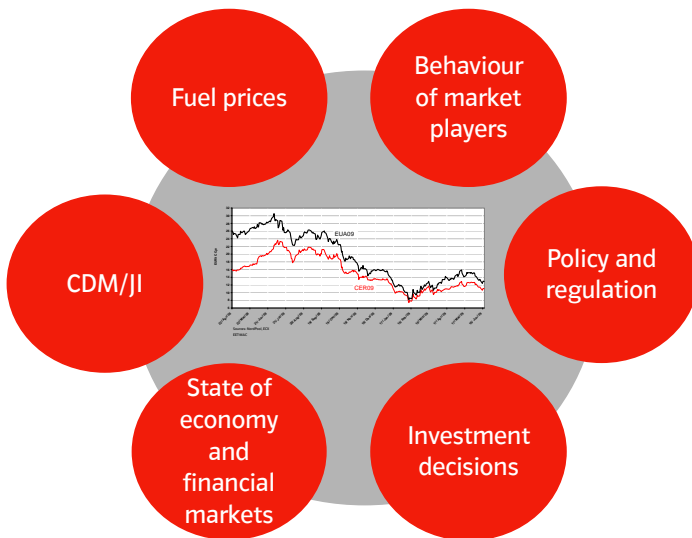
Although it is widely accepted amongst the analyst community that Phase II would be long after including the import of CERs and ERUs into the system, the prospects for tighter future Phases (see Figure 3) are supporting the price of allowances and preventing them from a complete deterioration. Figure 3 charts forecast business-as-usual CO₂ emissions (BAU; emissions development without implementing a CO₂ regime) for the EU ETS against the allocation and import limits of the system.

Figure 3: Hypothetical EU ETS carbon balance for a -20% emission reduction target



The drivers behind carbon market developments are very different. As the EU ETS is a politically constructed market, it behaves differently from other commodity markets. A summary of main price drivers is shown in Figure 4. The different price drivers are evaluated shortly in the following section.

Figure 4: Price drivers for CO₂



CDM/JI: The CER/ERU volume pipeline describes the expected issuance of CERs and ERUs for a certain time span. It affects the amount of credits available for the EU ETS and government compliance. Currently, approximately 300 million CERs have been issued. As the UNFCCC is having a tough stance on the approval, validation and verification process, overall volume is currently lagging behind former analyst expectations.

Fuel Prices: Somewhat unexpected to many, fuel prices are having a less pronounced effect on CO₂ prices than many predicted. The correlation between CO₂ prices and other commodity prices is positive, but often relatively low (see Figure 5).

Figure 5: Often, CO₂ shows only a little correlation with other Commodity Markets (10 June 2009)

30 days window		Last trading day								
Price returns correlations		Nordic Base 10	German Offpeak 10	German Base 10	German Peak 10	Coal API#2 10	EUA10	Oil F1	TTF Gas Cal10	Gas NBP 09 Sum
Half a year ago	Nordic Base 10	1,00	0,81	0,82	0,78	0,50	0,47	0,44	0,63	0,56
	German Offpeak 10	0,81	1,00	0,98	0,87	0,56	0,49	0,42	0,58	0,43
	German Base 10	0,84	0,97	1,00	0,95	0,61	0,55	0,48	0,60	0,47
	German Peak 10	0,78	0,79	0,91	1,00	0,65	0,58	0,53	0,57	0,51
	Coal API#2 10	0,68	0,64	0,71	0,73	1,00	0,44	0,69	0,66	0,62
	EUA10	0,74	0,74	0,79	0,78	0,73	1,00	0,58	0,17	0,21
	Oil F1	0,55	0,72	0,74	0,69	0,68	0,66	1,00	0,44	0,32
	TTF Gas Cal10	0,61	0,78	0,78	0,69	0,69	0,65	0,71	1,00	0,83
	Gas NBP 09 Sum	0,55	0,72	0,75	0,69	0,71	0,73	0,74	0,89	1,00

Cells in red: correlation (r) at least 0.8; cells in black: r at least -0.8

Behaviour of market players: Utilities, which are under-allocated with free allowances and therefore short against their economic power generation over the five year horizon of Phase II, are in general natural compliance buyers when hedging their power forward sales. On the contrary, industry is often well allocated with free allowances but is often somewhat unwilling to separate from length. Also, the behaviour of hedge funds, pension funds and government compliance strategies are affecting the market.

Policy and Regulation: As stated above, the European Commission is setting the framework in which the market participants are acting. A main driver is the decision process on setting the overall EU ETS target. But many other decisions of the EC and also the UNFCCC as well as on national levels are affecting the price of carbon.

Investment Decisions: Investments in technologies such as renewables and nuclear power plants are affecting the level of emissions; and therefore the prices of CO₂ certificates. Currently under political discussion is the framework for investments in Clean Coal (CCS – Carbon Capture and Storage) technology.

State of economy and financial markets: During the last couple of months, carbon prices have been affected by the financial and economic crisis. The deteriorating real economy led to unprecedented declines in European industrial output and therefore to decreasing emissions. On top of this the tightening of credit conditions has affected the industrial and utilities' sector.

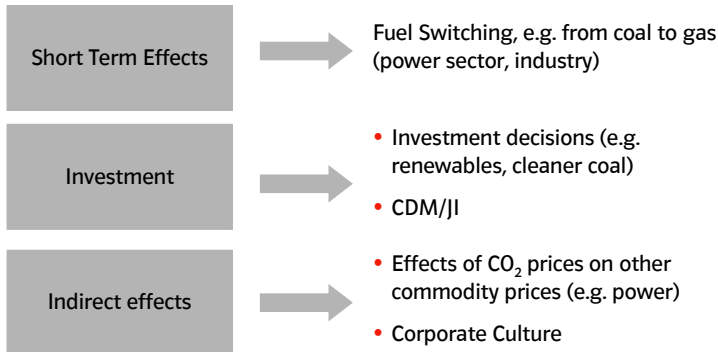
3) The effect of EU ETS carbon prices on CO₂ abatement

It is often questioned if the carbon price set by the EU ETS leads to any abatement of CO₂. This point is misleading as the total cap on emissions is set from the beginning in the EU ETS – it is guaranteed that emissions are curbed over the time of a trading period. Non-compliance gets fined with a penalty of €100

for each ton emitted without the return of an allowance. This property of ecological goal achievement of a cap and trade system has often been used by proponents of such a scheme.

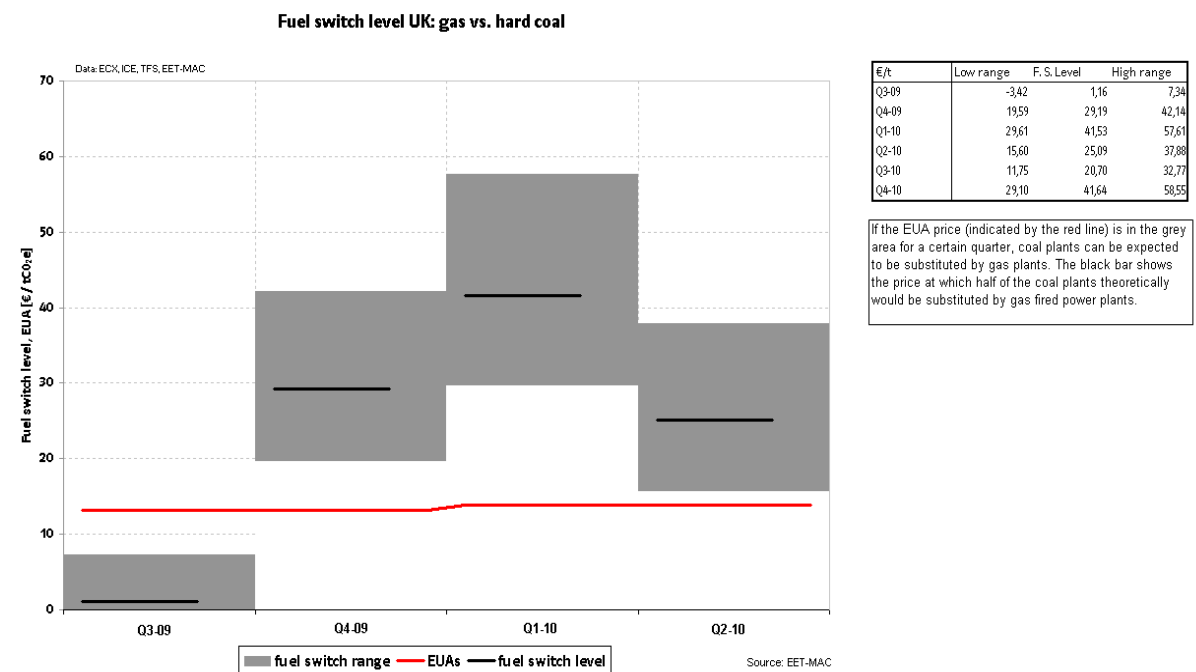
However, it is still interesting to note how the EU ETS incentivises compliance. Hereby, short term and more long term mechanisms have to be distinguished. The main drivers of abatement are displayed in Figure 6 and are evaluated briefly in the following section.

Figure 6: Induced abatement with a CO₂ price regime



Short Term Effects: In the case of spare capacity in the power sector a more CO₂ intensive power plant such as an old coal plant might be substituted by a gas plant if the relationship of fuel prices and CO₂ price indicate this. For example, a coal plant may produce 900 kg CO₂ per MWh while a gas plant may emit only 450 kg CO₂/MWh. The graph below shows the fuel switch levels for the UK as of June 2009. At the given hard coal/gas price relationship, most of the coal plants will be squeezed out of the market in Q3 2009.

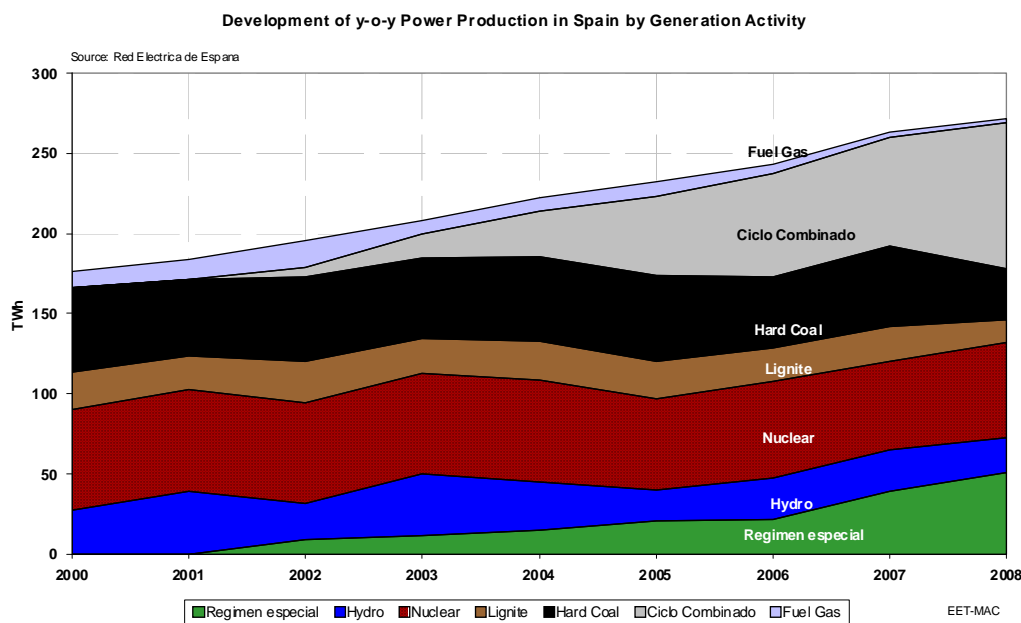
Figure 7: Fuel switching levels relative to the EUA price



Investment: A prominent example for a country where the power sector changes its shape to a low carbon intensity for electricity production is Spain. The huge economic growth in Spain was translated into a high increase of electrical consumption. The years from 2002 to 2007 saw a Compound Annual Growth Rate (CAGR) of 4.3%, even if decreasing during the same time range (2003=+6.8%, 2007=+3.1%).

The growth rate weighed significantly on Spain's national CO₂ emissions. The market-driven process of investment in generation led to the commissioning of numerous new combined-cycle power plants, with a total installed capacity of 21,670 MW, accounting for 32% of total demand. Furthermore, the contribution of wind power output, which has recorded a substantial increase over the past eight years (CAGR=25%), now covers more than 10% of total power demand. If this is added to the contribution cogeneration makes to this coverage, it means that the so called 'Special Regime' (under-tariff regime) provides more than 23% to the overall demand for electricity (see Figure 8). Of course the investment into the named power generation sources has been supported by financial incentives. The massive investment in CCGT and wind technology shifted coal fired plants to the end of the merit order, allowing Spain to increase its power production while simultaneously reducing CO₂ emissions.

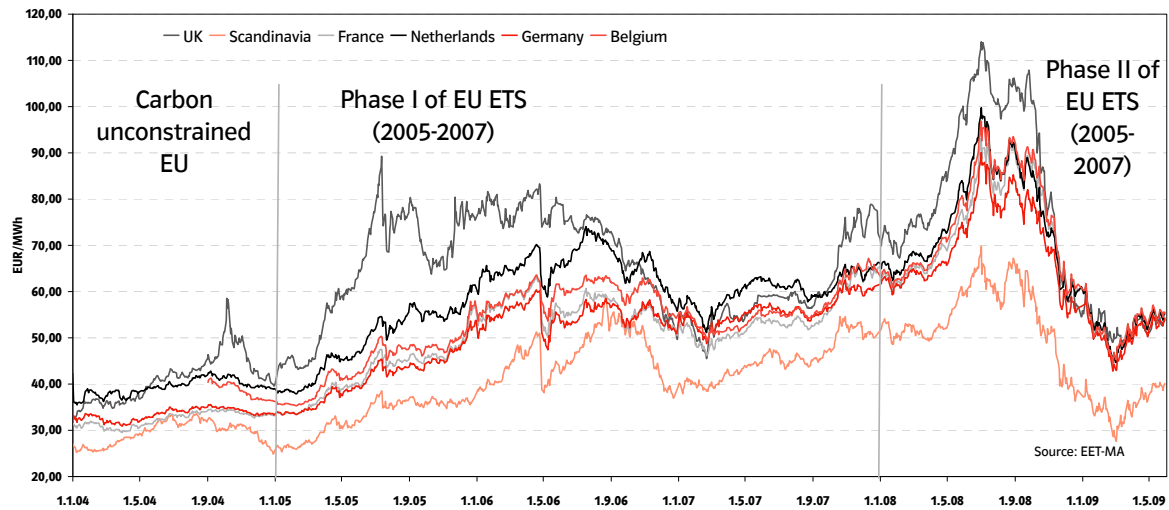
Figure 8: Gas and renewables are pushing out hard coal and lignite



Indirect Effects: With CO₂ for the first time in history having a price together with growing concerns about the potential effects of climate to mankind, nature and economy; there has been an increased awareness by many companies in the utility and industry sector. As one of the world's leading energy companies, E.ON believes that it is necessary to also be a leader in climate protection. E.ON aims to reduce the CO₂ intensity of its power generation portfolio by half compared to 1990 levels and fall to 0.36 t CO₂/MWh by 2030. E.ON expects to increase its generation capacity from today's 74 GW to more than 100 GW by 2030, with more than half of the energy mix consisting of zero-emission technologies and the other half of low-emission technologies.

Another indirect effect of pricing carbon on abatement behaviour is the increase in wholesale power prices due to the fact that CO₂ adds a new production factor to power plant operations.

Figure 9: European Power Forwards Base in carbon constrained and carbon-unconstrained environments



From Figure 9, which shows the development of the Baseload Power Forwards for several European countries, three effects are apparent:

- Wholesale power prices across Europe have risen with the introduction of a carbon trading scheme in 2005. The downward move in May 2006 with Verified Emissions being released for the first time shows that carbon became a common driver of wholesale power prices across Europe. E.g. the emissions factor in the German transmission grid is about 0.6 t/MWh. This implies that approximately 60% of the price for carbon is actually rolled into the power price. However, the lions' share of the increase is due to increases in energy prices such as coal and gas.
- Countries with a lower emissions factor in the grid are actually importing the higher power prices (such as Scandinavia) whereby countries importing less carbon intensive power from other countries are actually benefiting from the cleaner power (e.g. Italy imports a lot of power from France). Overall, the carbon system led to a convergence of European power markets in its market dynamics via the introduction of a carbon pricing regime.

With power prices increasing, a process was started on how to save power consumption. However, increasing power prices has raised awareness of carbon leakage amongst industry and politicians, meaning that part of industry could shift industrial production away to regions which don't have the carbon constraints of Europe. The discussion still continues.

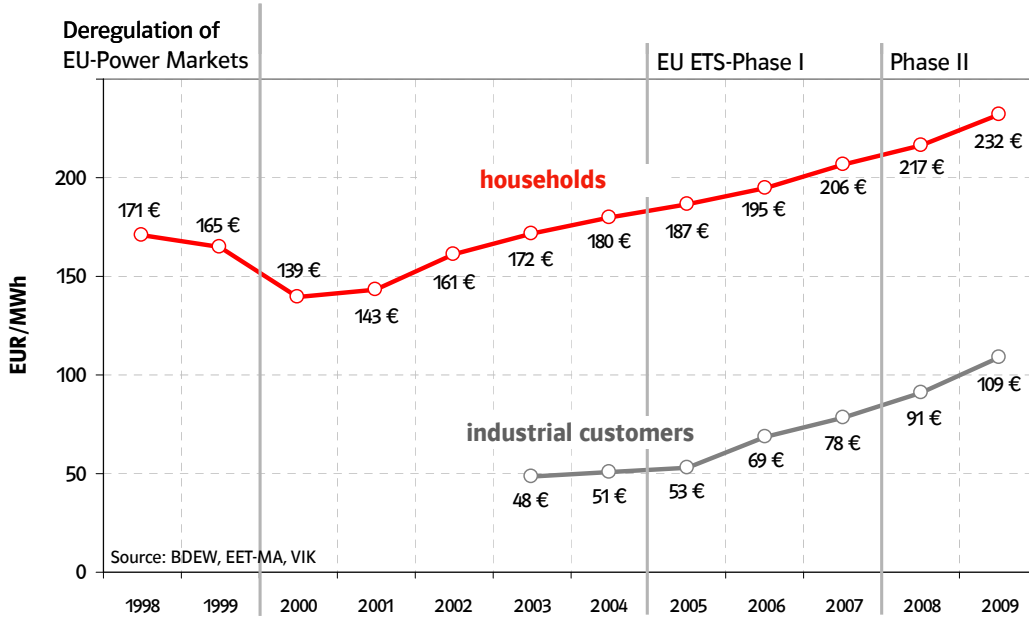
4) The effect of EU ETS carbon prices on power prices

As the effect of a carbon regime on wholesale power prices cannot be neglected, the situation looks a bit different for the end customers, households and industry.

With the deregulation of the EU electricity markets in the late 1990's, household power prices in Germany have declined sharply (see Figure 10). Rising energy prices have brought up household power prices

again. As can be derived from Figure 10, the introduction of the EU ETS just led to a continuation of the trend to higher retail prices but not to acceleration.

Figure 10: Retail prices are only influenced to a minor extent by CO₂-prices



CO₂ affects the production share of the household price, which is approximately 20-30% of the total power price. The household prices however are more dependent on other cost components than the generation costs. The costs of distribution and transmission as well as several state induced cost components are adding to the final consumer price.

Figure 11: Composition of power tariff (household - Germany) relatively stable, but price increased

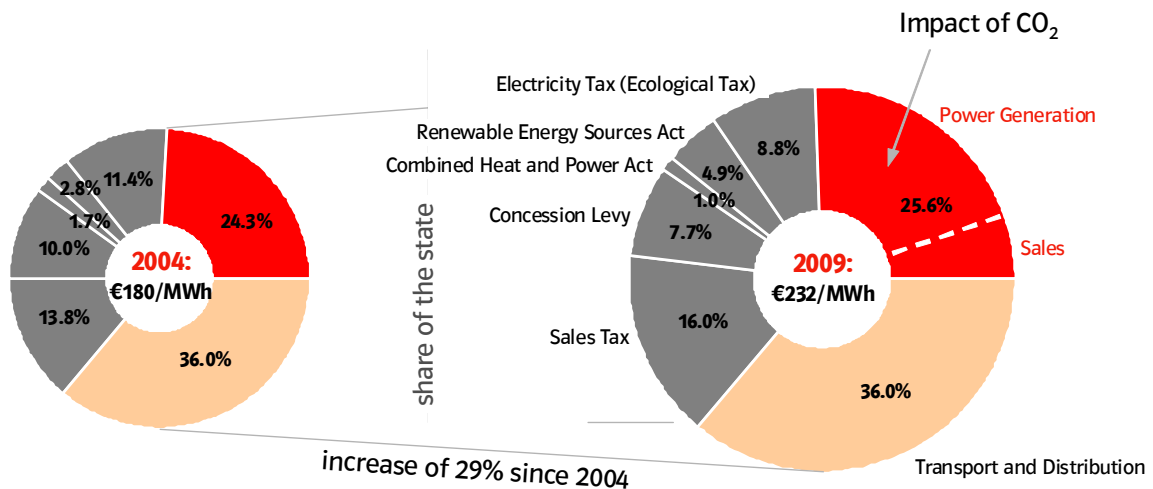


Figure 11 reveals that the share of the power production component remained relatively stable since the year 2004, the last year before the CO₂ price regime was introduced. The generation component has increased by 1.3% since 2004. The share of transport and distribution remained constant. With the introduction and mark-up of many new fees together with tax increases the state contributed a significant share to the overall power price for households, meaning that CO₂ is not the main price driver.