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The Sustainability Impact of the EU Emissions Trading System on the European Industry*

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Abstract

This BEEP explains the mechanism of the EU Emissions Trading System (ETS) for the greenhouse gas carbon dioxide and explore into its likely sustainability impact on European industry. In doing so, it focuses on energy-intensive industries like cement, steel and aluminium production as well as on the emerging hydrogen economy. The BEEP concludes that at the moment it is still very inconsistently implemented and has a fairly narrow scope regarding greenhouse gases and involved sectors. It may also give an incentive to relocate for energy-intensive industries. In its current format, the EU ETS does not yet properly facilitate long term innovation dynamics such as the transition to a hydrogen economy. Nevertheless, the EU ETS is foremost a working system that – with some improvements – has the potential to become a pillar for effective and efficient climate change policy that also gives incentives for investment into climate friendly policies.

Keywords: emissions trading, climate policy, impact assessment.

JEL codes: K32, L 51, Q48, Q58.

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1. Introduction

In this BEEP we explain the mechanism of the EU Emissions Trading System (ETS) for the greenhouse gas carbon dioxide and explore into its likely sustainability impact on European industry. In doing so, we focus on energy-intensive industries like cement, steel and aluminium production as well as on the emerging hydrogen economy. Our hypothesis is that while the impact of the EU ETS on energy-intensive industries is visible and likely to be negative, the impacts on the emerging hydrogen economy are almost negligible. If that proves to be correct, the ETS would have a bias towards cost-increases for industry without fully exploiting the potential to stimulate radical innovation. Our interest thus is an analysis of expected structural changes in the European economy as a whole, where industries are scrutinized to adapt to climate policy while keeping core competences of energy intensive production along value chains, and others are challenged to radically innovate and to invent a new energy carrier such as hydrogen within existing energy markets.

Our article is structured as follows: the following section 2 briefly explains the mechanism and the political background of the EU ETS. Section 3 looks into real developments since the system started in early 2005. Section 4 analyses the impacts on EU energy-intensive industries. Section 5 assesses in a preliminary way the impacts on radical innovation towards the hydrogen economy – seen as a technological proxy for a more sustainable energy system. Section 6 draws conclusions.

2. The EU ETS: Economics, Mechanism and Politics

According to economic theory, an Emissions Trading Scheme is an economic instrument that enables the meeting of emissions targets in a cost effective manner (BAUMOL/OATES, 1998). It reduces the cost of reaching a specific target by taking advantage of the different marginal abatement costs of participating actors with different emission sources. Cost savings are particularly big if mitigation costs differ significantly between sources covered by a scheme. This cost differential creates an economic incentive to trade. The task therefore is to build up a scheme that includes as many emission sources as possible and, if necessary, to link different domestic trading schemes. The economic theory of comparative advantages demonstrates that countries benefit and prosper economically from trade, relative to no trade. This can also be applied to the trading of emissions units. Against this theory it will be interesting to test how the EU ETS realizes the potential cost savings, whether the compliance costs resulting from additional bureaucracy outweighs the benefits and whether there might be undesired side effects.

With the Kyoto protocol signed in 1997 the European Union committed itself to reduce its GHGs by 8% in 2012 compared to the level of 1990. However, in the late 1990s the EU implementation of climate policy instruments has been rather lackluster and international credibility suffered. To address the reduction challenge cost-effectively, the EU established the European Climate Policy Program (ECCP) in 2000 in order to find the most promising climate policy measures. The results of the ECCP were to support the European Commission in developing an overall EU climate strategy (ECCP 2001). Yet, the overall progress of this strategy is up till now limited, except for the development of an Emissions Trading Scheme. At the time, this has been rather surprising, since for a long time the EU had been critical of market mechanisms[1] and preferred regulatory measures. NGOs were in general critical, since no recognizable “green” action was occurring, as in other measures such as promoting renewable energies. Industry and their lobbyists refuse caps and prefer voluntary approaches.

[1] Now the European Commission has become much for positive about market-based in-struments; see the recent “Green Paper on market based instruments for environment and energy related policy purposes” from March 2007 (COM(2007) 140 final).

One reason for the quick start of emissions trading in the EU was the attempt of some pioneering member states to introduce national emissions trading schemes. The UK and Denmark started one and others such as the Netherlands and Germany had established working groups dealing with such an idea. The Commission thus feared a patchwork of systems, since the already established ones and the ones existing on paper were not at all compatible with each other.

In March 2000 the “Green Paper on Greenhouse Gas Emissions Trading in the EU” was published. Emissions trading was seen as the best instrument to deliver the proposed target in time – certainly an advantage over Eco-taxes – and at lowest possible costs since large emitters could be identified easily. After intense consultation with the European Parliament, the Council and several lobbying groups, several opinion papers and draft directives, a compromise on emissions trading, for CO2 only, came out on October 13, 2003 (EC, 2003). The EU was set to become the world’s largest market for company-level emissions trading (IEA 2003).

If the EU emissions trading scheme (EU-ETS) proves successful, there may be bilateral interest in linking it to the domestic schemes of other non-EU countries. Several non-EU countries have plans to introduce domestic emissions trading schemes, and according to economics, there are benefits to creating a larger market by linking such schemes. The broader the coverage of an emissions trading scheme, the greater the potential for economic efficiency gains of the scheme in terms of lowering overall compliance costs. However, the extent to which these benefits are realized will depend on the details of their design and the similarities of the schemes (SCHUELE et al., 2006, ANGER et al., 2006)

2.1. Main Characteristics of the EU ETS

The EU emissions trading scheme takes place on the level on installations[2], thus targeting the emitters themselves. The Directive 2003/87/EC which establishes the scheme was issued in September 2003, with a start date set for the 1st January 2005. The scheme initially specifies two periods, the first from 2005-2007, the second from 2008-2012 (corresponding to the first commitment period of the Kyoto Protocol).

[2] Art. 3 of directive: “An installation is stationary technical unit where one or more activities listed in Annex I are carried out.”

Compliance is required on an annual basis within these periods, but the allocation of allowances will be decided separately for the two periods. The Directive sets out some of the key design features of the emissions trading scheme. One of the key elements defined by the Directive is the unit of trade.

The EU-ETS cap - and - trade system came into force in January 2005 and also applies to the accession countries. Each participating installation needs a general permit to emit CO_2 and gets an allocation of allowances representing its initial absolute emissions budget for a year or compliance period. Where emissions exceed allowances, operators will need to either invest in abatement or buy more allowances on the market. It has a mandatory three year start-up phase from 2005-2007 and a five year mandatory Kyoto Phase from 2008 -2012. The following table gives an overview of the basic characteristics of the size of the emissions trading market in the first phase from 2005-2007. The EU ETS is based on six basic principles (EEA 2005):

1. Cap and trade system
2. Initial focus is on CO_2 emissions
3. Implementation will take place in phases with reviews and possibilities for expansion of additional sectors and gases
4. Allocation plans for emission allowances are decided periodically
5. Compliance framework
6. EU-wide system that taps reduction opportunities in the rest of the world through the other mechanisms of the Kyoto Protocol (Joint Implementation and Clean Development Mechanism).

Figure 1: Trading Period 2005-2007 indicative data from the Commission based on National Allocation Plans (EC 2005a)

EU Member State	Allocated CO_2 allowances (million tonnes)	Share in EU allowances (%)	Installations covered [1]	Kyoto target (%)
Belgium	188,8	2,9	363	– 7,5 [2]
Czech Republic	292,8	4,4	435	– 8
Denmark	100,5	1,5	378	– 21 [2]
Germany	1497,0	22,8	1849	– 21 [2]
Estonia	56,85	0,9	43	– 8
Greece	223,2	3,4	141	+ 25
Spain	523,3	8,0	819	+ 15
France	469,5	7,1	1172	0 [2]
Ireland	67,0	1,0	143	+ 13 [2]
Italy	697,5	10,6	1240	– 6,5
Cyprus	16,98	0,3	13	—
Latvia	13,7	0,2	95	– 8
Lithuania	36,8	0,6	93	– 8
Luxembourg	10,07	0,2	19	– 28 [2]
Hungary	93,8	1,4	261	– 6
Malta	8,83	0,1	2	—
Netherlands	285,9	4,3	333	– 6 [2]
Austria	99,0	1,5	205	– 13 [2]
Poland	717,3	10,9	1166	– 6
Portugal	114,5	1,7	239	+ 27 [2]
Slovenia	26,3	0,4	98	– 8
Slovakia	91,5	1,4	209	– 8
Finland	136,5	2,1	535	0 [2]
Sweden	68,7	1,1	499	+ 4 [2]
United Kingdom	736,0	11,2	1078	– 12,5 [2]
Total	**6572,4**	**100,0**	**11428**	

Notes:

(1) Please note that the figures do not take account of any opt-ins and opt-outs of installations in accordance with Articles 24 and 27 of the emissions trading directive.

(2) Under the Kyoto Protocol, the EU-15 (until 30 April 2004 the EU had 15 Member States) has to reduce its greenhouse gas emissions by 8 % below 1990 levels during 2008–12. This target is shared among the 15 Member States, marked with (2), under a legally binding burden-sharing agreement (Council Decision 2002/358/EC of 25 April 2002). The 10 Member States that joined the EU on 1 May 2004 have individual targets under the Kyoto Protocol with the exception of Cyprus and Malta, which have no targets.

2.1.1. Coverage and Duration

The EU ETS covers no other greenhouse gases other than CO2. Annex I of the directive defines the activities that are obliged to participate. The following are some of the variety of sources (EC 2003):

- Combustion installations with a rated thermal input >20MW
- Mineral Oil refineries
- Coke ovens
- Iron and steel production >2.5 t per hour
- Cement > 500 t per day and lime >50 t per day production
- Glass production > 70 t per day
- Ceramics >75 t per day
- Pulp and paper >20 t per day.

Even with this limited scope, about 12000 installations are taking part. This accounts for 45% of EU's CO2 emissions. Energy-intensive sectors have not been included in general because they are energy users rather than producers, e.g. the chemical sector, waste incineration, aluminium and other metal industries are not included. The chemical sector's direct emissions of carbon dioxide are not very significant (less than 1% of EU's total Carbon Dioxide emissions). Additionally the number of chemical installations (ca. 34.000) would increase the administrative complexity significantly (EEA 2005). The issue of competitiveness also can be raised.

Looking at the scope from a polluter-pays viewpoint, one has to keep in mind that in EU policy the non-covered sectors and/or entities should be subject to other, equivalent policy instruments to avoid inequitable treatment. For the second National Allocation Plans the European Commission tries to be especially strict on this point (EC 2005b). In doing so however, one needs to be careful with the installations covered, in so far as they might face a double burden with other national climate policies such as energy taxes which would lead to rising abatement costs.

2.1.2. Allocation

The Emissions Trading Directive determined that the Member States allocate at least 95% of allowances free of charge. For the second period starting in January 2008 the amount is reduced to 90% free allowances. Such 'grandfathering' has been criticized by many economists for being not in accordance with the polluter pays principle (MICHAELOWA/BUTZENGEIGER, 2006). Member States are obliged to develop National Allocation Plans (NAP), which gives details about the total quantity that member States intend to allocate to the trading sector and how they propose to allocate them. To assist the Member States with the process of writing the NAPs, the European commission issued a guidance paper. Also for the second period, the Commission issued a new and stricter guidance paper in order to achieve higher harmonization between the different NAPs, to promote benchmarking and auctioning and to make sure that the Member States reach their Kyoto Targets. In the first period most Member States opted for full grandfathering on the basis of historical emissions whereas the proportion of benchmarking and the use of auctioning is likely to be increased for the second trading period. A lot of Member States were late to submit their NAPs for the first period. The same can be witnessed at the moment for the second trading period.

In the first phase Member states were allowed to “opt out” (exempt) individual installations from emissions trading. This has been done by some Member States especially to exclude some of the smaller installations and to reduce their administrative burden.

2.2. Linkage

In 2004 the Council of Ministers and the European Parliament agreed on a text for the linking directive (EC 2004 / LANGROCK and STERK, 2004). Its core is the recognition of credits obtained with Joint Implementation and the Clean Development Mechanism. CDM credits were eligible from 2005 onwards, whereas Joint Implementation credits may only be used from 2008 onwards. This means the system not only provides a cost-effective means for EU-based industries to cut their emissions but also creates additional incentives for businesses to invest in emission-reduction projects elsewhere, for example in Russia (JI) and developing countries (CDM). [3] In turn this spurs the transfer of advanced, environmentally sound

[3] Joint Implementation projects can be pursued in countries that themselves have a Kyoto reduction target, whereas Clean Development Mechanism projects can be organized in developing countries without reduction targets under the Kyoto Protocol, such as China, Brazil and India.

technologies to other industrialized countries and developing nations, giving tangible support to their efforts to achieve sustainable development (EC 2005a).

The relationship between the EU ETS and other policies and measures that pursue the same objective is most obvious in the case of taxes levied on energy products and electricity, which are harmonised by Council Directive 2003/96/EC (the “Energy Tax Directive”). Greenhouse gas emissions trading and energy taxation are different economic instruments, operating by different legal means but partially pursuing the same objectives, in particular as concerns internalisation of externalities via market-based instruments i.e. CO2 taxes targeting industry. The energy tax directive foresees that under certain conditions taxation can be fully or partially replaced, in particular for energy intensive companies, by some other instrument, including tradable permit schemes. This possibility is subject to the applicable State aid provisions. The EU ETS limits the emissions of covered installations in the EU collectively, and until 2012 the Directive requires most allowances to be allocated free of charge.

In line with its commitments, the Commission will consider further the interplay of the EU ETS with other measures pursuing the same objectives, and in particular with energy taxation. Now with the discussions on the review of the Emissions Trading Directive and on the Green Paper on the use of market based instruments for environment and energy related policy purposes this is a good occasion to look at these interplays.

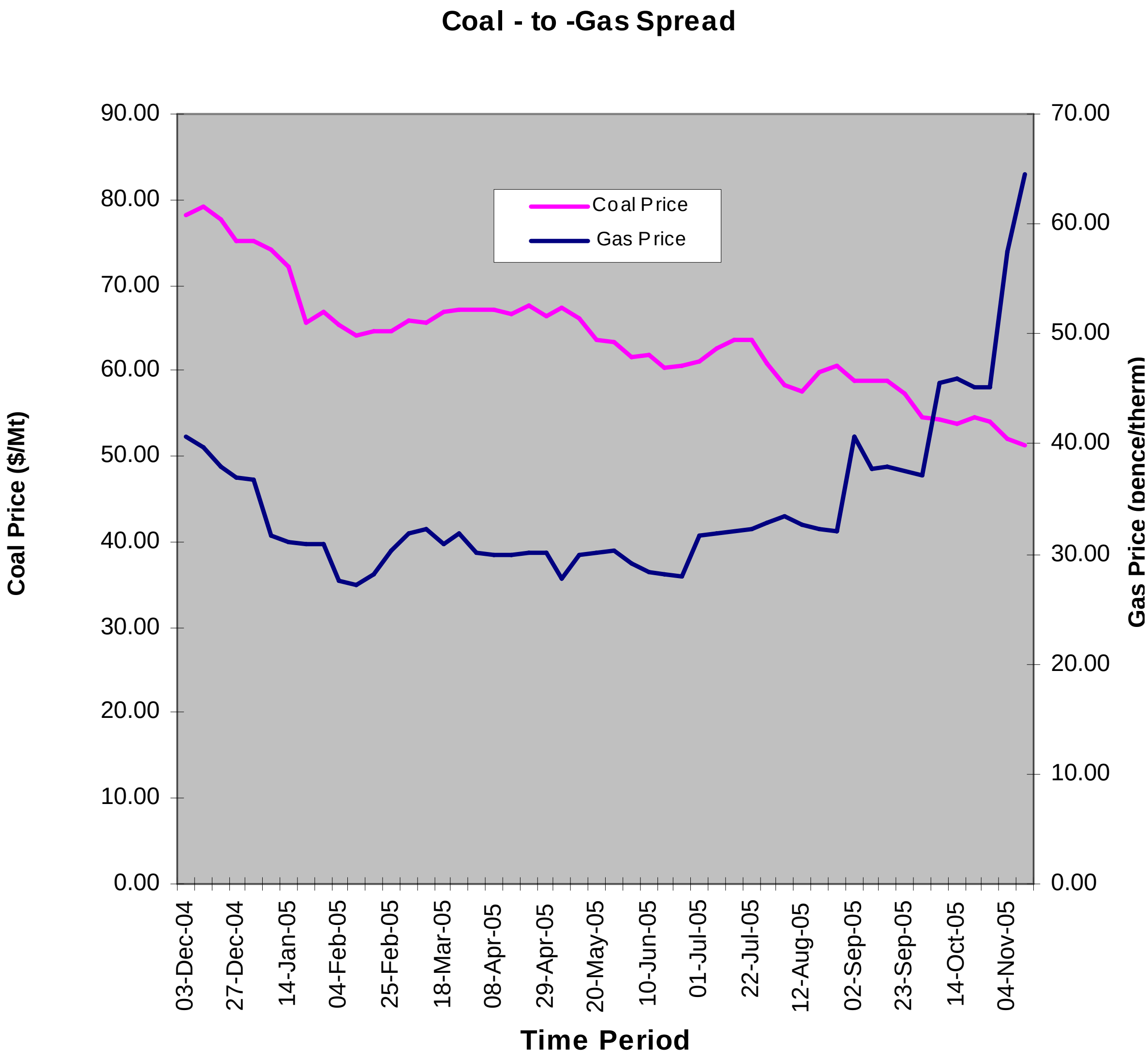
3. EU ETS: The Development

Since the official start of the European Emissions Trading scheme and even before one could notice a dynamic institutionalisation around the idea of emissions trading, trading platforms, such as Noordpool, EEX, ECX or EXAA have been created and brokers and banks have started to get involved in the subject. Since the EU ETS introduction there has been a need for new institutions and new administrations also at the Member State Level. Some Member States have established specialised agencies specialised in the implementation of the EU ETS and to manage the nation’s emission registry. The ensuing administrative costs are not negligible and should be taken into account after the start up phase when ex post evaluation will be done. Such emphasis on transaction costs is in line with new institutional economics (e.g. ZERBE, 2001), but not often reflected in textbooks on tradable permits.

Before the official start of the Scheme experts were unsure about the price developments of the newly developing carbon market. Some observers expected that prices would not be very high due to over allocation, especially in the new Member States, but also some “old” Member States. However, the prices started to climb immediately after the introduction of the EU ETS in January 2005 up to a level of above 20 € per tonne of CO_2 emissions in June 2005. Such a price was above all expectations and is not easily explainable. The main reasons are:

- The *immature market* is one factor that came into discussion, as only low volumes and a few players were active in the market. Even if liquidity was increasing slowly it was for a long time not sufficient as especially large players (many allowances) were hard to identify.
- Another reason could be *uncertainty* about the rules of the system in the future. Liquidity in this market is largely driven by emission reduction efforts that would free up allowances to then be traded on the market. Some companies fear that emission reduction efforts could be sanctioned (by possible changes) in the next allocation plan, so they refrain from reducing emissions in the current period. This impacts liquidity in the CO_2 market negatively (MCKINSEY/ ECOFYS, 2005).
- The market participants were slowly getting more *experience*. In the beginning, energy companies that are used to trading in the energy market and also leading in factoring costs, were active in the market. Accordingly, a lot of companies, especially smaller players, did not have a thorough understanding of the market and allowances were rather perceived as licenses to produce and not as an economic asset with opportunity costs.
- *Other energy markets*: During the period of high energy prices the coal – gas price spread has been moving to the advantage of coal as one can depict from the following figure. The increasing demand for coal thus has triggered the rising of the price of allowances.

Figure 2:



Source: CONVERY (2006)

Higher gas prices relative to coal moves coal up the dispatch order and is used more frequently relatively to gas. However, this required the purchase of more allowance certificates as coal emits more CO2 than gas fired power plants. Prices stayed at this level with high volatility though until some Member States announced their emissions data mid 2006 before the European Commission's deadline. The content of those announcements were that a lot of countries had more allowances than the industry needed, meaning a surplus of emissions. When this became obvious, the result was an immediate drop in CO2 prices from €33 to only 10 € per tonne of CO2 emissions (POINT CARBON/EEX 2006). Later on, prices increased again, but they never reached their pre-crash level. They remained rather low and tended to decrease further towards meaninglessness. Since Spring 2007, prices have been well below 5 € / t (see for permanent updates e.g.: http://www.pointcarbon.com). Thus it seems that, firstly, the market for carbon proves to be flexible and responsive and, secondly, information and especially expectations are main explanatory factors for price developments.

Figure 3: CO2 prices in the years 2005 and 2006

* Spot since Sept 2005, before Sept 2005 forwards on EUA 2005
** EEX futures

Source: POINTCARBON, EEX,
see for permanent updates e.g. : http://www.pointcarbon.com

A lot of industry representatives made the CO2 prices responsible for increasing power prices. Future contracts for power prices do indeed show a high degree of correlation with forward allowance prices. However, correlation does not necessarily imply any immediate causation. Oil prices have almost doubled during the time of high CO2 prices and therefore power prices have not only increased in Europe (CONVERY 2005). Emissions Trading is certainly but one factor when looking at energy prices. In fact one needs to take into account that changing relative prices in favour of less greenhouse gas emitting technologies is central to any serious climate change policy. Emissions trading, because it is a cost-effective way of reducing emissions, will mean most probably lower price changes than any alternative – but higher prices for CO2-intensive activities compared with business as usual. One should also not forget the fact that other policies have impacts upon prices in the electricity sector too. Emissions trading, or more accurately, taking action to tackle climate change, is just one of many factors potentially influencing the power markets.

Pricing in allowances as opportunity costs in the cost calculation following the free allocation of CO2 allowances was an expected scenario. Counting the allowances as assets in the company reports means that they are placed on the asset side of the company balance sheets with their market value. Since they are handed out free of charge, this in essence represents a windfall profit for the participating companies! The incomplete liberalisation of the European Energy Market however, allows power companies to pass on a high proportion of those opportunity costs – quite relevant for energy intensive industrial users. The pass-through-rate depends on various factors such as market power (i.e. oligopolistic structure), demand elasticity, mode of allocation, energy structure (e.g. coal-fired plants acting as marginal technology in Germany) or regulatory interventions (IEA 2007). Tentative ex post estimates on pass-through-rates come to the conclusion that peakload periods offer opportunities to pass through costs in the order of 41 % and 117 % (SIJM et al. 2005, 2006; HUCHLER 2007). It is thus important to analyse market structures and to keep an eye on a possible misuse of market power. From today's perspective though, discussion regarding high power prices due to Emission Trading should not be on the top of the agenda as allowance prices are on a low level (see above).

The system is working, even if there is an over allocation at the moment. Prices do react to market developments and information given out to the public. However, there are still a lot of issues that can be kept in mind for an improved system:

- *Allocation:* Grandfathering cannot be the future of the scheme as it brings along adverse incentives when the base year needs to be changed. Auctioning and also free allocation on the basis of some benchmarking (based on sector or fuel benchmarks) should be taken into account when looking at the period from 2013 onwards (MICHAELOWA/ BUTZENGEIGER, 2005).

- *Complexity and transaction costs* are rather high. Various interests have different objectives and as the regulator is trying to meet all demands the system tends to become more complex, less efficient and it looses market effectiveness (EEA, 2005). Transaction costs should be kept down e.g. via establishing an EU wide new entrants reserve or an EU wide registry and, later on, a European agency. Of course, information should be freely available for all market actors in the same manner and at the same time.

- The *trading periods* are regarded to be too short for any serious investment decision. Asset lifetimes in capital intensive industries are roughly between 20 to 60 years with several years of construction time. Most companies are therefore pleading for a trading period of at least 10 years and if necessary with adjustments (MCKINSEY, 2005), which is analytically in line with the concept of asset specificity (WILLIAMS, 1985).

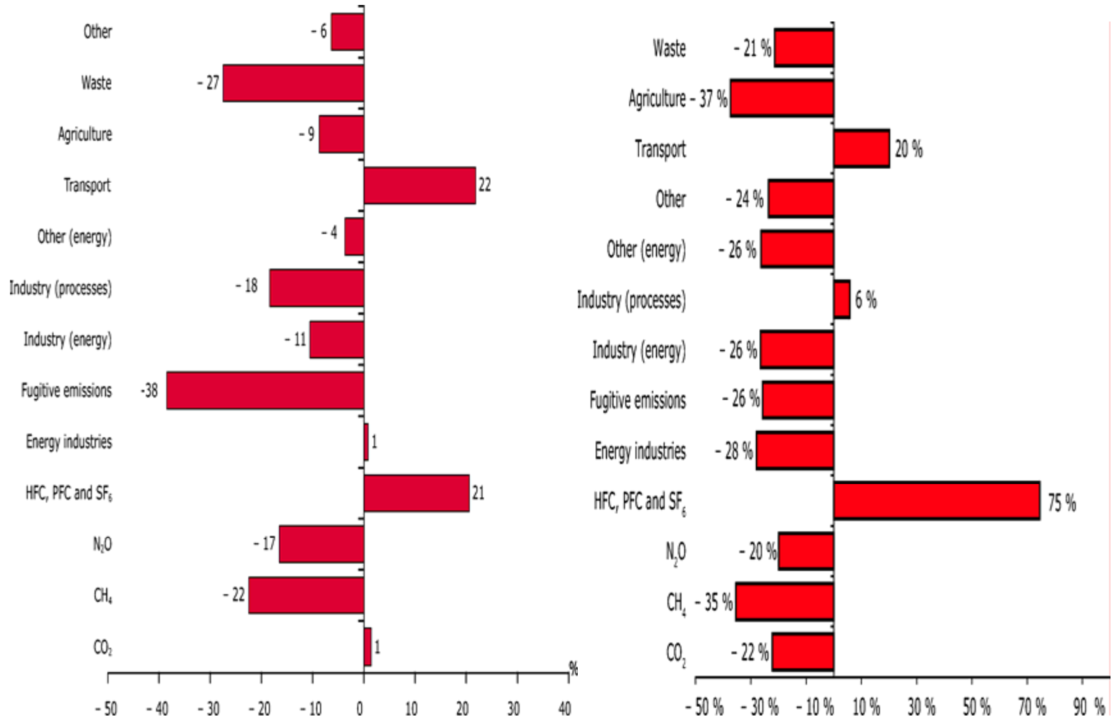
- In general a higher degree of *harmonisation* in all architectural aspects has been asked for by all actors involved in order to exclude inequality between the same sectors across Europe (MCKINSEY, 2005).

- Also, an *inclusion of further greenhouse gases and sectors* as soon as the EU ETS has stable rules has advantages. Especially as other sectors, such as transportation are responsible for a high proportion of total greenhouse gases and have in particular grown in the last years as can be seen in the following graphic. Aviation will most probably join the system in some years.

To tackle part of the transport emissions, in December 2006, the European Commission issued a legislative proposal to include CO2 emissions from aviation into the EU ETS from 2011 onwards (EC, 2006b). Even though the emissions from aviation account for only 3% of total EU greenhouse gas emissions, they are rapidly increasing (87% since 1990), as air travel has been becoming relatively cheaper compared to other travel possibilities. Air travel is not yet regulated by other parts of EU climate policy. For example, someone flying from London to New York and back generates roughly the same level of emissions as the average person in the EU does by heating their home for a whole year (EC, 2006b).

Figure 4: Change in EU-15 (left) and EU-10 (right) emissions of greenhouse gases by sector and gas 1990-2003

(EEA webpage http://dataservice.eea.europa.eu/atlas/available2.asp?type=findtheme&theme=climate).



Some issues in the debate on including aviation in the EU-ETS are:

- Whether or not to include international flights from 2012 onwards in the scheme. The US especially has made clear that such an action could result in trade sanctions as a consequence. The Commission plan maintains the idea of including international flights in the scheme, but proposes exempting them until 2012, while intra-EU flights will have to come under the scheme in 2011.

- How to take other greenhouse gases into account, including Nitrogen oxides (NOx) and the water vapour in aircrafts' condensation trails which also contributes to global warming. The Intergovernmental Panel on Climate Change (IPCC) has estimated that the total impact of aviation on climate change is currently about 2 to 4 times higher than what stems from CO2 emissions alone. NOx had been in the initial proposal by the European Commission, but for political reasons it was taken out.

4. Impacts on Energy-Intensive Industries

The case of the energy intensive industries is important for several reasons: firstly, competition intensity in general is higher than in energy production with its inherent natural monopoly (the grid). Secondly, energy intensive industries are an essential supplier to many other industries downstream and, thus, form a vital part of the European economy. Thirdly, if energy intensive industries would relocate, not only the environmental relief would be questionable (assuming that other countries would not have stricter environmental policies), but also sustainable value chain management would become more difficult. Assessing the impacts of the ETS on these industries therefore is of high importance.[4]

One impact is quite clear: the choice of allowance allocation does affect the international factor mobility as well as the location of new companies. That is especially true for sectors that are competing in a world wide market. This could even be true within the European Union, as companies situated in relatively well endowed accession countries, such as Poland, might have an advantage over companies that are situated in countries such as Spain or Portugal which have limited surplus allowances (KLEPPER/PETERSON, 2003).

Energy intensive industry, covered by the EU ETS or not, is affected directly by the cap that is set on their CO2 emissions or indirectly by increasing electricity prices. In general one can say that three factors determine the impact of Emissions Trading on the industry sector (CARBON TRUST, 2004):

1. Energy intensity,
2. Ability to pass on costs to the customer,
3. Abatement possibilities.

The ability to pass on costs depends again on three factors and differs substantially across sectors. Firstly the price elasticity of customers in the sector is essential when determining the degree of pass through ability of costs. The nature of competition is important as well. A sector with fierce competition has less opportunity to pass on

[4] There have been different analyses on the impact on industry due to the introduction of the EU ETS. One is for example a study conducted by KLEPPER/PETERSON in 2003. Carbon Trust examined different sectors in 2004 and a more recent one is done by McKinsey & Company and Ecofy in 2005/2006 commissioned by the European Commission/DG Environment. See also SZABO et al. 2006.

costs to its customers. The third factor – abatement possibilities – not only depends upon technology choices: any substitution of energy intensive materials downstream certainly is a desired steering effect. But abatement costs also relate to the geography of the market, meaning whether companies being affected by the scheme are competing on a global scale or in a regional/national market. Companies outside the EU will not experience any direct cost increase as a result of the EU ETS. However other countries which have signed the Kyoto Protocol will start to put in place national policies and, therefore, companies in those countries might be affected by other domestic policies.

Abatement possibilities have different costs depending on the sector. With CO2 emissions having a price, investment in abatement, such as energy efficiency, should offer opportunities that limit exposure to the EU ETS. Although some design features and uncertainty could hamper such a development. The Carbon Trust has tried to characterise the different sectors according to those factors as illustrated in figure 5.

Figure 5: Classification of Industry sector by Carbon Trust (2004).

Value at stake as a proportion of sector profit

« Value at stake based on potential increase in energy costs”

	High (ability to pass on costs)	Low (ability to pass on costs)
High (value at stake)	***Pass-through gains?*** Electricity*	***At risk?*** • Ferrous metals* • Cement* • Oil refining • Glass • Alumunium♣* • Chemicals♣
Low (value at stake)	***Unaffected***	***Marginal impact*** • Paper (newsprint) * • Pharmaceuticals♣ • Food & drink♣ • Retail♣ • Transport♣

• EU ETS sectors

♣ Non – EU ETS sectors

* Sectors analysed

Ability to pass on costs to customers

“Cost pass-through and impact on consumer demand linked to location, number and behaviour of competitors”.

In general, an economic analysis can say with confidence that electricity generators (i.e. utilities) are gaining or at least are not loosing from the introduction of the European Emissions Trading system, especially nuclear power plants. Fossil fuel power plants will incur a huge increase in direct costs, but are still able to pass through costs. This is partially due to the fact that the liberalisation of the European Energy market is not yet finalised and moreover a lot of incumbents still have strong market power in their respective market. For example, EDF can still be considered a quasi monopolist in France and Germany is characterised by an oligopoly with only four main players dominating the market. This paper will now look into the characteristics of selected energy intensive sectors.

4.1. The Cement Industry

The Cement Industry, included in the EU ETS, is the basis for every construction project and is therefore important for every economy. More than 50% of European cement production is accounted for by five major players, while the top 10 players hold about a 76% market share. It must also be mentioned that the top five players hold a large share in the global cement market of around 30% (MCKINSEY and ECOFYS, 2006).

Regarding the location of the cement industry, production usually takes place where the basic material is available. Transport costs are relatively high compared to the end price of cement, which results in low international trade. Recently marine transport is becoming more and more attractive and therefore international trade is increasing (CEMBUREAU, 2006).

Cement production costs will approximately increase by 36% due to Emissions Trading according to the McKinsey Study (2006) that assumes an average CO2 price of 20 €/ton CO2 emissions. Most of this cost increase is due to direct emissions, indirect impact from higher electricity prices make up only a small share of overall cost increase. Thus, depending on the ability to pass on costs to customers, the European cement industry on average will face a cost increase – moderate or neutral if the costs can be passed through. Potential cost increases will probably be seen close to seaports or EU borders (Greece, Spain, southern France, Italy) where the possibility of importing cement is the highest (MCKINSEY/ECOFYS, 2006) and therefore costs cannot easily be passed on to final consumers.

Experience during the first phase of the scheme shows that there is significant capacity to cut back emissions by reducing clinker input and by using more non-fossil fuel (CARBON TRUST, 2006). Thus some environmentally benign innovation effects seem to take place. The Carbon Trust (2004 and 2006) study that is mainly looking at the UK cement industry does not see major risks for the UK cement industry as there is hardly any international competition in the sector. However, both studies note that with higher carbon prices and the possibility that the allocation will be auctioned, the situation might change in the long term. Under changing EU ETS architecture with i.e. increased auctioning and with increasingly low-cost marine transportation, the cement industry will have an incentive to relocate at least parts of their production capacities.

4.2. The Steel Industry

The steel sector is a highly energy intensive industrial sector included in the EU ETS. When looking at the impact of Emissions Trading on the steel sector one has to take into account the two different main processes for steel making: Basic Oxygen Furnace (BOF), producing mainly flat products of high value and Electric Arc Furnace (EAF) production mainly long products for some construction purposes from scrap steel (MCKINSEY and ECOFYS, 2006). Nearly 100% of emissions in the EAF process are indirect emissions whereas only 10% are indirect in the BOF process. Consequently, the emissions in BOF are mainly directly process-related, whereas the EAF route principally emits CO2 indirectly through the use of electricity. Products produced by the EAF process compete mostly in regional markets and are therefore able to pass through more costs than products (cold rolled flat steel) from the BOF process, which are competing on the global market (CAR-BON TRUST, 2004).

Under the assumption of more auctioning for allowances and no pass-through of carbon costs, flat products (BOF) could experience a cost increase of 16%-17% (depending on the pass-through-rate in the power sector) supposing an CO2 price of 20 €/t (HUCHLER 2007: 22). Given the additional costs on marginal production of

BOF products there could be a possible incentive to stop producing in Europe and to shift production to countries without carbon costs.

If, on the other hand, one assumes free allowances of 95 % and also pass-through rates of additional costs to the steel users, the cost impacts on the steel industry will be very moderate and hardly exceed 1 %.

China is an interesting player on steel markets. Currently, China causes a scarcity of scrap steel which leads to high input prices for EAF processes. This is likely to continue for the next years (MCKINSEY and ECOFYS, 2006). If, in the mid run, China is to become a steel exporter instead of importer, the long term industry margin of about 5% might come under pressure especially in the BOF process. Especially flat steel would then be affected

Under favorable conditions, the European steel industry seems to bear only a moderate impact on its competitiveness. However, the institutional settings of the EU ETS and related market structures are crucial: under more unfavorable conditions, especially the flat steel production might come under pressure.

4.3. The Aluminium Industry

The Aluminium Industry is a sector that is not included in the European Emissions Trading scheme, but will probably still see an increase in production costs due to the indirect impact of rising electricity prices because of the EU ETS. Half of the EU's aluminium is produced by primary smelting whereas half is produced by secondary smelting/recycling. The process of smelting aluminium consumes over 15Mwh of electricity per ton of aluminium. In comparison to i.e. steel production (300kwh/tonne of steel) this is extremely high (CARBONTRUST, 2006). Recycling on the other hand or secondary smelting consumes about 0.7Mwh/ton of steel.

If aluminium smelters do not generate their own electricity (as a lot of them across Europe do not) they will be exposed to increasing electricity prices after their long term contracts with electricity companies run out and they will have to buy their electricity from the grid or purchase it at less favourable conditions via new contracts. True enough: this creates an incentive to set up own electricity production capacities.

Due to intense competition both inside and outside of Europe (high international trade) none of the cost increases can be passed on to customers. All studies expect the shut down of primary smelting in Europe in the next 20 years. However, the scheme is only one more reason to focus investment outside of Europe. Most probably this development would happen irrespective of the EU ETS due to the general development of the energy markets and the fact that aluminium smelters already operate at the high cost end. Secondary aluminium smelters will probably not be affected by higher electricity prices.

4.4. Conclusions

To conclude, our brief analysis reveals that the EU ETS may have negative economic effects on the energy intensive industries. Under the assumption that carbon prices are likely to increase again, those industries have – at least in parts – an incentive to relocate their production outside the EU. Even the cement industry where transportation costs are significant, may decide to use marine transportation from outside the EU. Assuming that those other countries do no meet the high environmental standards set by Europe, this should become a sustainability issue.

5. Impacts Towards Sustainable Energy Supply Systems

If one takes the climate issue seriously (STERN, 2006), the European Union needs to radically innovate and to change energy supply systems in the long run. Assuming that all GHG emissions need to decrease by at least 20 % by 2020 and by 50 – 80 % in the long run, there has to be a massive restructuring of the energy supply system. Despite these requirements however, both energy and electricity production is likely to increase from 2,963 TWh to 3,666 TWh till 2020 according to current EU forecasts and the McKinsey European Power Model (MCKINSEY, 2006). The challenges therefore are enormous and aggravated by the global nature of the problem and rising emissions elsewhere (IEA WORLD ENERGY OUT-LOOK 2005).

The European Commission launched its energy package in January 2007. The main aspect of the proposals is a binding target to slash the EU's greenhouse gas emissions by 20% in 2020 compared with 1990 levels (EC, 2007a). Against this background, economic analysis assesses the consistency and the impacts of current incentives. To what degree does, for instance, the EU ETS spur investments towards more sustainable energy supply systems?

Up to now the international agreements such as the Kyoto Protocol do not give a clear long term perspective. One could of course assume that the energy world will need to become less and less carbon intensive, but this is a normative assumption and there have been no intermediate and long term goals set. A promising energy carrier such as hydrogen, which is at the stage of demonstration projects but well below any deployment, needs long term forward looking politics with a system of clear time perspectives (CARRARO/EGENHOFER, 2003; BLEISCHWITZ/FUHRMANN, 2006).

Analysing the Emissions Trading Scheme, it partly encourages the uptake of climate-friendly technologies by rewarding businesses investing in energy efficiency and some green technologies, thus turning their investments into quick, short term profits. But given the uncertainties about its future characteristics, it can hardly encourage investments into long term solutions. Also given other barriers such as:

- lack of seed money and venture capital for start ups;
- split incentives between users and investors;
- biased calculation and underestimated payback times not favouring investments into more efficient technologies;
- existing market power, in particular in the energy sector;
- general information deficits.

The risk of sunk costs is still too big and the coordination costs are too high for many investors. In the case of the hydrogen economy, for instance, actors such as the gas industry, oil industry, automobile industry and many SMEs need to cooperate in order to establish an infrastructure simultaneously with production capacities and demand (e.g. from transportation).

This poor technology push effect is aggravated by the limited playing field for the ETS: the automobile industry and oil industry, both of whom have an interest in investing into mobility after the oil age, are not covered by the EU ETS. Surrounded by many constraints, the EU ETS can only provide narrow incentives to discover new technical solutions. According to ENDRES/OHL (2005: 29) the ETS will display the push generally expected from market forces only to a limited extent. The European Emissions Trading Scheme in itself thus does not give the incentive to invest in such disruptive technologies and it is also not its aim to start with. As a consequence, short-run and flexible abatement possibilities seem to be more appealing to firms.

A dynamic push towards sustainable energy systems would require both an improved ETS system and – especially – more targeted programs for business development and market entry of new energy sources and carriers. One could, for example, imagine that companies invest in emission reducing projects within the EU and get credits for it, comparable to JI or CDM projects. Though, the European Commission does not favour this option as it merely shifts reduction efforts from one sector to the other.

Some technologies can already be seen as key technologies for mitigating global warming and to ensure a less dependent energy supply in the European Union. Some are already being actively encouraged by EU policies (e.g. renewables) while others are still subject to further research (e.g. hydrogen, CO2 sequestration). A few options on how an improved ETS might be part of a larger policy package aimed at long-term innovation should be mentioned here:

1. *More strategic policy coordination between different parts of the European Commission*, such as DG Environment, DG Research and DG Transport and Energy is at stake. Quite often, steps are undertaken without sufficiently taking into account other policy areas. The regulatory impact assessment might be a tool for better individual regulation, but communication and strategic policies should also be improved.

2. *More focused action*: the Hydrogen and Fuel Cell Platform (HFP) and the upcoming Joint Technology Initiative (JTI) aim to facilitate and accelerate the development and deployment of European hydrogen and fuel cell based energy systems and component technologies for applications in transport, stationary and portable power. Major challenges can be seen in a) disseminating the knowledge and b) to speed up the deployment strategy. Currently not only the hesitation of the financial markets to support long term investments in new infrastructures or

public acceptance, but also the lack of coordination between the EU programmes themselves and between EU and national programmes are a serious barrier to deployment. A focused action could include large scale HFC demonstration projects and a few first pipeline distribution systems in areas with steam methane reforming capacities and high energy consumption, added by a cluster policy for innovative SMEs which bring new application products with HFCs in niche markets.

3. *Sectoral action plans with energy-intensive industries and its customers down-stream* where long term perspectives are formulated and some short term exemptions from climate policy are combined with binding roadmaps on sustainability innovation and market development in those sectors. E.g. exemptions from energy taxation and feed-in laws for renewable energies are economically justified only if those energy intensive industries adopt credible strategies for sustainable energy use. This also fits to the Thematic Strategy on the Sustainable Use of Natural Resources (COM(2005) 670 final).

4. *Make use of break even points*: tentative calculations (Huchler 2007) reveal that above a price of 23.4 €/t CO2 it becomes profitable to shut down existing coal plants and to replace them by new combined cycle gas turbines. Those break even points are relevant for many new technologies. A sustainable industrial policy therefore would increase and stabilize carbon prices beyond such break even points.

5. *Financing innovation*: If policy makers would adopt auctioning as the preferred allocation method one could use part of the generated revenues to put into a fund that is investing in research, demonstration and implementation projects such as hydrogen technology. An auctioning scheme would also create a uniform and transparent price signal for the costs of carbon, whereas allocation based on grandfathering creates manifold distortions and inconsistencies. As the transport sector is not yet included in the EU ETS, research could develop scenarios to indirectly decrease emissions from that sector in the long term with carbon free produced hydrogen/fuel cell vehicles. In order not to create additional bureaucracy, those revenues could support EIB programmes or the EU regional funds targeted to co-finance hydrogen communities.

This section has not been written down to fully describe incentive schemes towards a sustainable energy supply in the EU. Many economic and legal aspects need to be assessed thoroughly in the future.

6. Conclusions

The implementation of the EU ETS is the largest experiment in environmental policy in the world. Never before has such a market-based environmental policy instrument been created that has a comparable coverage, both in geographical terms and with regard to the emissions and the market volume. The EU ETS is foremost a working system that – with some improvements – has the potential to become a pillar for effective and efficient climate change policy that also gives incentives for investment into climate friendly policies. With a range of lessons being learnt and still to be learnt, emissions trading in the EU can move from a new instrument with teething problems to a mature instrument that allows the meeting of targets at the lowest cost, when compared to other policy options.

Current weaknesses of the EU ECTS can be summarized, with regard to the scope of our paper, as follows: at the moment it is still very inconsistently implemented and has a fairly narrow scope regarding greenhouse gases and involved sectors. The distribution of allowances to sectors and installations was seen as purely a distributional problem for a long time. However, the initial experiences of effective implementation show that some key provisions were implemented that create disadvantages which will have significant effects on the environmental effectiveness of the scheme in the medium and long term for the EU as a whole.

The EU ETS may create incentives to relocate for energy intensive industries – at least the three industries analysed here (cement, steel, aluminium) will be faced with higher production costs and cannot fully pass on those costs to their customers. If prices for allowances skyrocketed (say above 30 €/t) those industries would be at a disadvantage compared to their competitors from outside the EU.

As of today, the EU ETS does not yet properly facilitate long term innovation dynamics such as the transition to a hydrogen economy. This may not come as a surprise, because the EU ETS has not been set up to do that in the first place. It encourages low cost emissions reduction measures but does not yet properly provide the incentives needed to bring about structural change.

Suggestions for improvements along these lines include (see above):

- More strategic policy coordination between different parts of the European Commission;
- More focused action on deployment of key sustainable technologies;
- Sectoral action plans with energy-intensive industries and its customers downstream;
- Make use of break even points such as switching from coal to gas;
- Financing innovation.

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