MIT Joint Program on the Science and Policy of Global Change

The European Carbon Market in Action: Lessons from the First Trading Period

Interim Report

Frank Convery, Denny Ellerman, and Christian De Perthuis

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The MIT Joint Program on the Science and Policy of Global Change is an organization for research, independent policy analysis, and public education in global environmental change. It seeks to provide leadership in understanding scientific, economic, and ecological aspects of this difficult issue, and combining them into policy assessments that serve the needs of ongoing national and international discussions. To this end, the Program brings together an interdisciplinary group from two established research centers at MIT: the Center for Global Change Science (CGCS) and the Center for Energy and Environmental Policy Research (CEEPR). These two centers bridge many key areas of the needed intellectual work, and additional essential areas are covered by other MIT departments, by collaboration with the Ecosystems Center of the Marine Biology Laboratory (MBL) at Woods Hole, and by short- and long-term visitors to the Program. The Program involves sponsorship and active participation by industry, government, and non-profit organizations.

To inform processes of policy development and implementation, climate change research needs to focus on improving the prediction of those variables that are most relevant to economic, social, and environmental effects. In turn, the greenhouse gas and atmospheric aerosol assumptions underlying climate analysis need to be related to the economic, technological, and political forces that drive emissions, and to the results of international agreements and mitigation. Further, assessments of possible societal and ecosystem impacts, and analysis of mitigation strategies, need to be based on realistic evaluation of the uncertainties of climate science.

This report is one of a series intended to communicate research results and improve public understanding of climate issues, thereby contributing to informed debate about the climate issue, the uncertainties, and the economic and social implications of policy alternatives. Titles in the Report Series to date are listed on the inside back cover.

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Foreword

The European Union Emissions Trading Scheme (EU ETS) is the largest greenhouse gas market ever established. The European Union is leading the world's first effort to mobilize market forces to tackle climate change. A precise analysis of the EU ETS's performance is essential to its success, as well as to that of future trading programs.

The research program "The European Carbon Market in Action: Lessons from the First Trading Period," aims to provide such an analysis. It was launched at the end of 2006 by an international team led by Frank CONVERY, Christian DE PERTHUIS and Denny ELLERMAN. This interim report presents the researchers' findings to date. It was prepared after the research program's second workshop, held in Washington DC in January 2008. The first workshop was held in Paris in April 2007.

Two additional workshops will be held in Prague in June 2008 and in Paris in September 2008. The researchers' complete analysis will be published at the beginning of 2009.

The final version of this report was prepared by Cate HIGHT, Raphaël TROTIGNON and Christian DE PERTHUIS from the Mission Climat of Caisse des Dépôts. The report is also available in French on the website of the Association for the Promotion of Research into the Economics of Carbon (APREC), accessible at http://www.aprec.net/.

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1. Historical Background of the EU ETS: How to Transform Failure into Success?

Introduction

In a context of which Nietzsche would have approved, the European Union Emissions Trading Scheme (EU ETS) grew out of failure. Nietzsche admonishes us to:

Examine the lives of the best and most fruitful people and peoples and ask yourselves whether a tree that is supposed to grow to a proud height can dispense with bad weather and storms; whether misfortune and external resistance, some kinds of hatred, jealousy, stubbornness, mistrust, hardness, avarice, and violence do not belong among the favourable conditions without which any great growth even of virtue is scarcely possible.[1]

The sapling that became EU ETS has survived many of the challenges Nietzsche described. At its origin, the scheme was a product of two failures. First, the European Commission failed in its initiative to introduce an effective EU-wide carbon energy tax in the nineties. Second, the Commission fought unsuccessfully against the inclusion of trading as a flexible instrument in the 1997 Kyoto Protocol. It is instructive to examine each of these events before exploring the evolution of the trading scheme, a framework made possible by political cooperation, robust intellectual development and lessons from experience in the United States.

The initial failures

The Single European Act of 1986, which formally established European political cooperation and a single European market, provided the statutory basis for subsequent action to address climate change. It highlighted the need to address environmental challenges that transcended national frontiers on a community-wide basis, and to do so in a cost effective manner.

These considerations combined to convince the European Commission to propose an EU-wide carbon energy tax in 1992.[2] Opposition to the proposal came from two powerful sources. First, some Member States regarded a carbon tax as blow to their sovereignty that would be followed inevitably by other taxing initiatives that would incrementally leak fiscal autonomy to the Commission. Secondly, the main industry lobby also opposed the tax, with consistent and persistent case-making at Member State and EU levels.[3] The opposition proved too strong, and the carbon energy tax proposal was formally withdrawn in 1997.

During the same period, The European Union was very active in the international climate negotiations that led to the Kyoto Protocol. Three features characterised the European Union's negotiating position: a commitment to mandatory caps on emissions by developed countries, an undifferentiated target of 15% below 1990 emissions levels, and an antipathy toward emissions trading as a mechanism for achieving this target. The Kyoto Protocol was signed in December 1997. Signatories agreed to caps, but the EU failed to achieve its 15% reduction or undifferentiated target goal.

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[1] Friedrich Nietzsche, *The Gay Science*, 1882.
[2] COM (1992) 226.
[3] Some industry interests at this time proposed emissions trading as a preferable option to taxation, a position that proved of relevance later on.

In addition, at the insistence of the US delegation led by then-Vice President Al Gore, emissions trading between countries was included as a flexible measure, together with the Clean Development Mechanism (CDM) and Joint Implementation. The European negotiating team felt that it had failed to achieve most of what it had aimed for, and shortly after Kyoto most team members moved on to other assignments. Six months after Kyoto, new leadership at the Commission embraced emissions trading.

The emergence of emissions trading in the European Union[4]

A key decision which enabled EU trading to emerge was the Burden-Sharing agreement of June 1998. In this agreement, each of the then-15 Member States agreed to a national target, the sum of which amounted to the overall Kyoto target of 8% below 1990 emissions levels.[5] These targets were subsequently made legally binding. Also in June 1998 the Commission issued "Climate Change: Towards an EU Post-Kyoto Strategy,"[6] which stated that the Community *could* set up its own internal trading scheme by 2005, a move which would give the EU practical familiarity and even a leading edge in using this tool.

Member States were first to act on the potential that emissions trading seemed to offer. The UK had emerged during the 1990s as the European leader in mobilizing markets to address a range of environmental challenges. Denmark had a long tradition of using environmental taxes, and so was politically and temperamentally disposed to use markets to support environmental objectives. This early action by Member States convinced the Commission and others to move quickly at EU level. Otherwise, Europe would end up with a patchwork of schemes combining lack of scope and scale and probable incompatibilities to make the whole much weaker than the sum of the parts.

Momentum at the Commission quickly gathered force. Following the publication of a Green Paper in March 2000 and subsequent stakeholder consultations, the EU ETS draft proposal was submitted in 2001 for formal consideration. The European Parliament conducted its first reading of the draft Directive in October 2002, the Council of Ministers presented its position in December 2002, and an amended draft Directive was adopted and approved by the European Parliament and the Council of Ministers in July 2003. On October 13, 2003, emissions trading Directive 2003/87/EC came into effect, with trading to start in January 2005.

What made it possible?

In most Member States, objections to emissions trading were largely confined to industry and its representatives. Thus, securing agreements at the national level required the support of several key industrial lobbies. Given this context, the following seem to be amongst the key explanations of what made possible the rapid enactment of an emissions trading program in the EU:

- *Free allowances.* This met the needs of most industrial emitters. The European Parliament did take issue with this policy, but it never achieved traction with other key stakeholders and the general public.

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[4] The legislative history, including key preparatory studies, can be accessed at: http://ec.europa.eu/ environment/ climat/ emission/ history_en.htm and details are also available at http://www.carbonexpo. com/wEnglisch/carbonexpo2/img/dokumente/040316_ Hintergrundinformation_e_Carbon_Expo.pdf.

[5] Council conclusions of 16-17 June, 1998, Council Doc 9702/98.

[6] COM (1998) 383 Final, 3rd June 1998.

- *Fear of the alternative.* The use of carbon taxes and/or command-and-control regulation was variously proposed as alternative means of reducing emissions. Both of these options were less attractive to industry than trading.

- *Information flow from the US* generally and US businesses in particular, based on the experience of the Acid Rain Program. The US's success with sulphur dioxide emissions trading provided European economists with insights to apply to the European situation and provided officials in the Member States and the Commission with a body of literature and individual experiences to learn from.

- *The partition of the scheme into two phases,* a pilot phase (2005-07) and a second or "Kyoto" phase (2008-12). Drawing on operational US experience, the Commission became convinced of the huge volume of work that was needed to ensure a quality program, and the need to "learn by doing" over a defined period.

- *President Bush's decision not to seek ratification of the Kyoto Protocol,* or to implement a substantive alternative, created a space for Europe. This enabled the European Commission to take the international lead on climate change policy. It also reinforced the view that collective decisions at the EU level are generally more efficient than unilateral Member State actions.

- *Use of the Kyoto flexibility mechanisms was favoured by most stakeholders.* Industry approved linking the EU ETS with the Clean Development Mechanism (CDM) and Joint Implementation, as these tools would expand the supply of allowances and thus reduce allowance prices. Most NGOs also supported the inclusion of the Kyoto mechanisms after the US decided not to ratify the Kyoto Protocol.

While the EU ETS is still in its infancy, the significance (and importance) of the EU's ability to make the scheme operational so quickly cannot be underestimated. The European Union is home to 500 million people, living in 27 countries, embracing 23 languages, with per capita GDP ranging from $42,000 (Ireland) to $9,000 (Romania and Bulgaria). And it is not always a harmonious club. The EU ETS is not only playing a pivotal role in helping Member States achieve their Kyoto targets, but it is also sending a positive message to the international community that global emissions trading is now a viable policy tool.

2. The First Step: Allowance Allocation

Introduction

Allocation is a unique feature of cap-and-trade systems. Indeed, a critical issue in dealing with climate change is deciding who has a right to emit carbon dioxide (CO_2), under what conditions, and to what extent those emissions are limited. The EU ETS is the first instance of creating explicit rights to emit CO_2 and distributing these rights among sub-national entities. Its performance is attracting world-wide attention.

Initial conditions faced by the EU Member States

The experience of the EU allocation process shows how important the initial conditions are to the performance of the trading scheme. Member States overcame three major problems in the first trading period:

- *Tight time schedules.* The Member States faced significant time constraints in preparing their National Allocation Plans (NAPs) for the first allocation period. In accordance with the Directive, Member States had to submit their first allocation plans to the Commission by 31 March 2004, less than six months after the Directive's formal entry into force on 25 October 2003.

- *Limited data availability.* The lack of installation-specific emissions data was perhaps the biggest problem that Member States faced in the allocation process. This came as a surprise to many, as most countries had developed reasonably good inventories of CO_2 emissions data prior to the launch of the EU ETS. However, this inventory data was developed from aggregate energy-use statistics and did not extend to the installation-specific level. One of the insights from the EU allocation process is that data availability limits allocation choice: many *a priori* preferences were impractical due to the difficulties of obtaining installation-level data. This data problem was largely overcome by the time the second allocation plans were prepared.

- *Unclear definitions of coverage.* A third condition that rendered the preparation of the first NAPs difficult was an unclear definition of the types of installations to be covered by the trading scheme. The uncertainties arising from these unclear definitions were largely overcome in the second allocation phase as a result of increasing experience, which allowed the Commission to provide more consistent guidance.

Setting the allocation constraints

Three procedures characterized the process by which EU Member States assumed their emissions constraints.

- *Interaction between stakeholders and government.* The "macro" cap-setting was achieved in a decentralized, negotiated process between the Commission and Member State governments that reflected the political structure of the European Union. The "micro" aspects of allocation could best be characterized as an extended industry-government discussion dictated by data availability and the ETS mandate to distribute at least 95% of allowances to installations for free. These circumstances created an iterative process whereby data was collected, cross-checked, refined, evaluated, and modified by way of close interaction between stakeholders and governments.

- *Role of central coordination.* While the allocation process in the EU ETS was highly decentralized, the European Commission provided a vital coordinating role. It acted not only as an educator and political facilitator, but also as an 'enforcer of scarcity' in its review of the NAPs. The Commission used a minimalist approach, focusing its decisions on a few issues only. First, it made sure that the total allocation was not overly generous. The Commission reduced 15 NAPs in the first allocation phase by 290 million tons annually and 23 NAPs in the second allocation phase by 242 million tons annually. Second, the Commission was vigilant against ex post adjustments. Third, in the second allocation round, the Commission limited the number of CDM/JI credits that Members could import into the ETS.

Finally, moving from the first to the second allocation phase, the Commission played a stronger role in setting the EU cap, reducing the allocation from the first period to the second period. Instead of being negotiated between the Commission and the Member States, the Member State totals in NAPII were virtually predetermined by a single forecasting model that was transparent and consistent in its treatment of Member States. Although different assumptions concerning economic growth and energy efficiency improvements were made for individual Member States, the model's predictions of BAU emissions and each Member State's distance from its Kyoto target were major determinants of the caps.[7]

[7] Nonetheless, the decisions based on this procedure are being challenged by the eight Eastern European Member States, who argue that the model does not adequately take into account their unique

- *Use of projections.* A further distinguishing procedure in the EU allocation process was the use of emissions projections to set caps and distribute allowances among sectors. Member State caps were set using estimates of business-as-usual (BAU) emissions, which are uncertain on an ex ante basis. Moreover, the decision to allocate as many allowances as needed to non-power sectors required projections of expected sector emissions. These projections proved to be error-prone not only because of data and modeling problems, but also because of the inherent uncertainty of such predictions and the large effect of errors when the intended emission reduction is small. While the data problems of the first allocation period were largely overcome and a single predictive model is being used in the second period, the uncertainty surrounding predictions remains.

Allocation choices made by the Member States

Surprisingly, the allocation methodologies applied by the 25/27 participating nations were remarkably similar. Four choices seem particularly interesting.

- *Auctioning was only little used.* One of the most striking features in the EU allocation process was that most Member States chose not to take advantage of the Directive's provision allowing states to auction up to 5% of allowances in Phase I and 10% in Phase II. Only four Member States used auctioning in Phase I; auctioned allowances accounted for 0.13% of the total allocation. More allowances are being auctioned in the second phase, though the quantity is still well below the allowed limit. The general view is that auctioning percentages will be much higher post-2012.

- *Strong reliance on recent historical emissions.* The disparity between advocacy and practice was in no aspect greater than for benchmarking. Benchmarking was strongly advocated but nonetheless little used, which is a striking difference from US practice. This failure was not the result of lack of trying, but because allocations based on benchmarks would have been too far below recent emissions to gain widespread acceptance. In the absence of practical benchmarks and given source heterogeneity and data limitations, recent emissions became the default option and thus the basic reference point. Benchmarking has increased in the second allocation phase, mainly for the power sector, but always in a very fuel-differentiated manner.

- *Expected shortage was allocated to the power sector.* Another distinctive feature in the EU allocation process was that the power sector was obliged to bear almost the entirety of the emissions reduction burden. When a Member state was short on allowances, this shortage was almost entirely allocated to the power sector. There was an equally consistent attempt to allocate as many allowances as needed to industry. The clear distinction between industry and the power sector was justified by a twin rationale: the (perceived) abatement potential of sectors and their exposure to non-EU competition. Thus, the power sector was allocated the shortage because electricity production does not face international, non-EU competition and because power plants are believed to have the ability to abate emissions at less cost than others (typically by switching to natural gas) and thus have a greater ability to reduce emissions. This choice can be observed both in the first and the second allocation phases and it was reinforced in the second period by the so-called "windfall profit" concerns.

- *Highly novel new entrant/closure provisions.* All Member States have set up reserves for new entrants, and most require closed facilities to forfeit post-closure allowances,

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circumstances. As shown in Figure 2, the Eastern European countries (EU-12) have been allowed to increase their emissions compared to theit 2005 emissions, unlike the EU-15 Member States. However, the argument is one of degree.

even though there are significant differences between the specific Member State choices. This choice is neither a feature of other comparable programs nor recommended by experts or strongly lobbied for by incumbents. Instead, these measures were adopted in order to prevent disadvantaging the EU in competition for new investment, and to eliminate an incentive to shut down facilities and move production elsewhere.

Preliminary lessons from the pilot phase

- *The Phase I allocation process was useful.* While Phase I allocation was characterized by a number of problems, it is important to keep in mind that the first phase of the EU ETS was a trial period during which Member States had to submit National Allocation Plans within a very short timeframe. Some lessons from the pilot phase are already being learned, as is confirmed by several choices in the second phase. In particular, the European Commission has harmonized allocation rules across Member States and has tightened the carbon constraint in Phase II.

- *Free allocation does not necessarily lead to "windfall profits"*. There can be no doubt that freely allocated allowances improve the profitability of covered firms, at least in comparison to what would be the case if allowances were auctioned. Determining whether a firm is better off compared to an alternative in which there is no CO_2 price is more difficult. Much depends on whether the regulation to which the firm is subject and the competition that it faces allows the CO_2 costs to be passed through to consumers. Preliminary research indicates that there is some pass-through but that it varies considerably and is generally not full pass-through. This is a complicated subject that varies by sector and Member State, and research continues.

- *New entrant/closure provisions provided perverse incentives.* The main effect of these provisions was to preserve pre-policy incentives to invest in polluting technology. They also constituted an output subsidy given the emissions constraint. These provisions decreased investment costs to a differing degree among Member States, adding therefore a potential further distortion to the common market.

Even though the perverse incentives of these provisions were widely recognized, it was not possible to resist political demands. These features represent another distinctive difference from similar trading schemes, *e.g.* in the US, where with few exemptions new entrants must purchase the allowances they need and owners of closed facilities may keep their allowances.

From allocation plans to market developments

Allocation has become an extremely contentious issue in the EU ETS in large part due to the accusations of "windfall profits" but also due to "harmonization" concerns about the effect of allocations that are different among Member States for like installations. These controversies have tended to obscure the most fundamental effect of allocation, which is to create a market. The extent to which installations expect to be or find themselves short creates demand and those installations that expect to be or find themselves long provide the potential supply in addition to whatever auctions may occur. If by some miracle of prescience allocations exactly matched allowances, and agents knew it, there would be no market. As it was, a widespread market for allowances existed in which nearly all Member States participated. For instance, the surrender data for one of the coal-fired power plants in the UK that was most short of allowances show that it acquired allowances from long installations in 19 of the 24 other EU Member States.

3. Development of the European Allowance Market

Introduction

During the first phase of the European Emissions Trading Scheme, the CO_2 emissions from more than 10,000 installations in the EU-27 were capped at 2.1 billions tons per year. Each installation was allocated a share of this total and was able to save, sell or buy allowances over the period provided that it could surrender at year's end a quantity of allowances equal to its actual emissions.

The success of the European carbon market depends on the ability to freely trade allowances. This ability was limited in the first period of the EU ETS (2005-2007), as installations were unable to bank unused allowances for use during the second period (2008-2012) or to borrow allowances from Phase II for use in Phase I. On the other hand, free banking and borrowing was allowed within Phase I and will continue to be permitted within subsequent periods.

The quantitative development of the market

- *Volume of transactions.* Bilateral forward trades for EU allowances began in the spring of 2003, well before the official start of the scheme in January 2005. The spot market was launched at the beginning of 2005, with the first national registries entering into operation in February. The trading in futures contracts started in mid-2005, when the first organized marketplaces were set up.

The quantity of allowances exchanged in 2005 was relatively low at 262 Mt. Trades increased nearly fourfold by 2006, when 809 Mt were exchanged. The maturation of the market was confirmed in 2007, when almost 1,500 Mt were traded. This sharp increase in transactions included a growing number of Phase II contracts. These contracts for future deliveries between 2008 and 2012 represented approximately 4% of total exchanges in 2005 but accounted for nearly 85% of market exchanges in 2007.

- *Value of transactions.* With an average price of €22 per tonne in 2005, allowance transactions totaled €5.97 billion during the year. This total increased to €15.2 billion in 2006 before reaching €24.1 billion in 2007. According to the World Bank, these totals represent about 80% of the value of the world carbon market.[8] By comparison, the US Acid Rain Program exchanges about $1-2 billion per year. In the past three years, the European Union has created by far the largest environmental market in the world.

Market infrastructure

- *Registries.* Under the rules of the Directive, each Member State is obligated to develop a national registry in which capped installations must open accounts to register their allowance allocations and track all movements of allowances resulting from purchases or sales. These registries are essential to assure the environmental integrity of the scheme, as capped installations must surrender allowances equal to their actual annual emissions. National registries are connected to the Community Independent Transaction Log (CITL) which provides allocation and emissions data at the installation level. Unfortunately, CITL data are difficult to access and some elements of the data are not available to the public.

- *Organized marketplaces.* Unlike registries, organized marketplace development was the result of voluntary initiatives undertaken primarily by energy market managers. Six

[8] World Bank, May 2007, *State and Trends of the Carbon Market 2007*.

marketplaces were launched in 2005, and they have contributed to the transparency and liquidity of the market. These marketplaces offer standardized contracts for spot or future delivery with public bids and asks, and also provide clearing services that may be used in Over-the-Counter (OTC) Transactions. In 2007, organized marketplaces facilitated more than 70% of allowance transactions, a steady growth from approximately 40% in 2005. Of these transactions, 57% were OTC transactions.

How the market has facilitated compliance

The EU ETS is a compliance market, meaning that each installation must surrender each year a number of allowances equal to its emissions in the preceding year. The first goal of the EU ETS is to facilitate allowance transfers from long players (those with more allowances than actual emissions) to short players (those with more actual emissions than allowances). Using the CITL database, it is possible to reconstitute the main allowance transfers that took place during the first two years of the European market.

- *A transfer of around 409 Mt, valued at €6,540 M, during the first two years.* During the first two years, there was a net allowance surplus of 2.8%, equal to 118 Mt. Had all of the covered installations been long, the carbon market would not have functioned during this period. However, while 7250 installations had a gross surplus of 527 Mt, 2950 installations were short by 409 Mt. If we do not take into account the possibility of banking and borrowing between 2005/06 and 2007, the market had to facilitate a transfer of 409 Mt between long and short players. Given an average allowance price €16 per tonne over the period, these trades had a value of €6,540 M.

- *Geographical transfers.* Only five countries were short of allowances from 2005-2006 periods: the UK (-83 Mt), Italy (-33 Mt), Spain (-25 Mt), Ireland (-6 Mt) and Austria (-1 Mt). Other countries distributed to their installations more allowances than their actual emissions. This led to a significant cross-border flow of allowances. In particular, given the overall surplus in Eastern Europe, we estimate that the net flow of allowances towards the Western EU-15 countries was 41 Mt, representing a €700 million transfer.

- *Position of sectors and companies.* The CITL tracks nine categories of installations, all of which had net allowance surpluses, with the noteworthy exception of combustion installations which had a net shortage of 14 Mt over 2005-2006. Among these installations, power plants had the greatest shortage at 150 Mt and were the main buyers on the European market. At the company-level, the top three shortest firms were all from the power production sector: Enel (-10 Mt/yr), RWE (-10 Mt/yr) and Endesa (-8 Mt/yr).

Carbon pricing

The EUA price is governed by the balance between supply and demand. As no Kyoto credits could be traded during the first period and installations could not borrow allowances from the second period, the number of allowances available on the market equaled the number of allowances initially allocated to installations. Thus, total supply was determined by the political decisions regarding Member State caps, as discussed previously in the chapter on allocation.

Due to the inability to bank allowances between the first and second periods, allowance demand was driven by anticipated emissions during the first three years of the scheme, which depended on economic growth, weather conditions, relative energy prices and marginal abatement costs. These different drivers can explain carbon pricing during the first market period, which was marked by three main stages:

- *The launch period (Jan. 2005-Apr. 2006).* During this stage, the power sector immediately started buying the allowances it needed, whereas many players with surplus allowances were not prepared to sell their EUAs. Demand from power producers rose over the period due to increased gas prices during the winter. This created scarcity and increased carbon prices. The information available on the market was very poor, and most of the participants expected a global short market.

- *The information shock (Apr.-May 2006).* In April, the European Commission released the 2005 emissions data for the installations covered by the EU ETS, which showed a 4% allowance surplus. The news hit EUA prices hard as the supposed scarcity of the asset confronted the reality of a surplus. The market experienced a high level of price volatility, which disrupted the stable and long-term price signal required for participants to engage in GHG emissions reductions.

- *Total disconnection between the first and the second period prices (since Nov. 2006).* EUA Phase I prices started to converge towards zero, reflecting the allowance surplus over 2005-2007. Phase I allowance prices fell under 1 €/tCO_2 in February 2007 and ended 2007 at 0.02 €t/CO_2. Phase I contracts were unlikely to react to traditional price drivers, and volatility remained very high. Phase I transactions became scarce and the real market activity shifted toward second period allowances.

EUA prices for 2008-2012 remained relatively steady and rose to as much as €25 in response to the European Commission’s stricter review of second period NAPs and the European Council’s decision to reduce EU emissions to 20% below 1990 levels by 2020 (as compared to 8% below 1990 levels in 2008-12). The price volatility for Phase II remained at reasonable levels, providing market participants with more adequate price signals for the medium term.

Because installations may bank allowances between the second and third periods, the anticipated balance between the supply and demand of carbon emission rights between 2008 and 2012 will be significantly impacted by post-2012 expectations. In particular, if the European Commission’s proposal for the post-2012 ETS is adopted in its current form, it will have very different market consequences depending upon whether or not an international climate agreement is achieved. As a result, industries are now operating with a long-term price signal that depends on very uncertain future international political events.

Some preliminary conclusions

Over 2005-2007, the European market developed strongly in terms of traded volumes and market infrastructure. An effective carbon price has emerged on this market, reflecting balance between supply and demand. The observed balance for the first period led to a price close to zero in 2007 that is economically rational given the allowance surplus. On the other hand, steady prices for the second period reflected the anticipated scarcity resulting from political decisions and commitments.

The experience of the first three years provides us with two important lessons that may be applied to any new environmental trading scheme:

- *Market efficiency depends on market participants’ ability to access reliable information.* The first stages of the EU ETS have suffered from a lack of information at the installation level and from the practical difficulty of accessing reliable information from the CITL data bank. This contributed to price instability. While provisions for the second period will improve information availability, not all information will be publicly available.

- *The decision to not allow inter-period banking strongly contributed to price volatility* and led to a complete disconnection between the first two periods of the market. Indeed, in the absence of banking, industrial players cannot hedge between the current carbon constraint they are facing and the constraints they are anticipating in the future. The inability to bank into the second period reduced the decision horizon significantly, led to inequity among industrial players plagued with unused and worthless allowances at the end of period, and limited the incentives to reduce emissions through early reduction decisions.

During its first period, the EU ETS was able to overcome these flaws thanks to the leadership of the European Commission and the strong political commitment of the European Council to continue to reduce greenhouse gas emissions. Therefore, the collapse of the first period carbon price has not jeopardized the expansion of the trading scheme. This is probably one of the most impressive results of this first trial period: all the big industrial and financial players now accept that carbon is no longer free in Europe and that the carbon emissions will continue to be costly in the future. This is a major achievement after only three years.

4. Did Emissions Abatement Occur?

Introduction

The aim of carbon markets is to provide incentives to reduce CO_2 emissions. These incentives can influence both the short-term and long-term decisions of market players. Short-term incentives induce plant managers to reduce emissions today using available technology and capital stock. Long-term incentives impact managers' investment decisions over the long term. Because long-term incentives lead managers to account for carbon prices as they plan new capital investments, these incentives can have lasting impacts on the economy.

The US Acid Rain Program, which established a market for sulfur dioxide (SO_2) allowances, provided long-term incentives from its outset. The program allowed companies to bank allowances freely for use in future years, thus enabling them to incorporate SO_2 prices into their long-term investment decisions. As a result, installations were able to invest immediately in costly equipment to reduce their emissions, and SO_2 emission reductions were achieved within a short timeframe.

In the EU ETS, companies were unable to bank unused allowances from the first period to the second, and thus had no long-term incentive to modify their investment plans. However, the EU ETS did provide some short-term incentives which led to limited abatement in the first two periods.

Limited but significant abatement during the first two years

Research continues on this topic. However, preliminary results indicate that a modest amount of abatement occurred in 2005-06, fully in line with the modest ambition of the cap imposed in the first trading period. When viewed from the most aggregate level, three observations make plausible a conclusion that some abatement occurred:

- *A significant price was paid for CO_2 emissions during 2005-06*, and this would have had the effect of reducing emissions as firms adjusted to the new economic reality. Anecdotal evidence indicates that firms did take the CO_2 price into account, especially in the power sector.

- *Real output in the EU increased in 2005-06 at a relatively robust rate,* which when compared with historical rates of improvement in energy and CO_2 intensity, suggests that emissions would have increased or at the very least remained consistent with earlier years.

- *Verified emissions in 2005-06 were lower* than EU emissions in 2002-04, even after allowing for plausible upward bias in the pre-2005 data.

In a preliminary but detailed analysis of this data, Ellerman and Buchner (forthcoming in *Environmental and Resource Economics*) concluded that a reasonable estimate of the reduction in CO_2 emissions attributable to the EU ETS lies between 50 and 100 million tons for each year, or between 2.5% and 5% from what emissions would have been without the EU ETS. In making this finding, Ellerman and Buchner also note that such a finding does not rule out over-allocation, which clearly existed in some Member States and sectors. When combined with the absence of banking, the over-allocation created the effectively zero EUA price in 2007, when it is likely that little abatement occurred.

Emissions reductions often appear where they are not expected

The preliminary results from more focused research on the German and UK electricity sectors support this finding of modest abatement. In Germany, a shift from higher emitting lignite (brown coal) generation to lower emitting hard coal generation can be observed, as well as an increase in the use of biomass. In the UK, coal generation actually increased and natural gas generation decreased despite the new carbon price because of a reduction in nuclear generation and exceedingly high natural gas prices in 2005 and early 2006. Still, it is likely that coal generation would have been even greater without the CO_2 price and research is underway to attempt to determine the extent. Also, in the UK there was a noticeable improvement in the CO_2 efficiency of coal-fired generating plants, which could have been due to increased use of biomass or improved energy efficiency in response to the sharp increase in the cost of using coal to generate electricity.

An important observation arising out of these focused studies is that the EU ETS is creating abatement opportunities that had not previously been expected. To date, most attention has focused on switching from coal to natural gas, which did not occur in the magnitudes expected, largely because of the higher than expected natural gas price. In contrast, little to no attention had been given to either the intra-fuel substitution observed in Germany or the improved CO_2 efficiency observed in the UK. This result is consistent with results observed in the US cap-and-trade systems for SO_2 and NO_x emissions, where unexpected methods of emission reduction accounted for a significant share of the emission reductions.

5. Links Between the Carbon Market and the Power Industry

Introduction

The launch of Phase I of the EU ETS in January 2005 coincided with a particularly turbulent period in Europe’s electricity markets. Two European Commission Directives, Directive 2003/54/EC (Internal electricity market) and Directive 2005/89/EC (Security of electricity supply) advanced the objective of complete liberalization of electricity and gas markets in the European Union. In parallel, Europe experienced an intense process of industrial concentration with a *de facto* transnational oligopoly emerging around EDF, E.ON, ENEL, RWE and Suez – Gaz de France.

Coupled with the intrinsic short-term inelasticity of electricity demand due to the absence of storage, the establishment of wholesale markets outside national regulatory oversight and the movement towards concentration have repeatedly given rise to suspicions of the abuse of market power. There are also concerns about lack of investment in the face of rising demand, which can be a profitable strategy in the absence of vigorous competition. It should not be forgotten that electricity production continues to be subjected to increasing returns to scale and incurs substantial indivisibilities (technical competence, in particular when operating nuclear power plants, financial savvy, as well as the ability to spread risks over different geographic markets). The volatility and risk of electricity markets in the wake of liberalization has probably increased rather than decreased the optimal size of an operator.

To top it off, western and central Europe experienced severe cold snaps, both in winter 2004-2005 and 2005-2006, which in conjunction with low hydropower levels led to dramatically high electricity price spikes during the period the EU ETS was introduced. On 28 November 2005, for instance, the price for an MWh of peak load power on the day-ahead spot market reached a staggering price of 255 Euros.

Interactions between carbon price and electricity price

There is certainly a close connection between electricity and carbon prices. However, one should not forget that electricity prices had plenty of reasons quite independent from the newly introduced EU ETS to be both unusually high and volatile during Phase I, in particular during the crucial period stretching from the beginning of 2005 until spring 2006. European electricity markets remain in a phase of transition. Contrary to the ultimate objective of the European Commission, the European electricity market is not yet a “copper plate” where a point-source of demand can be serviced with minimal transaction costs by any provider in the system. It is instead a complex web of national markets in which limited and varying interconnection capacity opens and closes markets in a matter of hours or less.

We can observe two important facts in this context. First, gas-fired power generation is increasingly the choice of investors in volatile markets due to its short lead times and its flexibility. With gas thus being the marginal fuel for peak production, the interaction between gas, carbon and electricity prices is particularly close. Second, the growth of electricity demand in Europe has slowed remarkably in the last three years and declined in some sectors, which is at least partly due to the electricity price rises in which carbon prices play an important role.

Looking at the interaction between carbon and electricity prices, one must distinguish their interaction in the long-term and the short-term. In the long-term futures market, the price of the one-year electricity contract (calendar) displays a very solid relationship with the carbon allowance price. Given that most electricity is traded on these one-year forward contracts, one can conclude that producers and consumers now fully integrate the price of carbon into their long-term calculations.

But what determines the price of a carbon allowance? This question is much more difficult to answer and depends largely on complex interrelations in the spot market. That interaction is complicated by the fact that electricity prices are very volatile due to the non-storability of electricity. Supply and demand (the latter varying in an unpredictable manner in function of the weather, TV programming, etc.) thus need to be calculated at virtually every second. The price of carbon allowances – assets that may be used without loss at any time during the Phase I allocation period 2005-2007 – should be much more stable.

What is surprising then is that carbon, gas and electricity prices over certain periods correlate quite well in the short-term. Partly this is due to the fact that the EU ETS is a fairly young market in which traders are still looking for identifiable patterns independent of the real conditions of power generation, information which is difficult to forward to the trading desks. In addition, there is some evidence that high electricity spot prices due, for instance, to market power, are seen as a signal to raise carbon prices.

Carbon price and profitability of power producers

European power companies enjoyed large profits during Phase I of the EU ETS. Many factors contributed to this trend. Power producers took advantage of the rise in energy prices as electricity markets were liberalized. Furthermore, high natural gas and oil prices increased the profitability of nuclear power and hydropower. In this context, free allocation of carbon allowances provided additional profit opportunities in 2005 and 2006: the so-called “windfall profits”.

Receiving large amounts of allowances strengthens a company’s balance sheet even if it needs to use the allowances during the rest of the year for its operations. More important is the fact that higher revenues due to higher electricity prices are not offset by higher costs as long as the allowances are received for free. In addition, operators profited from the fact that the market vastly overestimated the scarcity and the price of carbon allowances. While *de facto* more allowances than needed were allocated and prices should have been low from the start, prices held up well during 2005 and 2006, providing handy profit opportunities.

All of these factors provided additional profits to European power operators, whose share prices have all surged during the past three years (in some cases, however, the beginning of the surge preceded the introduction of the EU ETS). This is the primary reason that the European Commission wants to introduce full auctioning of allowances in the electricity sector by 2013. While so far power producers have profited indiscriminately from the EU ETS, full auctioning would drive a wedge between carbon-intensive producers and carbon-free producers. While the former would lose their windfall profits from higher prices, the latter would continue to profit from them, thus making investments in nuclear power or renewable energies more attractive.

6. Carbon Price and Industrial Competitiveness

Introduction

To date, the EU is the only region of the world to have implemented a multi-sector greenhouse gas trading scheme to reduce the emissions that cause climate change. The EU ETS sets a price on carbon and forces emitters to internalize the negative impacts of their greenhouse gas emissions.

Industries outside the EU do not face these same carbon prices, and as a result may use this cost advantage to gain market share. As European companies face market share losses, they may choose to relocate overseas, where they will not be required to pay for their carbon emissions. This “leakage” would both undermine the environmental integrity of the European trading scheme and reduce economic activity in Europe. This is why an analysis of how the EU ETS affects European competitiveness is essential.

Competitiveness and the EU ETS: definitions and scope

Paul Krugman, in his famous article "Competitiveness: a dangerous obsession,"[9] warned against the view that nations, like companies, compete against each other, and that their economic problems are attributable to a failure to compete on global markets. Krugman's advice is all the more relevant for an analysis of the EU ETS, whose effects are felt almost exclusively by a subset of economic activities within Europe: energy-intensive and trade-exposed industrial activities.

Among these industries, power generation is to a large extent not directly exposed to international competition. Therefore, the sectors we include in our analysis include cement, refining, iron and steel, paper and pulp, petrochemicals, glass, and aluminium.[10] In 2005, these sectors accounted for less than five percent of EU Gross Domestic Product and their share in labour employment was even smaller. Thus, it would be inappropriate to draw broad macroeconomic conclusions from our study of these industries.

In our analysis we employ the OECD's pragmatic definition of competitiveness: at the microeconomic or sector-specific level, competitiveness is the ability to produce high-quality, differentiated products at the lowest cost possible to sustain market shares and profitability. These two latest criteria can be applied to detect short-term or long-term changes in competitiveness. In the short run, diminished industrial competitiveness will erode the profitability of existing facilities, reduce the operating rate of the less competitive plants, and increase net imports. In the long run, managers will likely react to market changes by modifying their investment plans. Decisions to invest in new capacity take years to finalise in heavy industry. Any impact on locating new capacity outside the EU at the expense of existing EU capacity would thus take some time to materialise. This is why our study currently addresses only the issue of short-term competitiveness.

Results to date by industry

- *Cement industry*. Our analysis of the cement industry focuses on the impact of the EU ETS on net exports in the cement market. An empirical statistical analysis for four European countries (France, Portugal, Spain, and the UK) for the period (at best) 1976-2005 shows that production capacity rate is the main driver of net exports and that relative energy cost plays a very secondary role. In addition, it turns out that carbon price does not have a significant impact on net cement exports over this period.

Lessons from these empirical results are limited. We will continue our research in two directions: the long-run impact of production cost on investment decisions and the determinants of cement prices. Both elements will prove critical to estimating the effect of the EU ETS on competitiveness in the cement industry.

- *Refining*. The refining sector encompasses a large spectrum of petrochemical plants that treat crude oil to produce petroleum products. It appears that the competitiveness effects of the EU ETS on these plants have been very modest. No significant changes in petroleum product trade flows, production patterns or prices were found. We note, however, that allowance prices were dwarfed by high refining margins over the period. Moreover, while the sector curtailed its emissions by 0.56% from 2005 to 2006, it enjoyed a 7% surplus in allowances and thus did not face direct allowance procurement costs.

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[9] Foreign Affairs, March/April 1994, vol. 73, number 2.

[10] While the aluminium sector is not covered in the first two phases of the EU ETS, it is very electricity-intensive and thus vulnerable to the pass-through of CO_2 prices into electricity prices.

Interviews with refining executives revealed that the EU ETS, together with rising energy prices, were instrumental in increasing industry's awareness of low-hanging emissions abatement opportunities, and in inducing firms to build new capabilities to respond to the subsequent phases of the scheme. Refineries will face tightening carbon constraints due to a structural trend toward heavier crude, which implies additional process emissions. Under such constraints, and as one of the sectors most exposed to foreign trade, the refining sector could suffer from a significant competitiveness burden.

- *Steel*. Steel is another sector with high carbon intensity per tonne of primary output. While the scrap-based electric arc furnace process is much less energy-intensive than the blast furnace, its expansion is limited by the availability of scrap. The sector was also exposed to a rise in electricity prices. The use of blast furnace gases for power generation also created problems in the allocation process.

Data from the Community International Transaction Log (CITL) indicates that the iron and steel sector has generally benefited from an allocation above its reported emissions, even if at rare occasions installations in this sector have relied on foreign allowances to achieve compliance. In addition, high steel prices throughout the period make it difficult to observe any effect of carbon prices on the sector's profitability. No conclusion can be made at this stage, and further analysis must completed on this sector using the methodology developed for the cement sector and pending data availability.

- *Aluminium*. With its very high electricity use per unit of output, primary aluminium stands out among the sectors we analyzed. While aluminium sector emissions are not currently capped by the EU ETS, we anticipated that the sector would likely experience profit and market share losses as electricity prices increased due to the CO_2 price pass-through. However, international aluminium prices skyrocketed from 2003 onward, an occurrence which could partially blur any effect of higher power prices on European smelters' operational margins.

Europe has been a net importer of primary aluminium for some years, with its smelters operating at full capacity. Has the price of CO_2 triggered additional imports into the EU, which could be interpreted as a loss of market share due to climate policy? Statistical analysis of 1999-2006 data invalidates this hypothesis. However, smelters were not generally exposed to a cost of CO_2 in electricity prices: only 18% of capacity operated without long-term power contracts in 2006, essentially in Germany and the Netherlands. By 2010, power supply contracts will expire for 65% of European capacity. The reaction of smelters in this new price environment will be an indication of the seriousness of leakage in this sector.

Preliminary conclusions

To this point, we have not found empirical evidence demonstrating a correlation between European carbon prices and a loss of competitiveness in the industrial sectors included in our analysis. However, these results were obtained in an environment in which allocations were overly generous for the covered industries. In addition, the years 2005-2007 have been marked by remarkably high commodity prices and profits in these sectors. Any impact of the CO_2 constraint on industry is likely to be felt more strongly when markets are less favourable.

Additional investigations must be conducted to confirm these preliminary results on short-term competitiveness and to asses the question of the long-term impacts on investment decisions. And the impact of the EU ETS on the competitiveness of heavy industry is only one part of the question. Another important dimension is how the scheme may spur investments in the low-carbon technologies that are likely to be in high demand as other regions launch GHG mitigation efforts. These new sectors, whose development may be stimulated by European carbon prices, should be included in future analyses.

7. Expanding the European Carbon Market

Introduction

Upon its launch in 2005, the EU ETS covered the CO_2 emissions of energy-intensive sectors in 25 Member States. These emissions represented 41% of all European GHG emissions, as non-CO_2 emissions from sectors such as agriculture, housing and transportation were not included. More generally, the gases covered by the EU ETS represented only 11% of GHG emissions from developed nations and less than 5% of the world total.

From the start, the scope of the EU ETS was designed to be enlarged. The ETS Directive included provisions to extend the cap by opting-in additional installations, by linking the EU ETS with other cap-and-trade schemes, and by linking the scheme to the international Kyoto credit market. The EU's use of these provisions resulted in the first empirical experience with linking different carbon markets. This experience provides valuable lessons on how linking may be incorporated into future climate regimes.

Geographical and sectoral extension of the cap

Since 2005, the coverage of the EU ETS has grown by approximately 6% due to three factors: Member States could unilaterally opt-in some installations; Romania and Bulgaria joined the scheme in 2007; and in 2008, Norway, Iceland and Liechtenstein also joined the ETS, with Norway connecting its existing cap-and-trade program to the European scheme.

- *The limits of the "opt-in provision"*. During the first phase, Member States were allowed to opt-in installations below capacity limits in ETS sectors, but only five Member States took advantage of the opportunity to opt-in combustion installations of 20 MW or less. From 2008 on, Members States may opt-in other activities, installations and/or GHGs. Out of the ten largest countries, only France and the Netherlands have taken advantage of this. They have included some combustion facilities below 20 MW as well as some N_2O-emitting facilities from the chemical industry, a move which extended the cap a further 5.2 Mt and 1.4 $MtCO_2eq$ per year, respectively.

Obstacles to using the opt-in provision seem to be three-fold: small installations that are opted-in may incur high transaction costs for monitoring, reporting and verifying their emissions; Member States do not have any incentive to opt-in large installations if their cap is too tight; and non-CO_2 emissions are not always easy to monitor. In some cases, as with landfill gas projects, it is easier to monitor captured emissions than continuous emissions.

- *The integration of Bulgaria and Romania*. Romania and Bulgaria were obligated to join the EU ETS when they became Member States in 2007. Both countries proposed much higher caps than were found acceptable by the European Commission, and they are appealing the Commission's decisions to the European Court of First Instance. Romania and Bulgaria will most likely be given more leeway to increase their CO_2 emissions during Phase III (2013-2020).

The lesson here is that countries can be integrated into the EU ETS ("stick") if the integration is part of a larger political deal ("carrot"), which in this case was becoming part of the European Union. Despite the size of the carrot, full integration in the scheme appears to have generated political tension.

- *The link with the Norwegian scheme.* On 1 January 2008, the European Economic Area (Norway, Iceland and Liechtenstein) joined the EU ETS. In 2005, Norway had set up its own ETS with an absolute cap on emissions. The Norwegian ETS initially covered 51 large CO_2-emitting installations accounting for 10 to 15% of national GHG emissions. In 2008, Norway adapted its ETS to link with the EU ETS by including offshore oil and gas facilities as well as pulp and paper plants. The EU ETS now covers 100 installations in Norway and 35 to 40% of the nation's emissions. This rapid integration was facilitated by strong political will and by the fact that the rules of Norway's existing ETS – regarding sectoral coverage, allocation, monitoring and verification – were compatible with the European scheme.

Linking with project-based mechanisms

Installations included in the EU ETS may use a certain number of Kyoto project-based credits for their compliance. During Phase II (2008-2012), operators are allowed to import up to 1,392 million credits. This partial fungibility has helped to launch the market for project-based credits.

- *The EU ETS has driven the development of the international Kyoto credit market.* On the international market, the two main potential buyers of Kyoto credits until 2012 are the Annex I countries and the EU ETS installations of Europe. At the outset of the international market, government demand appeared to drive the demand for Kyoto credits. Governments were the main participants in public and mixed-capital funds, which started to operate as early as 1999. Private sector investments took off starting in 2004/2005 when the EU ETS was established. European industry strongly contributed to Kyoto project financing by providing the first capital to private carbon investment funds.

The demand stemming from the EU ETS has led the price of European allowances (EUAs) to become the reference price for most contracts on CERs, the credits generated by Clean Development Mechanism (CDM) projects, and ERUs, the credits generated by Joint Implementation (JI) projects. As a consequence, the price of CERs is fairly well correlated with the price of EUAs, with a discount for risk. Thus, the European carbon price was a major trigger for the development of international projects. Private investment in carbon procurement vehicles that funded CDM and JI projects soared over the last three years and now represents more than half of the €7 billion raised. Project developers have responded to this demand by developing Kyoto projects around the world. Today, more than 3,000 CDM projects, amounting to 2.5 $GtCO_2$ of emission reductions until 2012, are in the pipeline, and projects registered by the United Nations account for 1.2 $GtCO_2$ until 2012. The development of JI projects started later but has gained momentum more recently in Russia and Eastern Europe. Russia and Ukraine will supply the bulk of JI credits until 2012.

Thanks to the carbon price established by the EU ETS, Europe has generated significant emissions reductions in developing and Eastern European countries. It is worth noting that the European Commission intends to use the future potential financial flows generated by these emission reductions to negotiate future commitments by developing countries in post-2012 agreements.

- *The use of JI mechanisms may further extend the sectoral coverage of the EU ETS.* Joint Implementation projects can provide an incentive to reduce EU-based GHG emissions that are not covered by the EU ETS. Most of the new Member States have established procedures to host JI projects on their territory, and in the EU-15, France, Germany, Spain and Denmark have done the same. In France, the legal framework was established and the first methodologies were approved in 2007. Over 30 projects are being developed in the sectors of energy, transportation and agriculture, and these projects should reduce emissions by 3 to 5 $MtCO_2$ over 2008-2012.

In Germany, over 70 projects are being developed. One of the three projects that have been approved by the government so far is a programmatic JI project that deals with energy efficiency.

The post-2012 EU ETS draft directive includes a provision that would enable the adoption of harmonized rules for European projects. These projects would allow the price signal of the EU ETS to finance emissions reductions in sectors like housing, agriculture and transportation, which are difficult to integrate into a cap-and-trade scheme. The success of the projects depends on several conditions: the rules should be easy for project developers to understand; they should favor top-down methodologies with standardized baselines and standardized ways of proving additionality; and they should provide for a predictable process that encourages project development.

Preliminary lessons

During the first three years of the EU ETS, the European Union has set up a political and technological framework that limits the previously free right to emit CO_2. It has also demonstrated that it is possible to expand an existing trading scheme to other areas to take advantage of additional emissions reduction opportunities. This experience has already led to a significant expansion of the scope of activity impacted by carbon prices and provides several lessons for future programs.

- *Opt-in provisions play a limited role in enlarging the scope of carbon markets created by decentralized cap-and-trade schemes.* This is why the European Commission has elected to expressly include air transportation in the post-2012 EU ETS, and why it is also considering including maritime transport. Opt-in agreements have much in common with the voluntary sectoral agreements being considered for inclusion in future international climate architecture. The lesson drawn from the European experience is that one should not overestimate the value of such voluntary agreements.

- *The integration of new countries in the EU ETS has been rapid and complete.* This integration was possible due to the very specific context in which new participants had large political interests to participate at the scheme. This same ease of integration seems very unlikely with other existing or scheduled schemes like those of Australia, New Zealand, RGGI and possibly the US. An indirect link through the use of common project-based mechanisms whose credits can be imported and traded between the different capped entities may be a useful intermediate step in linking these schemes.

- *The European carbon market has played a key role in the development of international credit-based mechanisms.* The next generation of CDM projects should correct the flaws which appeared during the launching period. The potential GHG emissions reductions could be multiplied with programmatic approaches that could present a real opportunity for better integration of developing countries in a future international climate agreement. In this context, the European Commission's post-2012 draft proposal seems a sort of "double or nothing" proposition: if this proposal is adopted and there is a new international climate agreement, the Kyoto project credit market will continue to be stimulated by the EU ETS; on the other hand, if there is no new international climate agreement, the Kyoto project credit market could be severely weakened, as European industry will retreat from the market for Kyoto credits.

- *The European Commission's post-2012 draft proposal could lead to standardized and harmonized European projects which could be credited with European allowances.* If properly developed, a European domestic offset scheme could deliver substantial emissions reductions in non-capped sectors and reinforce the strong complementarity between cap-and-trade systems and project-based mechanisms.

8. Conclusions

- *The pilot phase was useful.* The first phase of the EU ETS was characterized by a number of problems, but it is important to keep in mind that its aim was to make the system run, and that this was done within a very short timeframe. Lessons from the pilot phase are already being learned, as is confirmed by several allocation choices in the second phase. For example, countries followed more harmonized allocation rules in Phase II, and National Allocation Plans provide fewer allowances. An important insight from the pilot phase is that not all elements have to be in place when an emissions trading scheme is launched.

- *Carbon now has a real price.* From 2005-2007, the European market developed strongly in terms of traded volumes and market infrastructure. An effective carbon price has emerged on this market that reflects the balance between supply and demand. The observed balance for the first period led to a price close to zero in 2007 that was economically rational given the allowance surplus. On the other hand, steady prices for the second period reflect the scarcity anticipated by market players due to political decisions and commitments. All the big industrial and financial players now consider carbon to be no longer free in Europe and that carbon emissions will continue to be costly in the future. This is a major achievement after only three years.

- *Carbon price has induced some emissions abatement.* Despite over-allocation, which clearly existed in some Member States and sectors, a significant price was paid for CO_2 emissions during 2005-06 which induced some emissions abatement. While switching from coal to natural gas did not occur in the magnitudes expected, other unanticipated emission reduction strategies were employed, including intra-fuel substitution (brown to hard coal) in Germany and improved CO_2 efficiency in the UK.

- *Carbon price has had a limited impact on industrial competitiveness.* In the power industry, only a part of the profits made in 2005 and 2006 can be attributed to carbon prices being passed through to consumers. The industry enjoyed "windfall profits" due in part to free allowance allocation, but also due to market restructuring and high fossil fuel prices during the period. In the non-power sectors, including cement, refining, steel and aluminum, international competition makes it difficult, if not impossible, to pass carbon prices on to consumers. To date, there is no empirical evidence of any market share loss in these sectors due to carbon pricing. However, from our first investigations we are unable to make any conclusions regarding the long-term competitiveness of these industries, especially when future stronger carbon constraints may affect them.

- *The European carbon market has had external impacts.* From its inception, the EU ETS was designed to be enlarged. Since 2005, the scope of the EU ETS has been significantly extended. Two new Member States, Romania and Bulgaria, have been included, and the European scheme has been linked to the Norwegian emissions trading program. The EU ETS's link with the international Kyoto credit market has driven the development of Clean Development Mechanism (CDM) projects in developing countries and has led to additional emissions reductions through Joint Implementation (JI) projects. The development of the European carbon market has provided the first empirical experience with linking different carbon markets. It provides valuable lessons on how linking may be incorporated into future climate regimes.

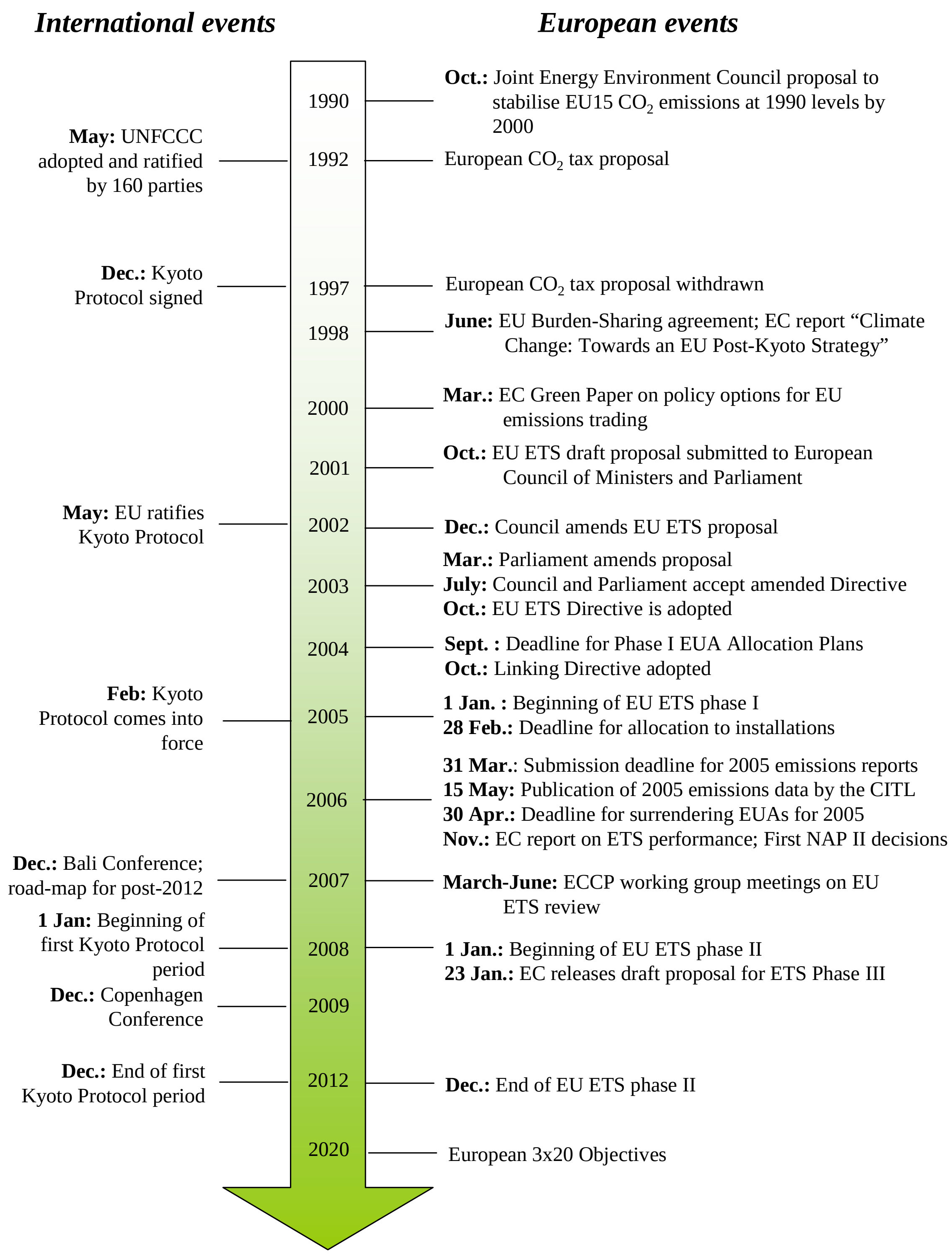
- *Lessons from the EU ETS can be applied to future climate negotiations.* The EU ETS is a true multi-national system. The European Union is home to 500 million people, living in 27 countries, embracing 23 languages, with per capita GDP ranging from $42,000 (Ireland) to $9,000 (Romania and Bulgaria). Through the EU ETS, nations of widely varying circumstances and commitments to climate policy have agreed to a common constraint. Europe's choice of emissions trading has created a 'fact on the ground' that will be difficult to ignore in future global climate negotiations. The EU ETS is likely to contribute to the shape of a future global system, and is already instructive for emerging national and regional schemes.

THE EUROPEAN CARBON MARKET IN ACTION: LESSONS FROM THE FIRST TRADING PERIOD

Illustrations

1. Historical Background of the EU ETS

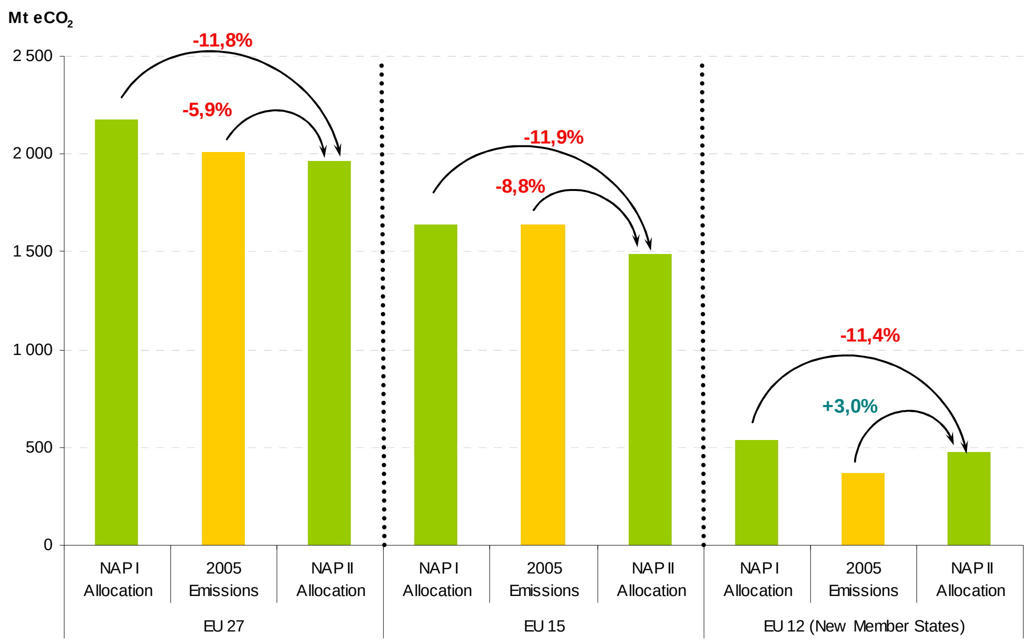
Figure 1 - European climate change policy: from carbon taxes to emissions trading.



Source: Mission Climat of Caisse des Dépôts, 2008.

2. The First Step: Allowance Allocation

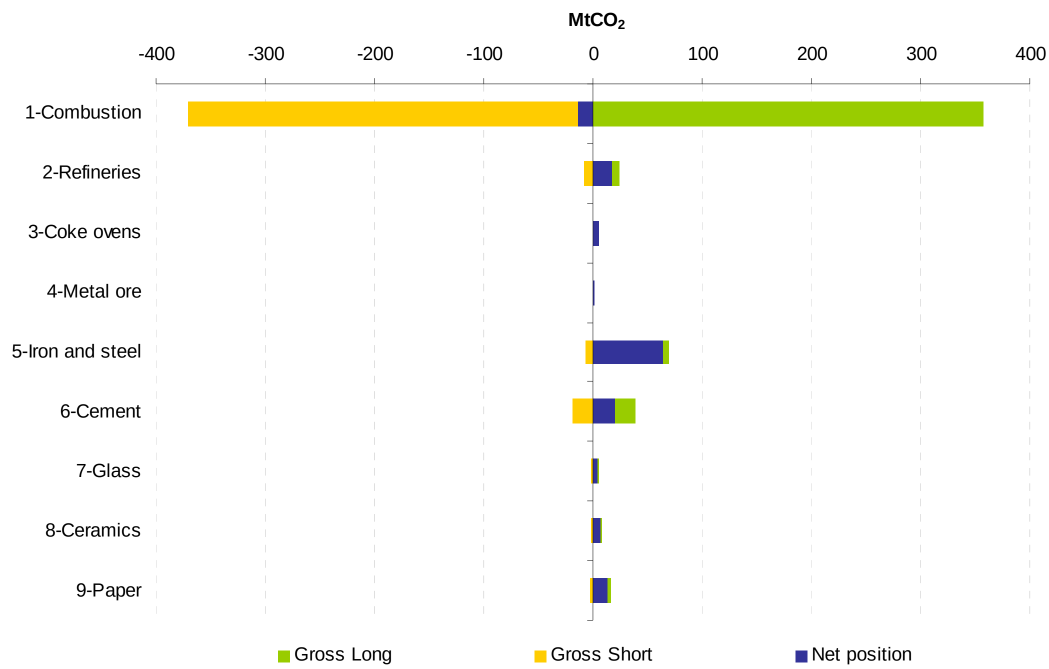
Figure 2 – The EU 15 and the new Member States face different allocation constraints.



Note: NAPs allocations exclude reserves and added installations.

Source: European Commission, 2008.

Figure 3 - The combustion sector faces the only net allowance shortage over 2005 and 2006.



Source: CITL, 2007.

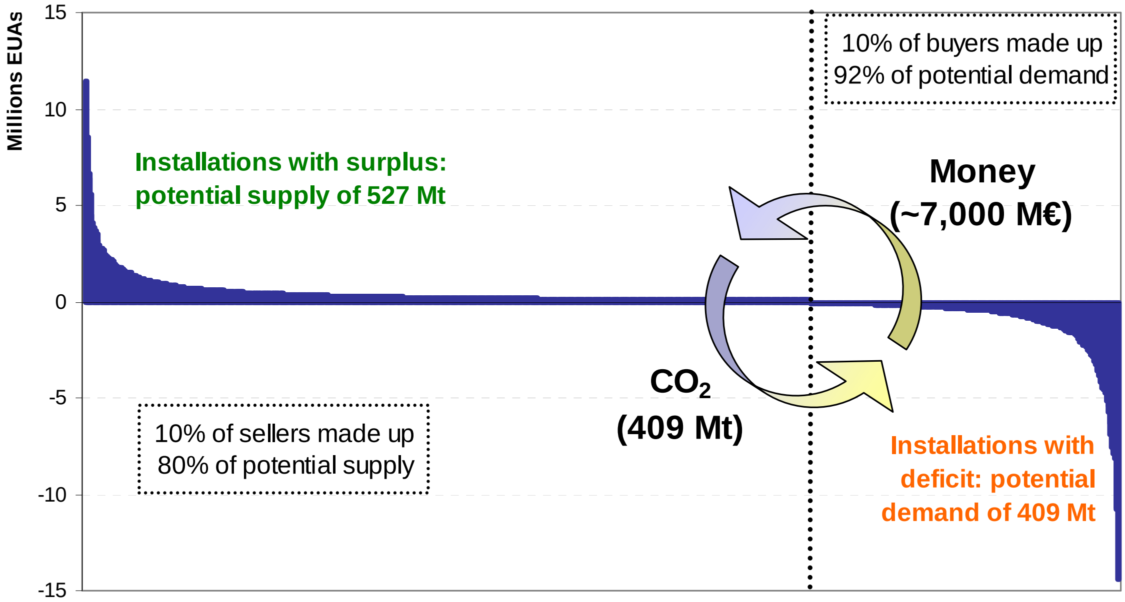
3. Development of the European Allowance Market

Figure 4 - An effective but volatile carbon price signal.

1. High volatility: price shock in April-May 2006 (compliance data release).
2. First period allowance price converges towards zero: surplus of allowances and no banking between periods.
3. Higher prices for second period allowances due to expected scarcity with stricter NAPII decisions and European Council commitments.

Source: Mission Climat of Caisse des Dépôts, 2007.

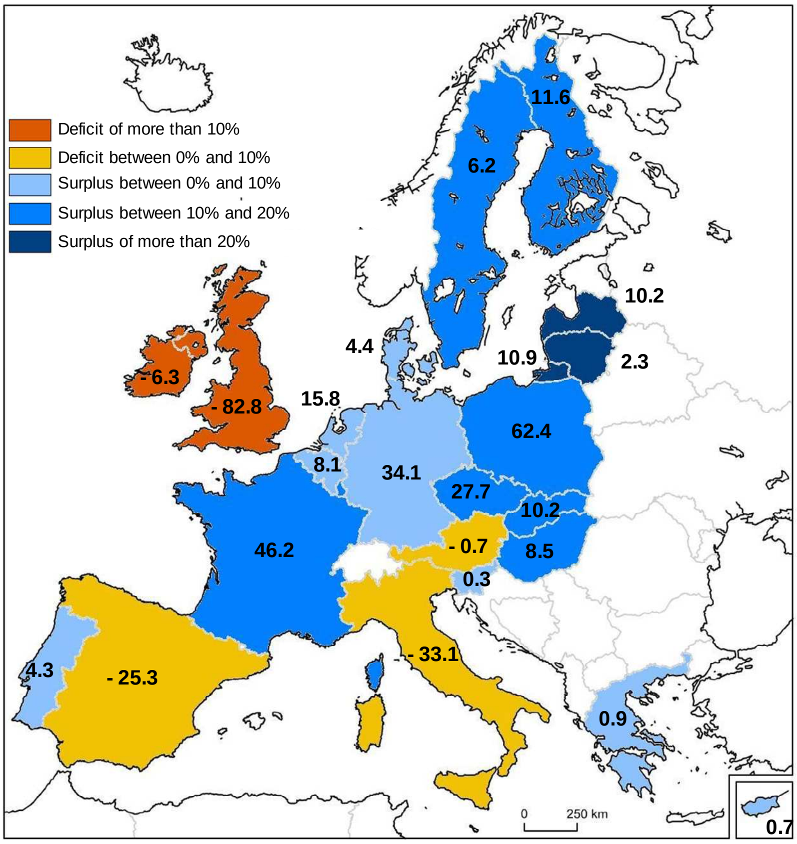
Figure 5 - Net positions of all installations for 2005 and 2006



Source: Mission Climat of Caisse des Dépôts; CITL, 2007.

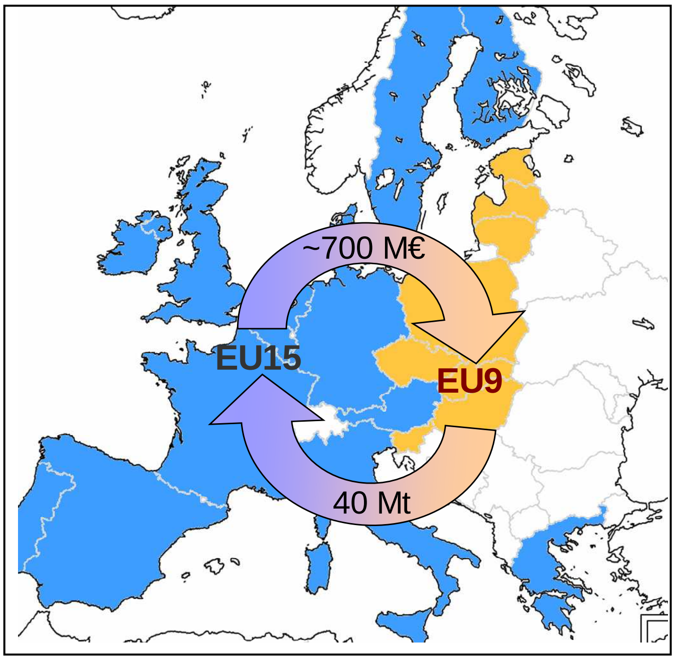
Figure 6 - A few countries were short on allowances.

Net position (allocation/emission balance) by country in Mt, 2005 and 2006



Source: Mission Climat of Caisse des Dépôts ; CITL, 2007.

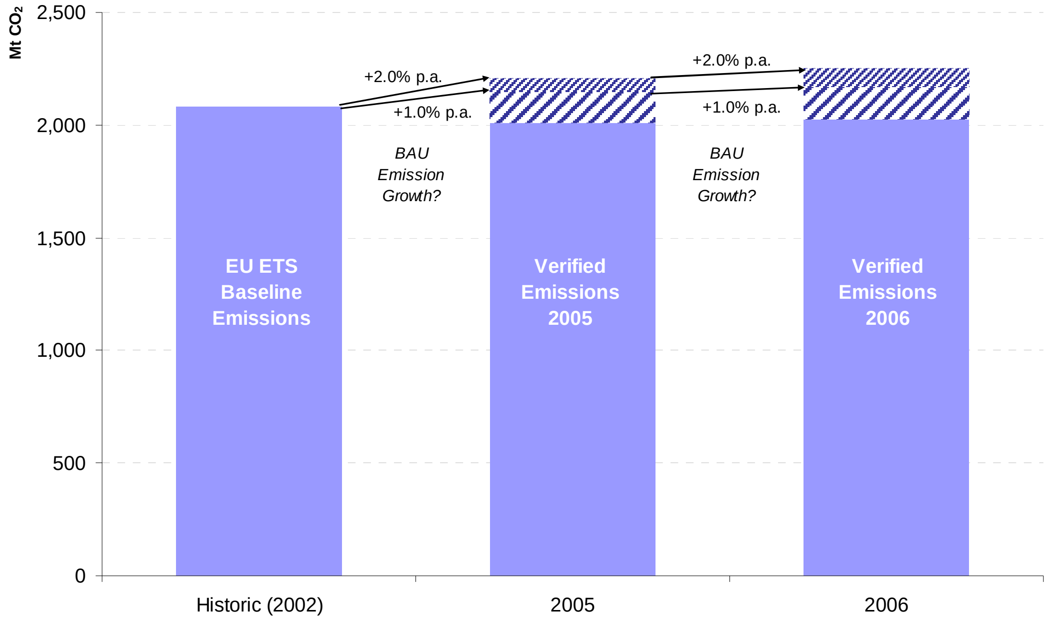
Figure 7 - Transfers between the EU 15 and new Member States in 2005 and 2006: physical and financial flows.



Source: Mission Climat of Caisse des Dépôts; CITL, 2007.

4. Did Emissions Abatement Occur?

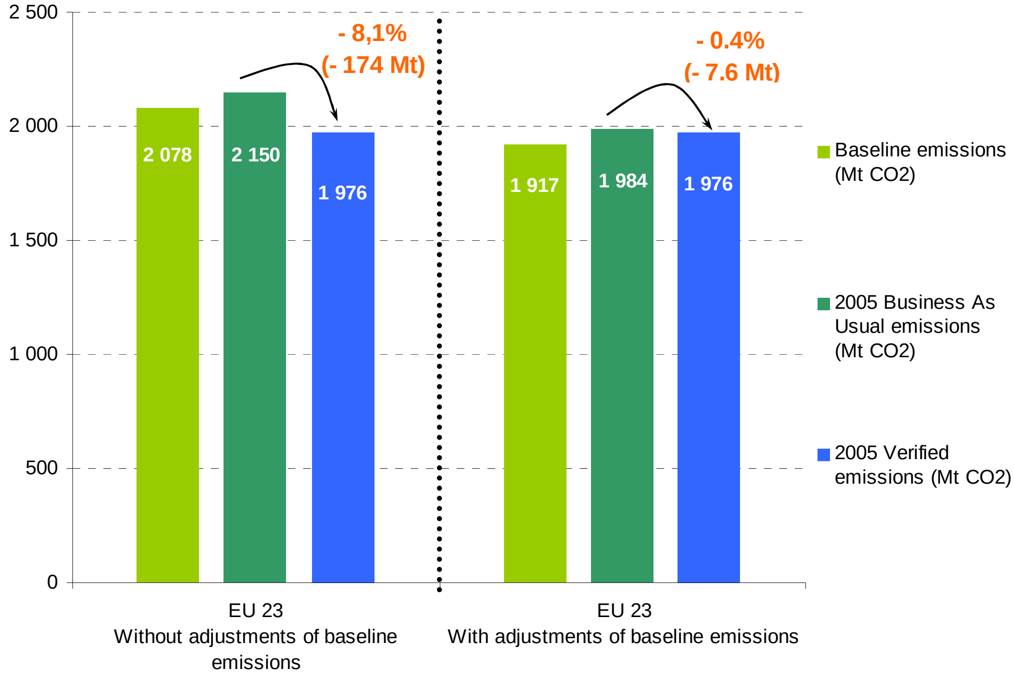
Figure 8 - A scenario for emissions in absence of the EU ETS.



Source: Ellerman and Buchner, 2008.

Comparing Business-as-Usual estimates (+1.0% or +2.0% growth) with actual verified emissions allows us to calculate the potential abatement that took place in 2005 and 2006.

Figure 9 - Comparing 2005 emissions with a BAU scenario shows that some abatement took place.

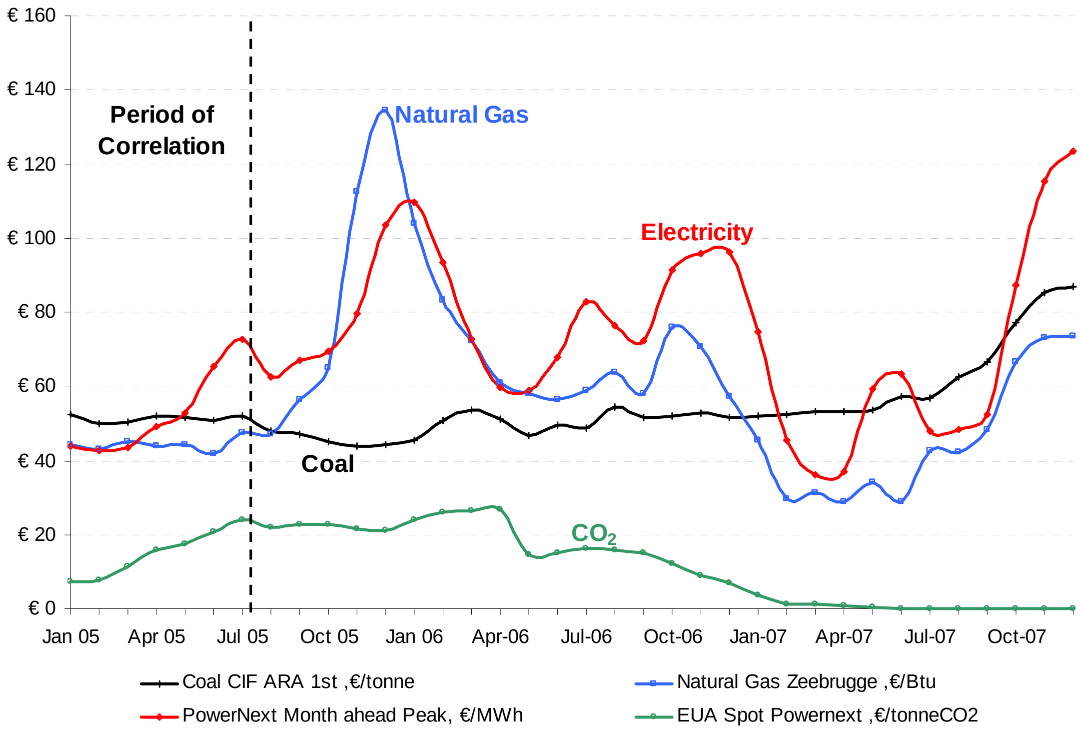


Note: with adjustments of baseline emissions (EU23: -7.8%, EU15: -7.0%, EU8: -11.0%)

Source: Ellerman and Buchner, 2008.

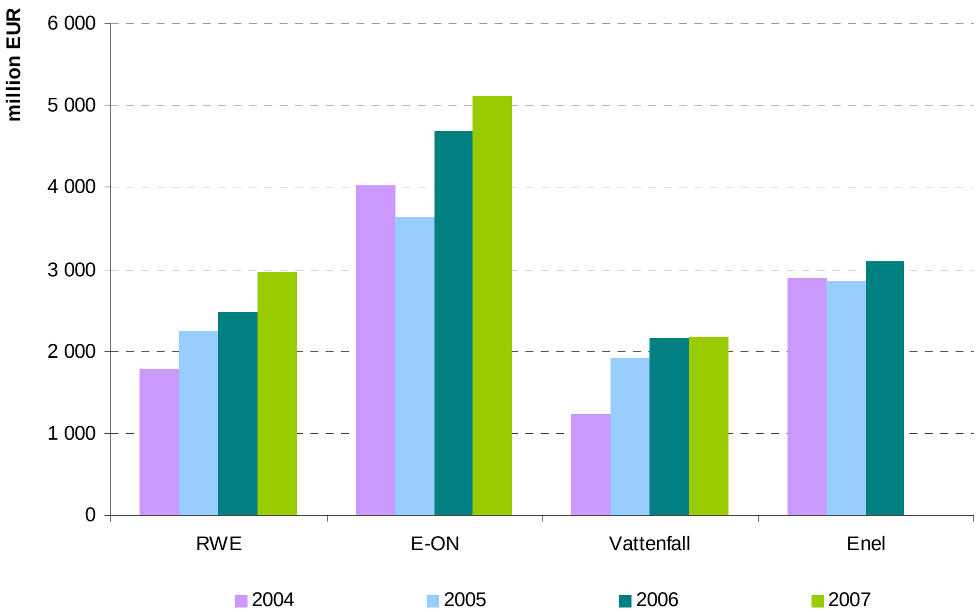
5. Links between the Carbon Market and the Power Industry

Figure 10 - Fuel prices were major drivers of electricity price fluctuations.



Source: Ellerman and Joskow, 2008.

Figure 11 - Recurring net income for a selection of large emitting power producers, 2004-2007.



Note: recalculations from net income to recurrent income (i.e. excluding non-recurring activities) might not be consistent among those firms and should only be considered indicative.

Source: Mission Climat of Caisse des Dépôts, using annual report data, 2008.

6. Carbon Price and Industrial Competitiveness

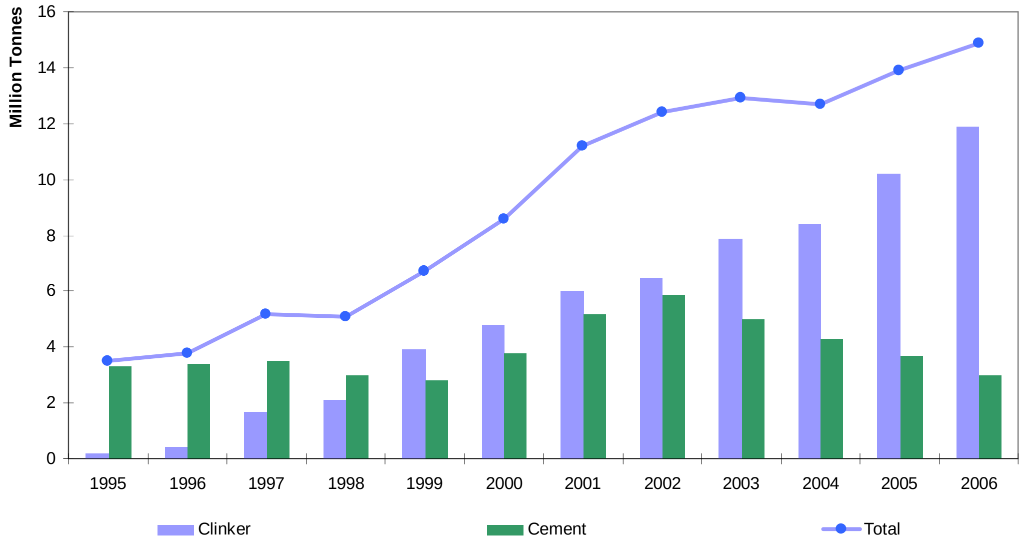
Table 1 - Carbon price has varying impacts across industries.

Sector	**Sub-sector**	**Share in EU25 total value added (2001-2003) ***	**Share in EU ETS ****	**CO_2 share in product price (direct and indirect) *****	**EU25 External Trade Perfor-mance ***	**Average annual growth (2000-2005) *******	**Direct jobs *******
Combustion	Electricity production	2%	52%	2 - 9%	-	5,1%	13 000
	Other combustion		18%	-		5,4%	
Refineries		0,30%	8%	0 - 1%	-0,08	2,5%	1 655
Iron and steel	Basic Oxygen Furnace	0,70%	8%	1 - 4 %	-0,18	-0,5%	11 100
	Electric Arc Furnace			5 - 10 %			
Cement		0,85%	9%	2 - 6%	0,27	2,8%	821
Glass			1%	-		-0,5%	3 848
Ceramics			1%	-		-7,3%	2 000
Pulp & Paper		0,55%	2%	1 - 5 %	0,18	2,3%	7 340
Aluminum		-	0%	8 - 15 %	-	-1,2%	1 258

Note: Sector definitions may vary with indicators and sources. External trade performance compares the trade balance (exports minus imports) for a product in one economic area (here, the EU25) to the total trade in that product worldwide.

*Sources: *European Commission, DG Enterprise & Industry - **CITL (2007) - ***P. Lund, Stanford Energy Workshop 2007, Helsinki University of Technology; figures rounded up, assuming a carbon price between €25 and €40/t - ****Eurostat.*

Figure 12 - Cement and clinker imports into the EU-15 from outside the EU, 1995-2006.

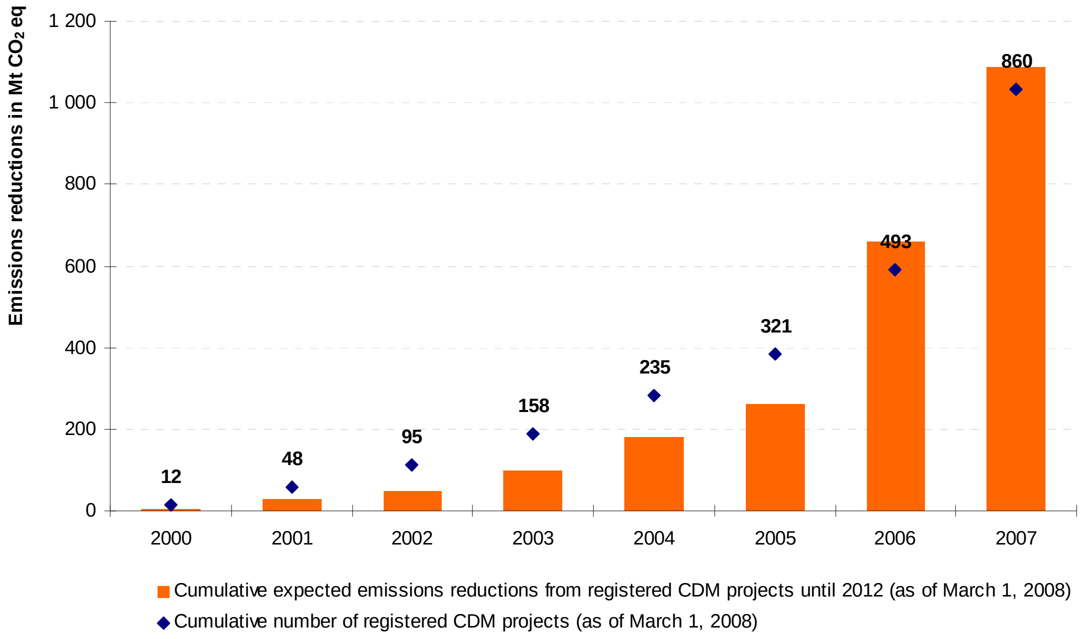


Source: Neil Walker, from "CO_2 Price Effects on EU Industry", presentation delivered at Research Program workshop on 24 January, 2008.

Clinker is the main material used in cement manufacture. Chemical reactions during clinker production are responsible for half of the CO_2 emissions produced during cement processing.

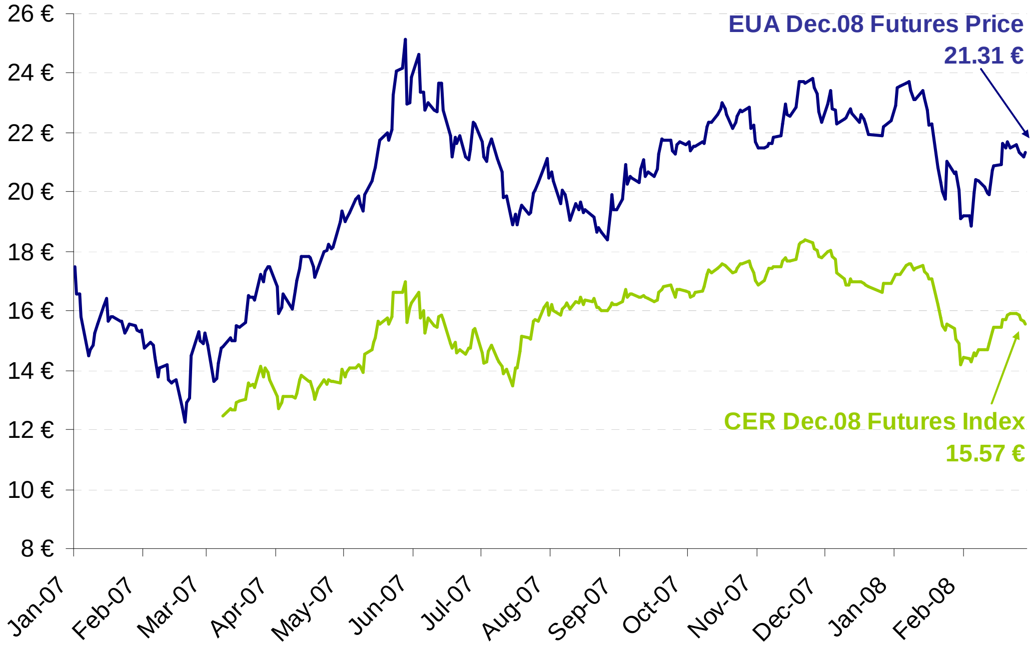
7. Expanding the European Carbon Market

Figure 13 - Emissions reductions resulting from Kyoto credit projects.



Source: UNEP-Risoe database, March 2008

Figure 14 - EU ETS demand is driving the rise in Kyoto project credit prices.



Source: ECX, Reuters

The correlation between the two series shows that the price of Certified Emissions Reductions (CERs) generated under the Clean Development Mechanism is driven by European allowances (EUA) price.

The European Carbon Market in Action: Lessons from the First Trading Period

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