European Climate Platform (ECP)

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THE EU EMISSIONS TRADING SCHEME:

TAKING STOCK AND LOOKING AHEAD

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About the report

This report is based on a background study and seminar on strategic aspects of the 2006 EU ETS Review organised under the auspices of European Climate Platform (ECP),[1] which is a joint initiative by CLIPORE and CEPS. The seminar was chaired by Frank Convery, Professor at University College Dublin and ECP Co-chair. The report was first presented at a UNFCCC side event in Bonn, Germany, on 23 May 2006.

This report contains an analysis on the review of the EU Emissions Trading scheme from a strategic and an operational perspective. It covers the EU ETS implementation so far, linkages with investment decisions, the 2006 review and impacts on global carbon markets. The executive summary contains a number of concrete and operational policy recommendations for improving the EU ETS. The recommendations are primarily addressed to EU policy-makers but some of them may also be relevant to other key players influencing the functioning of the EU ETS. The main report delves more deeply into the key issues and provides the background for many of the policy recommendations. Approximately 35 climate stakeholders and experts participated in the seminar and were given the opportunity to review the report.[2]

Appendix 3 lists participants in the seminar.

Disclaimer: A draft of this paper was prepared for a meeting of the European Climate Platform (ECP), which brought together key representatives of the research community, EU and member state officials and stakeholders, on 5 April 2006. The initial draft paper has been revised and circulated to participants for comments before being finalised in its current form. Although being subject to review, the responsibility for the content lies solely with the authors.

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[1] For further information on the ECP, please see the back cover of this report or visit: http://www.ceps.be/Article.php?article_id=484.

[2] Discussions in the seminar were based on two ECP Background Papers, which can be accessed at: http://www.ceps.be/Article.php?article_id=485. All seminar participants are listed in Appendix I of this report.

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Executive Summary

I. Status of the EU ETS and strategic challenges

Although the EU emissions trading scheme (ETS) has been adopted in a very short period of time, implementation is far from complete. In many respects, the EU ETS is still under construction with many critical elements of the infrastructure missing. Therefore, it is too early to pass (final) judgement on it. Nevertheless, a number of areas that will need further attention in the forthcoming review can be identified. They include the environmental effectiveness, lack of harmonisation, allocation methodologies including new entrants and closure rules and impacts on competitiveness, sector coverage, the way an international carbon market could emerge as well as the question on whether ultimately the ETS will support the development and diffusion of new and breakthrough technologies.

II. Key messages

The ETS Review

1. The objective of the EU ETS is to reduce greenhouse gas emissions in a cost-effective way and contribute to meeting the EU's Kyoto Protocol targets. In order for the EU ETS to meet this objective, there is a need to improve existing implementation, notably by ensuring real reductions, increasing consistency and transparency, improving allocation methodologies or in some cases, outright harmonisation. In addition, the EU ETS faces a number of long-term challenges to make the EU ETS fit for the post-2012 period: allocation methodology, sector coverage, investment incentives for the short and medium term and incentives for R&D for new, breakthrough technologies and linking with other emerging carbon markets.

Investment

2. In the long-term, a critical element for meeting the climate change challenge will be the development and diffusion of low-carbon technologies. One of the main criticisms with regard to the ETS has been that it discourages rather than encourages investment in new and low-carbon technologies. To an extent this is result of international indecision, which in return reduces predictability and has been partly the reason for short-term allocation periods. Some of the causes however are closer to home, notably the allocation methodologies that create wrong incentives, particularly regarding new entrants and closure rules. Similarly, fuel-specific allocation may have perverse effects on investment from a carbon perspective.

    a) The most immediate area where investment incentives can be improved are first, new entrants and closure rules followed by a more general consideration of allocation methodologies (e.g. benchmarking or auctioning).

    b) Most of the new investment will take place in the power sector (with an estimated investment need of between 500 and 600 GW for the period 2000-2030) and to some extent in the refining industry. Measures to increase investment incentives towards low-carbon technologies will need to focus on these two sectors, where also definitions for new capacity are easier than in energy-intensive sectors.

    c) Both predictability and flexibility would be increased by separating allocation methodologies from setting the cap. The allocation methodology could be fixed while the cap could be subject to future developments, within the EU and internationally. Some predictability on principles for future cap setting would be preferable since this will determine allowance price.

3. A second, more fundamental question is whether in the medium and long term the ETS could become a tool to provide significant incentives to develop and bring to the market new breakthrough technologies, i.e. make R&D on a huge scale profitable. In this case, price signals would need to be high enough and credible (i.e. provide long-term predictability) in order to activate a significant amount of private resources for R&D. This is not the case currently; long-term price signals are neither high nor credible enough to stimulate new breakthrough technologies although this should be expected at this early stage of development. Nevertheless, additional measures, such as technology policies may be needed, including R&D subsidies.

Allocation methodologies

4. There is consensus that new entrants and closure rules should be harmonised but disagreement on how. This paper has presented three principal options. Proposal 1 is to auction for new entrants as this gives stronger signals for low carbon investment but may delay somewhat the investment (as it puts new investment at a relative disadvantage to incumbents as they are overcompensated by free allocation). Proposal 2 is to give new entrants allowances for free – based on fuel-neutral benchmarks – as this might bring new investment to the market at the lower power price as would be with auctioning. New investment will bring power prices down as efficiency goes up and overall carbon content in power down. The downside is that it provides generally weaker signals for low-carbon investment than auctioning. As the two options aim at different objectives[3] they constitute a trade-off. Option 3 is to treat new entrants and incumbents alike, i.e. the same degree of free allocation and auctioning. This provides stronger signals towards low-carbon investment and thereby could have a positive effect on power prices while ensuring equal treatment of incumbents and new entrants. It would also largely dissolve the trade-off that we have identified above. For the short-term (i.e. the next 3 or so year) power prices will not be affected by investment in new capacity because of the limited capacity that can be created.

5. Experiences with the first round of allocation in the ETS have also shown the limits of using grandfathering as allocation methodology. These limits are shortcomings related to the base year that becomes increasingly remote, or if the base year is ‘updated’, it undermines incentives to reduce emissions here and now,[4] complexities for new entrant allocation as well as closure rules and distributional impacts. While the high degree of discretion for member states has increased complexity, administrative burdens and transaction costs, it also led to distortions to competition in the internal market. Industry has put pressure on governments not to hand out less allowances than other governments. This has heightened interest in benchmarking and auctioning as potentially simpler and fairer methods of allocation, and methods that do not look back but rather ahead.

Competitiveness

6. Since the start of the ETS, many potential options to address competitiveness and power price issues have been discussed and reviewed. There is no ideal option to address implications. We have identified two different categories of measures: ‘alleviation’ and ‘compensation’. Alleviation measures aim at changing the incentive structure and the functioning of the allowance market essentially through regulation. Attention is needed to

[3] Proposal one aims at power prices in the shorter term while proposal two at longer-term investment.

[4] If allocations continue to be based on an ‘updated’ base year, installations have every incentive to emit as much as possible as this is likely to increase their future allowances. This is sometimes referred to as ‘updating’.

ensure that such measures do not impede efficiency of the EU ETS, power or other markets. Compensation measures try to correct undesirable economic and social outcomes from the trading market. In principle they are executed through recycling of revenues, allocation or subsidies. They raise issues on the organisation of this compensation (i.e. allocation, raising and distribution of funds), notably, how to minimise government intervention. Measures from both categories may have unintended consequences. Options are discussed in greater detail in Appendix 1.

Sector coverage

7. From a pure economic point of view, including transport in the ETS (i.e. subjecting it to a cap) would minimise the societal cost of obtaining a given climate target, dynamic effects such as carbon leakage not considered. However, such a move would have major distributional impacts. As we see already, linking sectors together in a common scheme creates complexity and distributional frictions. This underlines the importance of developing policies that strike an appropriate balance between reductions in the trading sector and possibly within transport and other non-trading sectors. Member states have given little attention so far to this.

Emergence of a global carbon market

8. Linking of schemes is motivated by attempts to create a global carbon market. The case rests on the economic argument that a wider market reduces overall abatement costs, prevents distortions to international competition and increases liquidity. To date, it is difficult to provide an assessment of the feasibility of such linking as those schemes to which the ETS could be linked to, are in development only with yet uncertain design options. However a few tentative conclusions can be made. Linking of emissions trading schemes, even if they act as an obstacle to the development of widely divergent designs, does not run into fundamental problems, as long as technical fixes such as gateways or additional eligibility rules are put into place. However, such fixes generally reduce the efficiency through adding transaction costs, market fragmentation or through perverse effects or distortions. This is associated with a risk of increasing complexity up to a point where the economic efficiency of such schemes becomes questionable. The most critical issue for linking is distributional impacts as different participants would be affected in dissimilar ways. When two programmes are linked, the market price will be higher than the pre-link price in one of the trading schemes and lower than the pre-link price in the other zone, thereby creating winners and losers. This paper therefore has identified three possible options for an emerging global carbon market:

   a) Linking of national or regional schemes: principal challenges are complexity, allocation and dealing with winners and losers;

   b) Bottom-up carbon market based on market participants searching for arbitrage possibilities enabled by the existence of projects credits in all emission trading schemes. Environmental outcome is uncertain as dynamics are fuelled by economic concerns primarily.

   c) Sector-wide international trading schemes would provide clearer market signals but pose many institutional, notably governance issues.

III. Recommendations

1. The forthcoming EU ETS review should concentrate mainly on the following key issues to avoid diluting resources to lesser important issues: i) improving member state implementation to increase consistency and transparency, notably for allocation and ii) re-

assessing key design options, especially allocation methodologies, sector-coverage and investment incentives to make the ETS more compatible with long-term climate change targets and allow it cope with the post-2012 period.

2. The EU ETS review must be based on real empirical evidence such as member state verification reports, including ex-post evaluation if available.

Investment incentives

3. As investment in new low-carbon technology will become increasingly dominant, the focus of the debate on investment incentives should first be on new entrants and closure rules followed by a more general consideration of allocation methodologies (i.e. benchmarking or auctioning).
4. Discussions on investment incentives should primarily focus on the power sector and possibly refining, where the main investment will take place.
5. If the aim is to provide incentives to low-carbon technologies, for the short-term (i.e. phase II), there should be no fuel-specific allocation to new entrants. Free allocation of power to new entrants should be limited, while closure rules should be harmonised across the EU and preclude immediate withdrawal of allocation upon closure of an installation in order to provide correct incentives for new investment.
6. For the long-term, all fuel-specific allocation must be abolished and free allocation phased out, provided negative effects on competitiveness and security of supply can be minimised.
7. The EU and its member states should de-link the discussions on allocation methodologies and setting the cap. As a minimum the EU and member states must agree on an allocation methodology for the period beyond 2012 while providing flexibility in setting the cap to adapt to international developments.

Breakthrough technologies

8. As the EU ETS on its own will most likely not provide sufficient incentives for the development of new breakthrough technologies, the EU and member states should start exploring what additional measures are needed, notably including R&D.

Allocation methodologies

9. The Review should first develop a set of criteria against which future allocation methodologies should be judged (e.g. environmental objectives, efficiency, investment incentives into low-carbon technologies, competitiveness effects or distributional impacts) to provide more clarity and transparency.
10. Rules on new entrants, closures and new entrant reserves (if applicable) must be harmonised. Member states should review the two options discussed in this report for new entrants allocation (see item 4 of Key Messages).
11. Particular attention should be paid to cross-border effects of NERs provision and the Review should consider the usefulness of EU-wide default rules if not EU-level NERs rules.

Sector coverage

12. Member states must pay more attention as to the optimal mix of policies between the trading and non-trading sectors as this has major consequences for total abatement costs as well as distributional impacts and by extension political acceptability (i.e. willingness to pay).

13. The EU should develop criteria against which to judge sector-coverage: e.g. i) size of installation, i.e. emissions ii) numbers of installations, iii) accuracy and simplicity of monitoring, reporting and verification, iv) administration costs to governments and covered sources, v) expected abatement costs, vi) volume of and trends in emissions, vii) technical feasibility of reducing emissions, viii) competitiveness effects, ix) the feasibility of alternative policies and measures.

14. Pre-determined criteria must be applied when evaluating the need to increase or reduce sectors or gases, for example in the case of aviation, other industrial sectors, treatment of small installations or domestic off-set projects.

Competitiveness effects

15. Any solution to the power price issue and possible competitiveness problems of some energy-intensive industries must carefully take into account possible unintended consequences (see also Annex 1 of this paper).

Emerging of the global carbon market

16. As the analysis of this paper suggests, at least three different ‘models’ of linking are possible[5] and the EU should equally support all options as at this moment is not yet clear whether any would be superior to the others.

[5] Linking via international agreement (Art. 25), bottom-up approaches driven by market participants searching for arbitrage possibilities between different schemes, and sector approaches at international or global level.

THE EU EMISSIONS TRADING SCHEME: TAKING STOCK AND LOOKING AHEAD

Report of the European Climate Platform (ECP)

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1. Introduction

The European Emissions Trading Scheme (EU ETS) is the flagship of EU climate change policy for political, environmental and economic reasons. Emissions trading is one of the crucial pillars upon which both the EU's climate change policy and the (yet to emerge) global regime is expected to rest. It covers almost half of the EU CO_2 emissions and more than a third of total greenhouse gas emissions. The ETS is the show case for applying the economic policy instrument of emissions trading in practice at large, cross-border scale for CO_2 emissions. It has even been argued that the success of the ETS is crucial to convince other parts of the world to adopt binding commitments. The stakes are high and the forthcoming 2006 review offers a unique chance to address real shortcomings of the ETS and to make the ETS fit for the post-2012 period. This paper addresses the principal strategic challenges that the EU ETS is facing and makes a number of concrete recommendations.

2. Status of the EU ETS and strategic challenges

Even though the EU ETS will ultimately be judged on the basis of its effectiveness as a tool to reduce GHG emissions, the underlying rationale for choosing emissions trading was based on economic considerations. From the outset, those designing the EU ETS have attempted to internalise a market externality (i.e. CO_2 emissions) with minimal impact on competitiveness. In theory, under the ETS, the market price of carbon is driven by the marginal abatement costs of all controlled sources, thereby ensuring that the environmental objective is achieved at the least cost. The resulting market price was expected to create long-term predictability, which is critical for spurring investment. In addition, the ETS should offer flexibility to management to choose the most cost-effective compliance strategy. The EU ETS has attempted to add extra flexibility and potentially low-cost abatement options by allowing credits from the Kyoto Protocol's project mechanisms to be used for compliance via the Linking Directive. One of the principal challenges therefore has been getting the balance between supply and demand 'right'. Recent developments suggest that the first period may have failed in this respect. This should not come as a surprise though, as i.e. allocation methodology and cap level has been determined somewhat arbitrarily, notably as result of allocations being based on emissions forecasts, which in many cases have turned out to be wrong.

On the other hand, the EU ETS has been adopted in a very short period of time – reflecting the strong political will in the EU to meet its obligations under the Kyoto Protocol – but implementation is far from complete. In many respects, the EU ETS is still a construction site with many critical elements of the infrastructure still under creation.[6] A lack of infrastructure inhibits trading and efficient price-setting.

[6] This includes for example, the late establishment of registries, late installation level allocations in some member states, the missing International Transaction Log – a precondition for trading of CDM credits – or the sometimes hesitant steps taken towards implementing the Linking Directive.

While this infrastructure is progressively being put into place, the initial phase of the EU ETS has coincided with high energy prices, which in the context of imperfect energy markets generally has increased costs to enterprises. Beyond that, another important factor for the initial results of the EU ETS has been the increased spread between coal and gas prices, which has pushed up EU allowance prices. In the short term, fuel switching – from coal to gas – is the principal way to reduce CO_2 emissions. However, the coal/gas spread increase has compelled power plants to burn more coal, which in return has made CO_2 prices climb. In addition to shortcomings due to the lack of infrastructure, this has generally meant that it was mainly the power sector, which has been short due to allocation and the coal/gas spread that has engaged in the trading market. The industrial sector – generally long – has been less engaged. In addition, most active trading participants come from those member states with tighter allocation, and hence are buyers. On the other hand, market participants from those countries with less tight allocation, potential sellers from mainly but not only the new member states, have not yet engaged in trading as a result of a lack of infrastructure and in some cases, the absence of installation level allocation. In the absence of member state verification reports prior to mid-May, the behaviour of market participants had to be guided by expectations rather than reliable information. Such a situation is not unusual in newly developing markets, and in some cases has led to 'strange' behaviour. This will however disappear with a more mature market.

Uncertainty has prevailed because of doubts on the further development of the Kyoto Protocol project mechanisms, the timing of the International Transaction Log, international developments with effects on oil and gas markets, the relative illiquidity and the perceived high level of market power concentration in the EU ETS market but also the possibility of a prolonged legal battle on the UK claim for an addition of 20 $MtCO_2$ to its NAP, the effects of future entry in the EU and the ETS of Bulgaria and Romania. The dramatic price collapse in late April has reflected this uncertainty.

Against this background it is too early to pass (final) judgement on the EU ETS. Nevertheless, a number of issues have been identified by the literature and that will be discussed in the following sections: allocation including new entrants and closure rules, investment, economic impacts including power prices, sector coverage and the EU ETS in the global carbon market as strategic long-term questions.

3. Allocation: Lessons from phase I

Now that the first round of allocation is almost completed, a number of concerns have been identified. An important concern is that of environmental targets, because most member states have allowed emissions from the covered sectors to rise in the period 2005-07, despite the fact that many must reduce their emissions to achieve their Kyoto Protocol targets. For example several member states have allowed their covered sectors to increase emissions by as much as 10 or 20%, although they are on a trajectory that will not enable them to meet the Kyoto Protocol targets.[7] Initial draft verification reports of member states indicate that there has been significant overallocation in several member states and that the market as a whole is also long by approximately 2.5% during the first year of trading (i.e. companies received more allowances than needed).

[7] Initial draft verification reports of member states indicate that there has been significant overallocation in several member states and that the market as a whole is also long by approximately 2.5% during the first year of trading i.e. companies received more allowances than needed.

Other concerns relate to the high degree of decentralisation – a deliberate member state choice – with a considerable amount of member state discretion in the allocation process (i.e. NAP-related issues), which has been a deliberate policy choice by the EU. This, however, has led to inconsistencies between member states, which could distort competition, diminish the efficiency of the market and ultimately, undermine environmental effectiveness and the trust placed in the system. Some have been addressed by the updated Guidance document on allocation, published in late 2005 (European Commission, 2005a).

The following broad experiences can be mentioned:

- **Allocation levels:** Allocations have often been based on projections of future need. In most member states, allocations have exceeded historic emissions. Inflated baselines were a striking feature of the first round of allocation plans, resulting in substantial over-allocation for industries in some countries (LETS Update 2006: 6-7). Generally, governments engaged in close dialogue with the industry prior to the allocation, and the national governments could do little else but give in to pressures from their own industry. Since the submission of extra allowances did not have any immediate cost to member states, the rules opened up a classic free-rider situation. For energy-intensive industries, allocation was a means to compensate them for ETS-related costs. The situation is, however, different for phase II, which coincides with the Kyoto Protocol commitment period. For phase II, many member states will either have to decrease the allocation considerably, reduce emissions in the non-trading sectors or buy shortages through CDM and JI (Zetterberg et al., 2004).

- **High degree of decentralisation makes member states vulnerable to industry pressure.** While the considerable discretion of member states when undertaking allocation has helped to accommodate national differences, at the same time it has submitted member states to considerable pressure from industry not to provide less allowances than other governments.

- **Shortages are in the energy sector:** When allocation is reduced in relation to projections or current emissions this is often done in the power or energy sector. In Sweden the allocation to energy installations is 80% of emissions reported in 1998-2001. Similar reductions are done in the UK, Denmark and Austria. The reason for this is that the energy sector is assumed to have the lowest costs of abatement – at least in member states with liberalised energy markets – also has the possibility to pass through the extra costs associated with allowances to the clients. But there are member states that have not followed this. In Finland and Lithuania the energy sector has received more allowances than current emissions (Zetterberg et al., 2004).

- **Considerable interest in benchmarking:** As the first phase allocation plans were developed there was considerable support for using benchmarking, both among governments and industry. The main arguments being that benchmarking rewards CO_2-efficiency, it is seen as a driver towards more CO_2-efficient processes and it is perceived as fair. This support is currently still high in industry. Consequently, governments in several member states, for instance in the Netherlands, Germany, the UK and to some extent Sweden, have invested considerable effort in investigating alternative allocation methodologies. However, experiences to date have shown that benchmarking is often associated with problems concerning data retrieval and the definition of product groups (e.g. Radov, Harrison & Klevnas, 2005; Zetterberg & Åhman, 2005).

- **Allocation involves high values.** The value of allocation is important. In the energy sector, the value of allocation to new entrants lies between 18% and 27% of expected revenues in Denmark, Finland, Germany and the Baltic member states. Compared to fixed costs of new capacity, the value of allocation lies between 70 %-105 % in these member states (Åhman

& Holmgren, 2006). Values are however sensitive to the relationship between actual fuel and CO_2 prices at a certain moment.

- **New entrant allocation rules distort competition.** Each member state has developed rules for allocation to new entrants and these rules vary considerably between member states. A new natural gas CHP plant would in Germany receive allowances corresponding to 130% of its expected emissions. The corresponding figures are 120% for Finland, 90% for Denmark and 60% for Sweden. For a new natural gas combined cycle electricity production unit (no heat) the differences are even larger. In Germany the installation would receive 105% of the required allowances. In Finland 100 %, in Denmark 82 %, and in Sweden 0% (Sweden does not give allowances for non-CHP). Since the differences in allocation are associated with large values, current allocation rules have an impact on investment decisions, and can significantly distort competition if they remain unchanged (Åhman & Holmgren, 2006).
- **Distinction of new entrants from capacity expansion has been difficult.** Generally, governments have struggled to distinguish between new entrants (i.e. new capacity) and capacity expansion (see Åhman & Zetterberg, 2003), primarily in the industry sector. In the power sector, such a distinction was easier as new capacity in the power sector typically consists of individual boilers.
- **Closures rules create perverse incentives**. Most member states apply closure rules stating that if an installation is closed or if production is reduced significantly the amount of allocation corresponding to the reduction of economic activity will be withdrawn. The rule may seem logical, since the company will not need all allowances. But the problem is that it reduces considerably the incentives for clean technology that the ETS was intended to create (Åhman et al., 2005). Withdrawing allocation upon closure amounts to introducing an incentive to continue (an inefficient) operation in order to keep allowances. In the opposite case, allowing an installation to keep allowances after closure creates an incentive to close inefficient installations as the installation can keep allowances and use the corresponding revenue to invest in new installations. Transfer rules whereby allowances from closed installations could be used for new installations have tried to overcome this problem but have increased complexity and risk creating distortions.
- **The setting up and management of new entrants' reserves increases complexity and risks distortions.** Most member states have created a new entrants reserve (NER) to be allocated for free to new entrants. The governments must decide on how to allocate, for example on the basis of expected emissions (since new entrants will have no historic emissions base) or based on benchmarks and projected production. Member states must also decide what to do if more new entrants appear once the set-aside fund has been used up and conversely, what use will be made of any allowances that are left in the reserve at the end of the period.

3.1 New entrants (i.e. new capacity) allocation

As the 2004 Guidance document on allocation states (p. 12), "the treatment of new entrants, i.e. installations starting operation in the course of a trading period, is one of the most important design choices in any emissions trading scheme" (European Commission 2004) because it affects firms' compliance strategies. Theory suggests that new installations should be forced to buy allowances rather than be given for free.

In the short-term and in an operational sense, economic *incentives* with regard to production and/or trading decisions are the same regardless of whether a new installation is given allowances for free or not. Decisions are based on cost considerations including opportunity costs and ultimately depend on pass-through capacity of the cost of CO_2. Strategically, i.e. with regard to investment decisions, allocation methods matter however. The fundamental reason why new installations should buy their allowances – rather than get them for free – is that auctioning provides the best incentives for investments in new, less carbon intensive technologies. A further argument for auctioning is that new installations do not carry the cost of previous investment, which was made when there was no carbon constraint (i.e. sunk costs).[8]

The most commonly voiced arguments in favour of free allocation to new entrants run along the following lines (for an overview and further details, see Egenhofer & Fujiwara, 2005 and 2006):

1. Existing installations are overcompensated through grandfathering, which may justify an equal subsidy to new installations.
2. Existing installations are encouraged to continue operating since allowances are withdrawn if they close. This puts new installations at a disadvantage. Thus the justification for free allowances to new entrants becomes easier under current closure rules than if closed installations can keep their allowances.
3. Since firms typically are constrained by capital, and capital markets are not perfect, there could be reason to subsidise capital by allocating free allowances in order to reduce the investment barrier.
4. Perceived fairness; if existing installations get free allowances, why should new installations not also get them, especially as they carry a price risk? If new entrants are not granted allowances on the same basis as existing market participants, price risk, particularly in an illiquid market would put them at greater disadvantage. This is heightened by the fact that a new entrant entering the market is most likely to buy allowances from its incumbent competitor.
5. It is argued that free allocation will help to contribute to limiting wholesale power prices and to minimise windfall profits. This is likely to be the case in the long run and if allocation is based on benchmarks. For the short-term (i.e. the next 3 year or so) power prices will not be affected by investment in new capacity as it will be too small. If free allocation is to be used, the strongest incentives for low carbon technologies are created by the use of fuel- and technology neutral benchmarks.

There is no doubt that new entrants are crucial to both the deployment of new and more efficient technology, a key objective of climate change policy and attempts to reduce power prices. Current allocation rules, notably rules on new entrants and closures provide incentives keep inefficient plants in operation, maintain an upward pressure on power prices as it would keep high costs producers (as marginal generator) in the market. Market power concentration and inefficient power markets in many EU member states reinforce this tendency.

On the other hand, the first round of allocation has shown that special provisions for new entrants is a *political* priority in all member states and is likely to remain so in the second phase. It is therefore realistic to propose that member states continue to allow (but not require) new entrant reserves. However, to avoid competitive distortions between member states, a standardised approach across member states is needed.

Ultimately, three proposals have emerged on the interface of new entrants-power prices-investments.

[8] This is only true as long as a new entrant is not an upgrade of an existing installation.

Proposal 1 is to auction for new entrants but this may delay the investment as it puts new investment at a relative disadvantage to incumbents, especially as they are overcompensated by free allocation. This proposal gives clear signals for low carbon investment. Power prices may remain high as the marginal plant – although more efficient – needs to buy all allowances. There is little political support for this option as long as the other industrial regions are not part of a global scheme.

Proposal 2 is to give new entrants allowances for free from a dedicated reserve. The resulting effectiveness depends now on the details of this free allocation. Current practice of some member states to grant as many allowances or even more than are needed provides little incentives to reduce emissions.

As the two options aim at different objectives[9] they constitute a trade-off.

A third proposal is to treat new entrants and incumbents alike, i.e. the same degree of free allocation and auctioning. Proponents argue that this provides stronger signals towards low-carbon investment and thereby could have a positive effect on power prices while ensuring equal treatment of incumbents and new entrants. It would also largely dissolve the trade-off that we have identified above.

3.2 Closure rules

The issue of closure rules (i.e. what happens if an installation that has received allowances ceases to operate) is closely linked to that of rules for new entrants. To obtain a level playing field between incumbents and new entrants the interaction between rules on closures and new entrants should be given more consideration (see Åhman et al., 2005).

Theory suggests that allowances in case of closure should not be removed as this keeps correct incentives to close inefficient installations. As more efficient new entrants will replace these installations, emissions would go down (see also Åhman et al., 2005). Conversely, withdrawing allocation upon closure equals introducing an incentive to continue (an inefficient) operation. Since the number of allowances that would be lost upon closures is greater for inefficient installations – assuming they have been allocated a greater number of allowances per unit of production than more efficient installations – the effects of such a closure rule can in fact be significant.

In practice, only two member states, i.e. the Netherlands and Sweden ‘follow’ the theory and allow for keeping of allowances in case of closures. As this extends only to the end of the first period, the incentive effect is likely to be small, however. In some cases member states deliberately chose to seize allowances in case of closure to keep power plants running for reasons of security of supply.

Some member states (e.g. Germany, Italy, Austria and Poland) have introduced transfer rules, saying that in case of new investment operators should be allowed to ‘transfer’ allowances to new installation. This has a similar incentive effect as allowing installations to keep allowances when closing, but increases the complexity of the system. Further, such a system favours new investments made by incumbent companies over ‘true’ new entrants to the market (see Bode et al., 2005; Åhman et al., 2005), which can increase market power concentration in EU electricity markets.

[9] Proposal one aims at power prices in the shorter term while proposal two at longer-term investment.

3.3 Allocation methodologies: The limits of grandfathering

Experience with the first round of allocation in the ETS has shown the limits of using grandfathering as an allocation methodology. In addition to the complexities related to new entrant allocation as well as closure rules, they have raised distributional issues and miss to provide adequate investment incentives.

In addition, the high degree of discretion for member states has increased complexity, administrative burdens and transaction costs while leading to distortions to competition in the internal market. Industry has put pressure on governments not to hand out fewer allowances than other governments (e.g. Zetterberg et al., 2004; Matthes et al. 2005; PriceWaterhouseCoopers, 2005).

As the EU ETS moves forward, basing allocation on performance before 2005 will become increasingly less relevant and harder to justify. On the other hand, if allocation is based on events from 2005 or after, this introduces incentives to the firms to adjust operations in order to influence allocation and maximise profits, i.e. updating. Somehow updating cannot be avoided as the original base year becomes increasingly remote and meaningless. If allocation is to be updated, auctioning would create the greatest incentives for carbon efficiency, followed by (fuel-neutral) benchmarking. Grandfathering (emission-based allocation) would create the lowest incentives for abatement (Zetterberg, 2006). For grandfathering, however, the abatement incentives can be increased considerably if the base years are chosen with a significant time lag, i.e. ten years earlier (Åhman et al., 2006).

It is hard to perceive that EU industry would accept auctioning in the absence of a global climate change regime that imposes comparable carbon constraints to all its competitors. As a consequence, there has been increasing interest in benchmarking (e.g. Radov, Harrison & Klevna 2005; Zetterberg & Åhman, 2005; Schyns, 2005), another free approach to allocation.

3.3.1 Benchmarks

A benchmark system could be defined as neutral or specific with regard to fuel, technology and/or product. For example, a fuel-neutral benchmark would give an equal number of allowances per generated MWh, regardless of what fuel is used. Fuel-specific benchmarks would instead give a different number of allowances per MWh, depending on what fuel is used. The benchmark[10] would serve as guide to allocate allowances on some sort of 'fair' criteria. As allocation is linked to performance, benchmarking rewards CO_2-efficiency including low carbon investment and early action. Hence, benchmarking is principally regarded as a means to address fairness and investment.[11] Most importantly using benchmarks for allocation to both existing and new installations would reduce the perverse incentives introduced by adjustments of allocation to closures and new entrants. Nevertheless, while benchmarking might be appropriate to set efficiency criteria concerning the allocation of emissions rights, the question of fixing the activity level for each installation is an open and difficult one. The Swedish benchmarking experience has shown difficulties with data availability and generally complexity, such as setting boundaries of output or how to measure it. In some sectors such as steel, it appears to be very difficult to set a benchmark for an integrated mill due to the complexity of the production processes but also different legal operators. The alternative, a theoretical benchmark would be more practical but would have the disadvantage not fully reflecting the situation in each

[10] Sometimes called performance standard.

[11] However, it does not always fully take into account sunk costs – as for example grandfathering does – that arise due to investment that has been made prior to the carbon constraint.

individual installation. Although over time, in line with the Sevilla process to develop indicators for BAT (best-available technology) it should be thinkable to move towards benchmarks.

Benchmarks have been used by some member states in their phase I NAPs. Some (e.g. Germany, Denmark and Finland) have utilised benchmarks for allocation to new entrants, and others (e.g. Sweden, Netherlands, Italy) for installations in general and/or fixed energy efficiency rates for energy production installations. While such approaches are covered by the EU ETS Directive, the problem is that the metrics differ between member states. For instance, some member states base allocation on installed capacity and projected utilisation rates, some on projected output and others on best-available technology. Hence, better coordination across member states to work towards EU-wide benchmarks could be an important first step towards progress on benchmarking. *EU-wide* benchmarks instead of national ones are necessary to avoid fragmentation in the EU internal market.

The next question is whether to apply fuel-specific or fuel-neutral benchmarks. It is without doubt that fuel- and technology-neutral benchmarks provide the strongest incentives for low carbon technologies. Fuel-specific benchmarks will only drive efficiency for each fuel and technology but not necessarily lead to switching to low-carbon fuels and technologies. On the other hand, fuel-neutral benchmarks are likely to affect security of supply by for example further increasing gas import dependency. There would be very big differences between member states as to security of supply concerns. In addition, fuel neutral benchmarking creates winners and losers. They will lead to an allocation that is either considerably lower (e.g. in the case of coal) or that is considerably higher (e.g. in the case of natural gas) than actual emissions. As the NAP phase I has shown, such a situation is likely to increase pressure on government from potential losers. In order to reach acceptance for the NAPs, many governments have been hesitant to deviate from status quo, i.e. current emissions. We can also note that in those cases where benchmarks were applied, notably for new entrants, usually fuel specific benchmarks were used.

3.3.2 Auctioning

Auctioning is allowed in the EU ETS, to a limited extent. Five per cent of the total quantity allocated in each country may be auctioned for the first phase of the scheme, and 10% for the second phase. While only Denmark, Hungary, Ireland and Lithuania will use auctioning in NAP phase I, several member states have indicated to make more extensive use of auctioning in NAP phase II.[12] The main issues related to auctioning is likely to be the impact on costs and resulting effects on competitiveness (i.e. profits) for the energy-intensive industries, whose competitors are not subject to a similar carbon constraint, a ‘secondary allocation’ debate on how to recycle revenues as well as open questions on the mechanics of auctioning, notably to avoid that market dominance is enhanced (i.e. ‘deep pocket’ issues). Finally, the effects on auctioning in different member states would be very different depending on the structure of the power sector, i.e. whether coal or nuclear/hydro based. Member states will therefore be subject to pressure by their industries.

4. Economic impacts (including power price increases)

The potential economic impact of the ETS can either stem from the need to cover process emissions, i.e. emissions in excess of those covered by ‘free allocation’ or the fact that it covers

[12] The Association of Danish Energy Companies (Dansk Energi) has publicly announced its support for auctioning (Hansen 2005). Auctioning is generally also supported by environmental NGOs.

combustion emissions, which – regardless the allocation method – leads to power price increases. The actual impact on each sector or installation then depends on: i) a sector's ability to pass through costs in different product markets and ii) the structure of national or regional power markets.

Several studies (e.g. IEA, 2005a; Demailly & Quirion, 2005; Carbon Trust, 2004; Quirion, 2003) tend to confirm that the EU ETS could lead to market share losses and, as a result, to carbon leakage, especially if the indirect effects owing to the inclusion of carbon in the power price are realised. Potential losses in market share, however, depend on the extent to which EU producers can pass on the extra cost to consumers and suppliers. A second element is how quickly non-EU producers can increase their production in the short-term. Therefore it is most likely that negative effects on competitiveness do not fully come into play in the immediate short-term. This is even truer as long as investors assume that over a reasonable period other countries will gradually become subject to carbon constraints. The one notable exception to the general finding is aluminium, where studies agree that it is directly affected in its net value as a result of the fact that the sector cannot pass on price increases, as product prices are set by international commodity markets (e.g. Carbon Trust, 2004; IEA, 2005a). According to the aluminium industry, the power price constitutes more than 25% of the total production costs of primary aluminium. As primary aluminium is a globally traded commodity, its price is set by the world market and the European aluminium industry has no opportunity to pass on the increased costs. Preliminary conclusions from a study of McKinsey (forthcoming) indicate that a price of €25/t CO_2 will lead to a 14% cost increase for primary aluminium production. An internal analysis by Hydro (Nord, 2005) shows an even greater increase. The aluminium industry reckons that this would represent an average 10% of the selling price of metal at today's prices (Stevens, 2005).

Under a €10 per tonne of CO_2 scenario by the IEA (2005a) study, basic oxygen furnace steel, cement and aluminium would already incur reductions in profit margins of between 6-8% of total profits. Contrary to the IEA study, the Carbon Trust (2004) concluded that at a price of €10 per tonne of CO_2, only aluminium would be directly affected in its net value. At a price of €25 per tonne of CO_2, however, Carbon Trust (2004) estimated that aluminium, cement and steel would need to be able to pass on significant price increases in order to maintain their market share. The figures are 31.4% for aluminium, 7.3% for steel and 17.4% for cement. Although there is major controversy on the ability of pass-through of sectors, it is hard to imagine that industries are able to pass-through cost increases in that magnitude.

Neither of the studies has examined the specific effects that occur due to geographical proximity of non-EU competitors for example in the Mediterranean in cement or refining. For some industries the competitive disadvantage is related to the geographical proximity of their competitors' particular installations.

Power prices are influenced by many factors, of which the EU ETS is but one. In general it is difficult to assess the impact of CO_2 allowance prices, as these are determined by a large variety of factors, including fuel prices, available generation capacity, euro/dollar exchange rates, investment costs, power imports, weather conditions, heat demand ('must runs'), the flexibility of gas contracts as well as market expectations and more. Even the extent to which CO_2 prices are passed through to power prices varies by market, load factor and the power market in question (see Sijm et al., 2005; Sijm et al., 2006).

The objective of the EU ETS was to include the CO_2 price in the marginal costs of power. While the ETS is likely to push up power prices, it may at the same time reduce coal prices. It must also be noted that the EU ETS was launched at a time of very high energy prices, which has influenced power prices. In addition, high gas prices make power plants continue to burn more coal and push up EU allowance prices. This is coupled with the fact that current allocation rules provide for disincentives to close inefficient plants, and allow for potential windfall profits for the power sector. There are two different causes of windfall profits. The first category is due to the fact that generators pass on CO_2 costs for which they have not actually paid as a result of free allocation. The second is that low carbon generators benefit from ETS-induced increases in power prices. The latter category is unavoidable as putting a price on carbon makes low carbon generators more competitive.

Are there options to address competitiveness issues?

Since the start of the ETS, a number of potential options to address the issues have been discussed. They are reviewed by Sijm et al. (2005) and Harrison & Radov (2005) and tested on their political suitability for example by CEPS (Egenhofer & Fujiwara, 2005 and 2006). There seems no ideal option to address implications.

As follows, CEPS has identified two different categories of measures: 'alleviation' and 'compensation'. Alleviation measures aim at changing the incentive structure and the functioning of the allowance market essentially through regulation. Attention is needed to ensure that such measures do not impede efficiency of the EU ETS, power or other markets. Compensation measures try to correct undesirable economic and social outcomes from the trading market. In principle they are executed through recycling of revenues, allocation or subsidies. They raise issues on the organisation of this compensation (i.e. allocation, raising and distribution of funds), notably, how to minimise government intervention. Measures from both categories may have unintended consequences. Some options are discussed in greater detail in Appendix 1.

5. Sector and gas coverage

The EU ETS originally had limited the trading sector to six sectors: energy production, iron and steel, cement, glass, ceramics, and paper and pulp. This coverage was meant to strike a reasonable balance between creating a sufficiently large market and remaining practical and simple to minimise transaction costs. Hence there were implicit criteria for sector coverage.

More recently, there have been calls for including aviation (European Commission, 2005b), transport more generally as well as for exploring the opportunities for opting-in additional gases or domestic off-set projects. The fundamental argument for bringing more sources under the EU ETS lies in the opportunities to increase the options for emission reductions within the ETS and hereby lower the total costs for reaching climate targets but also bring new sources under the cap. Additional gases increase the variety of reduction options, offer additional innovation potentials if innovation lead times are respected and increase liquidity and ultimately the efficiency of the market. Precondition are however effective monitoring and that inclusion achieves real reductions, for example beyond business-as-usual. According to Capros et al. (2000), a '6-gas strategy' approach for the EU ETS could decrease the allowance price by more than a third from the CO_2 only price level. According to this estimate, the EU ETS allowance price for one tonne of CO_2 equivalent could be reduced from €33/tCO_2 with CO_2 only to €20/tCO_2 with six gases only to reach the EU's Kyoto target, i.e. 8% reduction in GHG emissions. Although estimates about efficiency gains remain controversial for example depending on the translation of Global Warming Potentials (GWP) (e.g. Aaheim et al., 2004), there is an acknowledgment that multi-gas trading is generally more efficient, i.e. it reduces compliance costs (e.g. Hyman et al., 2002; Kets, 2002). On the other hand, additional gases can increase the complexity and increase transaction costs or lead to mitigation of distributional impacts. Hence, policy makers may face a trade-off between overall efficiency on the one hand and distributional impacts on the other. The following sections discuss the potential implications of including more sectors into the EU trading system from an economic and equity point of view.

5.1 Transport (in general and aviation)

Both the European Commission and the Council of the EU have expressed their interests in analysing whether air transport emissions could be included into the EU ETS. The last six months the discussions have focused on design elements of how aviation can be included in the system. These elements include coverage of non-CO_2 effects of aviation such as condensation trails, geographical coverage, trading entities, allocation responsibility, allocation methodology and interaction with the Kyoto protocol. These elements have been analysed in detail in CE et al. (2005). CE Delft (2006) and Sweden's FlexMex2 commission (SOU, 2005) have also performed introductory studies on the feasibility of including road transport and shipping into the EU ETS in a longer time perspective.

When discussing options for introducing transport under a cap and trade programme, the leading issue appears to be whether transport should lie under the same cap as the current trading industries or whether transport should lie under its own dedicated cap. The transport sector differs from the industrial sector in two important ways: firstly, the sector is expanding at a fast rate and secondly, the willingness to pay for carbon emissions *in general*[13] is expected to be much larger in the transport sector than in the industrial sectors. These facts have significant implications on the consequences from having one common cap or two separate caps.

From a pure economic point of view, putting transport under the same cap would minimise the society costs of meeting a given climate target, given dynamic effects not considered. Since the transport sector is important as an emission source the introduction of this sector in the EU ETS is attractive. But given the growth rate and the willingness to pay, we would expect a dramatic increase in the demand for allowances from transport under the same cap as the current trading industry. This would increase the price of allowances and probably that of electricity, and increase the risk for relocation of EU industries to outside the EU.

One alternative solution would be to have two caps; one cap for the current trading industries and one separate cap for transport with both having separate allocations. By having separate caps one could isolate the sectors from each other and define separate emission targets for each sector. Having separate caps would thus 'protect' the current trading industries from price increases due to increased demand from transport. The allowance prices would be different in the different caps, which indicates that the costs for emission reductions are different in the different sectors. Total costs for society would be higher compared to implementing a common cap. The distribution of costs on different actors is also very different if we have two separate caps compared to one common cap. This might however only remain theoretically possible. If both the current ETS and the transport sector have access to the CER/ERU market, the two sectors act like communicating tubes. A strict cap for the aviation sector would result in high demand for CER/ERU and contribute to an increase of allowance prices in the EU ETS.

The insights from this example of separate caps can be generalised. With the burden sharing agreement as an overall constraint, setting a cap for the trading sector implicitly sets an emission target or 'cap' for the non-trading sectors. The choice of sector coverage and size of the trading sector cap in relation to the implicit emission target in the non-trading sectors will have direct

[13] This does not mean that there are no low-cost potentials in the transport sector. Gillen, Morrison & Stewart (2003) show that for aviation in North America differences in price elasticity for long and short distances as well as for business and leisure travel.

implications on the society's total costs for reaching the climate target, and also significant implications on how these costs are distributed between sectors. If we place the divider between the trading sector cap and the non-trading sector emission target will have implications on the total costs for reaching a climate target (economic efficiency) and considerable implications for the distribution of these costs between sectors (equity). This shows how important it is to develop policies that strike an appropriate balance between reductions from the trading sector, transport and other non-trading sectors. Ironically, this issue has received little attention so far.

Some argue that the growth of the transport sector needs to be limited and that therefore it is inappropriate to have transport under the same cap as industry. The advocates of this argument see the sector (growth) target as more important than the climate target. The debate is interesting because it puts a finger on something important that lies at a higher political level than climate policy. When discussing the role of different sectors in reaching climate targets, what do we want the targets to achieve? Is it economic efficiency in reaching climate targets? Or is the target to reach a balance between different sectors that we believe to be optimal for the development of the society? Or is it to find solutions that are politically acceptable? If so, it is relevant to ask if a climate policy instrument such as the ETS is the best instrument for this.

5.2 Criteria for sector-coverage

To date there are no explicit criteria against which to judge sector coverage. There is however an implicit criterion to keep the system as simple as possible. On the other hand, there may be economic and environmental reasons to expand the ETS. To ground the political discussion in a more rational context, it would be helpful if the ETS review were to provide a set of criteria against which possible enlargement could be judged. Possible criteria are: i) size of installation, ii) numbers of installations, iii) accuracy and simplicity of monitoring, reporting and verification, iv) administration costs to governments and covered sources, v) expected abatement costs, vi) volume of and trends in emissions, vii) technical feasibility of reducing emissions, viii) competitiveness effects, ix) the feasibility of alternative policies and measures (see also LETS Update, 2006).

Such criteria could be applied to all sources or installations and could therefore become the basis upon which to decide on whether to include or exclude a particular source, sector or installation, how to deal with small installations, domestic off-set projects or new sectors and gases.

6. Issues for an emerging global carbon market

As in the case of sector coverage (section 5 above), the case rests on the economic case that a wider market – here through linking of markets – reduces overall abatement costs, prevents distortions to international competition and increases liquidity. Article 25 of the ETS Directive foresees the linking of the ETS with other national or regional emissions trading schemes via an international agreement. This reckons that the development of emission markets could become a possible pillar of the architecture in the post-2012 regime. To date, it is difficult to provide an assessment of the feasibility of such linking as those schemes to which the ETS could be linked to are still in development, with yet uncertain design options.

Against this background, only a few tentative conclusions can be made. Linking of emissions trading schemes even if they inhibit widely divergent designs such as those on banking rules, coverage of sectors and gases or opt-ins/opt-outs does not run into fundamental problems, as long as technical fixes are put into place (Blyth & Bosi, 2004; Haites & Mullins, 2001; Baron & Bygrave, 2002; Haites, 2003). However, such fixes generally reduce the efficiency through adding transaction costs, market fragmentation or through perverse effects or distortions.

Linking of schemes will most likely require considerable adjustments of existing domestic and regional emissions trading schemes beforehand. This is associated with a risk of increasing complexity up to a point where the economic efficiency of such schemes becomes questionable. Critical issues for linking are allocation, monitoring, reporting and verification and issues of global governance (Egenhofer & Fujiwara, 2006).

The most critical issue for linking is distributional impacts as different participants would be affected in dissimilar ways. When two programmes are linked, the market price will be higher than the pre-link price in one of the trading schemes and lower than the pre-link price in the other zone, thereby creating winners and losers. Winners will be net sellers in the low price scheme as the price goes up for them and net buyers in the high price scheme as prices go down for them. The reverse is true for net buyers in the low price scheme and net sellers in the high price scheme (Haites, 2003; Bode, 2003). The same holds true for expansion of the scheme. As a result, even though linking or expansion can yield an economic benefit, certain participants in the trading scheme will be worse off. Thus, extra incentives will be needed for potential losers.

Given the possible obstacles from a political, economic and implementation point of view, let alone the fact that there is little to link to at least at the moment, a better option for a global carbon market to emerge may well be market participants searching for arbitrage possibilities between different carbon commodities. Such arbitrage is already happening as most national or regional climate change strategies foresee the use of project type of mechanisms either in the form of the Kyoto Protocol projects mechanisms (CDM/JI) or similar domestic projects such as those in the US or Australia. As long as domestic or regional emissions trading schemes allow for the use of credits from projects as the ETS does through the Linking Directive, the possibility of arbitrage is ensured.

The third option for an emerging global carbon market would be to move towards sectoral agreement on an international scale (e.g. IEA, 2005b) as opposed to linking domestic schemes that include a variety of sectors. This would have the benefits of combining similar sectors or 'carbon commodities' (Colombier & Kieken, 2006) with similar characteristics. This would greatly reduce the winner/loser conundrum while facilitating to provide an efficient price signal. There are however many open questions on institutional matters notably enforcement at global level.

In conclusion, we can formulate three possible options for an emerging global carbon market:

1) Linking of national or regional schemes: principal challenges are complexity, allocation and dealing with winners and losers;
2) Bottom-up carbon market based on market participants searching for arbitrage possibilities enabled by the existence of project-based credits in all emission trading schemes. Environmental outcome is uncertain as dynamics is fuelled by economic concerns primarily; speed is also uncertain.
3) Sector-wide international trading schemes would provide clearer market signals but pose many institutional, notably governance issues, notably monitoring and enforcement at the global level.

7. Does the EU ETS promote the development of low carbon technologies?

In the long-term, a critical element for meeting the climate change challenge will be the development and diffusion of new breakthrough technologies. Ultimately, any climate strategy will have to be measured against its capacity to foster first the development and then investment in new low-carbon technologies.

One of the main criticisms with regard to the EU ETS has been that it discourages rather than encourages investment in new and low-carbon technologies in the long-term. To an extent this is result of international indecision, which in return reduces predictability. Some of the causes however are closer to home. They include short-term allocation periods and allocation methodologies, notably including new entrants and closure rules. In addition, fuel-specific allocation may have negative effects on investment in a carbon perspective as they do not discriminate necessarily between high and low-carbon fuels.

A second, less prominent but more fundamental issue of the ETS is that by itself the ETS will not be capable to provide sufficient incentives to develop and bring to the market new breakthrough technologies, i.e. make R&D at massive scale profitable. Price signals need to be much higher and more credible in the long-term to generate a significant amount of private resources for R&D.

As to the first criticism, the fear is that uncertainty stemming from the ETS will reduce investment incentives (see e.g. IEA, 2003; Matthes et al., 2005). The argument is that the EU ETS adds to investment uncertainty notably through short-term allocation periods. Current allocation periods provide certainty for only three, and then five years – periods that are far shorter than those associated with investment cycles. Other uncertainty stems from possibly perverse effects from new allocation methodologies, notably new entrants and closure rules or the possible depletion of NERs. Finally, a major part of uncertainty stems from the dynamics of international negotiations that notoriously are unpredictable.

Uncertainty however is a normal factor for many investment decisions. Uncertainty relates to demand, electricity and other product prices, factor prices (primary energy, feedstock, labour, transport etc.), technological progress, competitors' strategies as well as regulatory risks, which is the category the ETS falls into. Although there is nothing the EU can do to alleviate uncertainty stemming from the indecisiveness of international negotiations, the EU ETS Review should reassess the ETS impacts on investment certainty. The area to start with is new entrants and closure rules as well as allocation in general (see section 3 above). In addition, a number of additional options have been identified,[14] which the EU ETS 2006/7review could assess. Critical precondition is however that efficiency indicators at installation level are in line with long-term climate change targets and that such indicators are locked in long-term rules of allocation methodologies. Particular attention should be paid to the power sector as the principal investment relevant to climate change will be there. A more complete analysis is provided in Annex 2 of this report.

As to the second criticism that the EU ETS will induce technological change of the magnitude that is required (e.g. Montgomery, 2005) it would be unrealistic to expect the ETS to do that at least in the short and medium term. Current policies including the ETS with a CO_2 price below €30 do not make R&D profitable hence do not contribute to the development on new and breakthrough technologies. In addition, emissions trading schemes – as well as taxes – face credibility problems with investors. Price signals from the ETS essentially stem from government policy (i.e. how caps are set). This strong government role undermines the credibility of the long-term signal to an extent. Finally, in the 'real world' prices do not always provide the right signals as the different sectors (e.g. power, carbon-intensive industries, other industry, residential sectors or transport), representing different carbon commodities react

[14] i) longer allocation periods, ii) new entrants' and closure rules, iii) benchmarks, iv) long-term efficiency targets; v) relative targets for the industrial sector, vi) auctioning, vii) change of allocation methodologies, viii) long-term indicative targets for the EU, ix) ceiling on the allowance price (i.e. price caps); for details see e.g. Egenhofer et al. (2006).

differently. EU governments indeed struggle in combining an ‘affordable price’ to reduce competitiveness effects with ‘appropriate investment signals’ (see Colombier & Kieken, 2006). This struggle increases political pressure on governments, which in return reduces the credibility of the long-term price signal. Emissions trading schemes (e.g. EU ETS) – as well as taxes – therefore are more of a short-term tool that provides incentives to increase energy efficiency by incremental improvements rather than the development of breakthrough technologies.

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Appendix 1: Options to address power price increases: alleviation and compensation measures

A) Alleviation measures

Alleviation measures aim at changing the incentive structure and the functioning of the allowance market essentially through regulation. Attention is needed to ensure that such measures do not impede efficiency of the EU ETS, power or other markets. The following alleviation measures have been considered:

a) Some have argued that the *auctioning of allowances*, as long as it is combined with revenue recycling, could be a suitable way to address the competitiveness issue. Auctioning ensures that all participants are treated in the same way. In addition, it is preferable from an efficiency point of view and reflects the 'polluter-pays' principle. Finally, it generates revenues to be recycled to address public policy objectives, such as reduction of other taxes, or to address market distortions. The disadvantages on the other hand are well-known: it increases the cost for participating industries and is comparable to a tax and hence enjoys little political acceptability. Recycling of revenues can mitigate these effects, but it is not evident how to do this efficiently. It then becomes a matter of the management of a 'secondary allocation'. Of particular concern are internal market issues and the role of the EU but also the impact on companies' cash flow. Most important, however, is the temporary limitation of auctioning under the current Directive, i.e. 5% and 10% maximum, for the first and second period respectively. While some have argued that the Directive would allow for a higher level of auctioning as long as it is accompanied by full recycling, the issue would almost certainly have to be settled by the European Court of Justice. For the medium and longer term, this would lead to a shift to less carbon-intensive fuels, most likely gas. Such a shift to gas could further increase import dependency on mainly Russian gas, potentially increasing risks associated with security of supply. The effects of higher power prices of course could be offset by the revenue recycling, depending on the exact rules for recycling.[15]

b) Reducing the CO_2 allowance price has sometimes been mentioned as a possible measure. This could be done for example by relaxing the overall cap of the covered sector or by encouraging the influx of CDM and JI credits into the EU ETS as a result of the Linking Directive. Relaxing the overall cap implies that emissions reductions will have to be undertaken by other sectors – given the Kyoto Protocol's targets – which is likely to increase overall compliance costs for member states, as low-cost reduction options in the covered sector would be omitted. On the other hand, compensating for the relaxing of the overall cap by member states using the Kyoto Protocol's project mechanisms (i.e. CDM/JI credits) is likely to run against current political, technical and other constraints related to those mechanisms. While the EU can attempt to address them, it will need the cooperation of all international partners in the UNFCCC. Encouraging the influx of CDM/JI credits through the Linking Directive faces the same difficulties. The purchase of AAUs by member states, as an alternative, might be politically difficult unless such AAUs are 'greened' through for example the Green Investment Scheme (GIS), which earmarks revenues from the sale of excess AAUs for projects that reduce greenhouse gas emissions. Ultimately, the use of flexible mechanisms finds its limit in the Kyoto Protocol's and the Linking Directive's supplementary provisions.

[15] The effect on power prices remains uncertain. In theory, 100 percent free allocation, benchmarking or auctioning would lead to the same level of CO_2 cost pass through and, hence, similar power prices. In practice, however, the level of pass through could depend on the allocation method.

c) Another option that has been discussed to limit the CO_2 price is to set a maximum price on an EU allowance, but this is not a viable option for the second period (2008-12) as the current Directive does not allow the setting of a maximum price.[16] Moreover, setting a maximum price risks missing the environmental objective of the covered sector with the consequence that reductions would have to be achieved by other sectors, which would increase overall compliance costs. Another downside of setting a maximum price is that it would reduce liquidity and therefore may actually undermine trading activity and so could be seen as 'managing a market'. There are equally institutional issues associated with such a price cap, notably who decides on it and under what procedure.

d) A possible measure that has been discussed is a system of *allocation* of emissions allowances based on *relative quota or a Performance Standard Rate* (PSR) such as an energy/carbon efficiency benchmark per unit of output. A benchmark could be multiplied by the expected output to determine the allowance *ex-ante* or alternatively, multiplied by the realised output, i.e. with *ex-post* adjustment. The major advantages are that it would virtually avoid windfall profits, reward carbon efficiency and be popular with industry since it is less restrictive of economic growth. There are a number of shortcomings, however: lower economic efficiency, less environmental certainty and higher information and other transaction costs. The principal issue is that a relative quota system does not fit into the present Directive (and the political consensus) and hence could not be implemented before 2012.

e) A *regulatory measure* would be to restrict power price increases – either at the wholesale or retail level – to avoid passing through of opportunity costs. Instead power companies would only be allowed to pass through the real, average costs of CO_2 allowances. While such a mechanism would restrict power price increases beyond average costs and eliminate windfall profits, it would radically alter the incentive structure of the ETS. Such a proposal would counter the ETS' intention to set a price for CO_2 and include this into the marginal cost of production including power. There is no reason to treat carbon separately from other cost factors, especially costs stemming from the abatement of NOx, SO_2 or other pollutants. This raises the fundamental question on how to reconcile such an approach with one of the key objectives of the internal energy market, namely providing undistorted price signals based on full marginal costs, such as fuel, labour and environmental costs including carbon costs. In essence, this would constitute a move back to a regulated market. Furthermore, regulators have limited, if any instruments at hand to regulate whole sale prices. There are a number of implementation issues although member states could impose some sort of a 'voluntary agreement' between energy-intensive industries and power generators (Sijm et al., 2005: 92). As a result, such regulation would create additional inefficiencies in the power market. Intervention in the power market of that kind is likely to distort production, consumption and as a consequence investment decisions. It would almost certainly increase total power demand as the costs of CO_2 would not be internalised, with higher emissions. *De facto*, it would mean that the power sector would be largely 'sheltered' from the carbon constraint. 'Exempting' the power sector despite the Kyoto commitment would mean that costs of emission reductions are pushed to other sectors in the economy, which would be economically detrimental.

[16] The current penalty price of 40/100 €/tonne, for the first respective second period is not designed as a price cap. Non-compliant installations are required in addition to paying the penalty to surrender the allowance in the following period and are subject to public announcement of their non-compliance ('naming and shaming').

B) Compensation measures

Compensation measures attempt to correct undesirable effects of the EU ETS from a societal perspective. When assessing their relative merits, it is important to assess the potential environmental, economic or social effects against the principal objectives of the ETS, i.e. to reduce CO_2 emissions in a cost-effective way. There are a number of *compensation* measures including government support in the form of tax breaks, other reductions of burdens, government subsidies, re-distributed 'windfall taxes', but also more subtle mechanisms that could work through the ETS. They also raise a number of questions, however.

The fundamental assumption upon which compensation or redistribution rests depends on whether energy-intensive companies choose to cross-subsidise their production by the amount of the compensation they have received – at least in the short-term – or whether they base their investment decisions on opportunity costs, meaning that the revenues are invested where they promise the highest return, i.e. possibly in other regions than the EU. Hence, compensation measures would need to be designed to create incentives for investing in the EU.

Another critical element is where the financial resources for compensation come from and how they are redistributed. If it is the government that compensates, it is likely that revenues will first be collected via a tax on windfall profits, auctioning, or through other measures. Compensation raises many equity issues and internal market issues.

- An option that has been discussed intensively (e.g. in various CEPS Task Forces) is indirect allocation of emissions allowances. In such a system of grandfathering, electricity users receive emissions allowances for free while power generators are responsible for surrendering allowances according to their actual emissions. They would buy their allowances from the energy-intensive sector, for which this would constitute compensation. While this would allow for full pass-through of CO_2 costs (the intended objective of the ETS), reduce possible windfall profits and compensate energy-intensive industries, it raises issues of fairness for the non-covered sector and households remain uncompensated. Including them in such a scheme would, however, increase the complexity of the EU ETS significantly. Furthermore, those energy-intensive sectors that in fact are able to pass through the cost increases due to higher power prices would be compensated twice, reaping in fact windfall profits.

- Another option that has been mentioned is border tax adjustments for costs incurred from procuring CO2 emissions allowances. Such border tax adjustment would do away with leakage and in addition allow EU member states to design the ETS largely free from international competitiveness concerns. Uncertain is still whether such measures are feasible in practice and in political terms, not only vis-à-vis the US but also developing countries that by now are the major competitors of EU energy-intensive industries.

Appendix 2: Improving investment certainty of the ETS

There have been discussions on how to create greater stability and predictability for the covered sectors of the EU ETS. We attempt to review a number of options including allocation-related solutions (e.g. a 14-year guaranteed allocation based on fuel-specific benchmarks in the German NAP I), the alignment of targets with the investment cycle by using for example long-term efficiency targets as a basis for setting a cap for the manufacturing industry, benchmarks and auctioning, or the so-called 'TenYear Rule',[17] long-term indicative targets or a ceiling on the allowance price.[18]

a. The most obvious option is longer allocation periods to ensure predictability and certainty. A critical precondition for longer allocation periods however is that efficiency indicators at installation level are in line with long-term climate change objectives (e.g. fuel-neutral benchmarks).

b. Closely linked are rules for new entry and closures and a possible re-design to add more certainty. This could already be dealt with in NAP phase II. Nevertheless, they run up against the fact that the Directive has foreseen multiple short allocation periods, making it difficult to extend certainty beyond these periods.

c. There is strong interest and support among member states to further analyse and develop benchmarks. In order to do so, there is a need to ensure: i) consistency across member states on both the types of benchmarks (e.g. fuel, technology or product-specific), ii) the metrics to apply (e.g. installed capacity, projected utilisation rates, projected output or best available technology and techniques, and iii) data availability. Given the different approaches used by member states, it is unlikely that EU-wide benchmarks will play a major role in NAP phase II, unless some sectors would opt for such an approach.

d. Long-term efficiency targets for the manufacturing industry, for example based on benchmarks, are another potential way to increase long-term certainty for the sector. The principal item is how such a system could be incorporated into the EU ETS, which operates on absolute caps. Setting relative targets would transform the ETS into a baseline and credit scheme, which is not foreseen under the Directive. Hence, this becomes a topic for the 2006 review. However, nothing would stop member states from basing their allocation to the energy-intensive sectors on long-term efficiency targets.

e. Using auctioning in combination with recycling of revenues has also been proposed as a possible way to create investment incentives as it is thought that it would create a more reliable long-term price signals. The downside is that auctioning would have a negative impact on companies' profits of energy-intensive industries and thereby might lead to change of investment patterns over the longer term. In addition, this would open a 'secondary allocation' debate on how to recycle revenues and raise questions on the mechanisms of auctioning.

f. A so-called 'ten-year rule' (Åhman et al., 2005) has been proposed to balance efficiency considerations, including investment, with perceived issues of fairness. This concept attempts to acknowledge the need both to compensate incumbent installations for sunk costs and not to discriminate against new entrants for reasons of fairness. It can be used for both

[17] Under the Ten-Year Rule (see 3.5), a member state will allocate allowances based on the average of, say, three reference years (e.g. 2000-2002) for 10 years. After ten years, the reference years would be updated on a rolling basis, i.e. from 2000-02 to 2001-03, etc. Hence, there is some compensation for sunk costs but not forever. A new entrant would receive allowances from a reserve according to emission rate benchmarks (to be standardised across the EU member states).

[18] For more details see Egenhofer & Fujiwara (2006), pp. 16-21.

emissions and performance-based allocation. The main criticism has been the risk that insufficient reserves for new entrants would deter new investment.

g. To provide a signal to the power sector, the idea has been proposed to develop long-term indicative targets for the EU as a whole, or, if more appropriate, for the relevant national or regional markets. In order for such an indicative target to serve its purpose, it would require extending them far beyond the short-term allocation periods. This would imply, however, that member states develop energy strategies on how to arrive at the needed reductions. Another issue is the legal nature of such indicative targets. Non-binding targets have very often been of little practical effect, as can be seen from the EU energy efficiency targets in the 1980s, or more recently, from ‘soft’ targets agreed under the Lisbon agenda. In order to be effective, targets could be attached to a revised EU ETS, in much the same way that indicative targets have been formulated in the Annex of the Renewables Directive. Long-term certainty would be helped by a common EU energy policy.

h. Another proposal has been a ceiling on the allowance price (i.e. price cap) which would provide long-term certainty as the upper limit of the allowance price and hence, the investment incentive is set. This raises however questions both on the environmental effects as reductions would not necessarily be achieved and on the functioning of the allowance market as it could reduce liquidity. Moreover, if the ceiling is too low, the incentive for reductions would be equally low. In fact such a system would become in effect a carbon tax. There is high risk that governments would give in to pressure from industry for a low ceiling. In any case, setting the ceiling is a highly politicised act and this by itself could increase uncertainty again. One of the issues to be settled is to how and by whom the price cap would be decided.

Appendix 3: List of participants to the ECP EU ETS Review Seminar, 5 April 2006, Brussels

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The ECP is a joint initiative of the Climate Policy Research Programme (Clipore) of the Swedish Foundation for Strategic Environmental Research (Mistra) in Stockholm and the Centre for European Policy Studies (CEPS) in Brussels. Established in 2005, the ECP aims to facilitate interaction within the policy research community, mainly but not exclusively in Europe. Its working methods consist of bringing together a select number of policy-makers, negotiators and experts to vigorously debate key topics in the area of international climate change policy and to widely disseminate its conclusions. The ECP actively seeks dialogue with policy-makers and other stakeholders while being dedicated to academic excellence, unqualified independence and policy relevance. The ECP is governed by a steering group, drawn from government and academia. For further information, see: http://www.ceps.be/Article.php?article_id=484 .

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