Powering the energy debate

Ofgem Discussion Day

ofgem

Emissions trading: impacts on electricity consumers

Tuesday 22 February 2005

A summary report by Professor Paul Ekins,
Policy Studies Institute

OFGEM DISCUSSION DAY ON
'EMISSIONS TRADING: IMPACTS ON ELECTRICITY CONSUMERS'

A REPORT BY
Professor Paul Ekins
Policy Studies Institute

SUMMARY

This paper on the EU Emissions Trading Scheme (EU ETS) explores questions including: what the price of emission allowances might be; how the generators might respond to this price; to what extent generators and suppliers will pass through any allowance prices and cost increases; and what will be the subsequent impacts on consumers, both businesses and households.

The EU ETS involves about 10,000 installations in the energy and energy-intensive industrial sectors, which are together responsible for about 50% of EU carbon dioxide emissions. Emission allowances have been allocated in EU Member States on the basis of National Allocation Plans (NAPs). The first Phase of the scheme runs from 2005-07.

The price of emission allowances depends on a number factors, including the initial allocation, international linkages outside the EU, economic growth, the treatment of new entrants, and the cost of abatement. Typical estimates of the price of emission allowances in the paper are €5-10/tCO_2 over 2005-07, and €10-15/tCO_2 from 2008-12. However, it should be noted that prices are very volatile. At the time of the seminar they were €8/tCO_2 but by the end of June 2005 they had risen to €23/tCO_2. They may well go back down again.

The EU ETS will result in both gains and losses for companies. Net gainers will be those firms which have low emissions relative to their initial allocation, low costs of abatement, an ability to pass on cost increases to their consumers and low exposure to the power generation sector. Net losers will display opposite characteristics.

The power generation sector is likely to pass on most or all the opportunity cost represented by the price of emission allowances. This would result in it making perhaps substantial 'windfall profits'. The likely rise in electricity prices (4% for households, 10% for large industry) is the most significant indirect effect of the EU ETS on other sectors. Despite this rise, other sectors in the EU ETS are likely to have increased profitability because of the EU ETS, because of their ability to increase their prices to reflect the price of the allowances which they have been sector. In contrast, the aluminium sector, which is outside the EU ETS, is likely to experience reduced profitability because of the rise in electricity prices.

The 4% and 10% increases in electricity prices for households and business that seem likely from the EU ETS will not have a major impact on most households and firms. However, this will not be the case for energy-intensive firms, especially those outside the EU ETS. It is also not likely to be the case for fuel-poor households, especially when this impact is added to those from the Renewables Obligation and the Energy Efficiency Commitment.

In addition to costs, effects on competitiveness depend of exposure to competition from non-EU firms, and perhaps on differences in implementing the EU ETS within the EU. Competitiveness effects generally are likely to be small, but could be significant in some sectors, especially aluminium. Concerns about intra-EU market distortions from the EU ETS could be removed by allowing a greater role to the auctioning of emission allowances. Greater international buy-in for the need for emissions reductions would alleviate concerns about extra-EU competitiveness and trade effects, and about the displacement of GHG emissions.

1. INTRODUCTION

- The purpose of the Ofgem Discussion Day was to explore, in relation to the EU Emissions Trading Scheme, which became operational on January 1st 2005: what the price of emission allowances might be; how the generators might respond to this price, and the scheme more generally, in operational terms; to what extent generators and suppliers would pass through any allowance prices and cost increases; and what would be the subsequent impacts on consumers, both businesses and households.

The European Union Emissions Trading Scheme (EU ETS, or just ETS hereafter) became operational on January 1st 2005. It is the principal EU-wide instrument through which the countries of the EU intend to constrain their emissions of greenhouse gases (GHGs), the most important of which is carbon dioxide (CO_2), so that they may achieve their GHG reduction commitments under the Kyoto Protocol of the Framework Convention on Climate Change. While there has been some experience with emissions trading to date (notably in the United States with emissions of SO2 and NOx), the EU ETS is easily the largest and most ambitious such scheme to have come into existence. Its operation and impacts will be keenly watched worldwide in the context of growing political concern about climate change, but also of concern about the potential economic impacts of seeking to constrain the emissions that are causing it.

The EU ETS is briefly described in the next section. The purpose of the Discussion Day on the issue, convened by Ofgem, was to identify the factors arising from the EU ETS which might influence electricity prices, and to explore both how markets might respond to these factors and the consequent effects on consumers. The key questions for the day (Moselle 2005) were:

- What will the allowance price be, taking into account such factors as the marginal abatement cost curve, the overall availability of allowances, both through the EU allocations and extra-EU developments, and how the market is developing?
- How will operators respond, in terms of generation patterns, fuel switching, investment decisions and attention given to allowance, in relation to other, costs?
- How will generators and suppliers act, especially in relation to passing through the costs of allowances and sharing them between customers, recognising the different market circumstances of different generators?
- What would be impacts on consumers (small, medium and large businesses and households), in the context of other price changes and other sustainability-related policies, and was the EU ETS time-scale long enough to trigger significant investment responses?

This report highlights the main issues related to these and other relevant questions, that were raised both in the presentations and the discussions which followed them, drawing on both the presentations and a limited number of other sources which are either relevant to or fed directly into the presentations and discussions (see Annex 1). The sources cited do not amount to a comprehensive survey of the area, but they and the presentations do cover the main relevant issues.

2. BRIEF DESCRIPTION OF THE EU ETS

- The EU ETS involves about 10,000 installations in the energy and energy-intensive industrial sectors, which are together responsible for about 50% of EU carbon dioxide emissions.
- Emission allowances have been allocated on the basis of National Allocation Plans (NAPs). The first Phase of the scheme runs from 2005-07.

The political decision to establish the EU ETS was taken by the EU in October 2003 with the passing of Directive 2003/87 (EC 2003). The decision resulted from a policy desire to implement at the European level an instrument, which was both cost-effective and operated in a similar way across the whole EU market, to reduce emissions of carbon dioxide and potentially other greenhouse gases, both to comply with the EU's commitments to 2012 under the Kyoto Protocol and to achieve further emission reductions thereafter.

The first Phase of the ETS will run from 2005-2007, and Phase 2 will coincide with the commitment period of the Kyoto Protocol, 2008-2012. Subsequent phases will be of five-years duration. Phase 2 will include Bulgaria and Romania if they have joined the EU by the time it starts.

The ETS applies to installations throughout the 25 Member States of the EU which engage in the following activities and are above a specified size: combustion installations (most importantly for power generation, but excluding municipal and hazardous waste incineration), mineral oil refineries, coke ovens, steel manufacturing, and production of cement, lime, glass and glass fibre, ceramics and pulp and paper. It has been estimated that the ETS will apply to 9,200 (Enviros 2004) or 12,000 installations (RFF 2004) that are responsible for about 46% of EU carbon dioxide emissions. The Directive also provides for other sectors (perhaps chemicals, aluminium and aviation) and gases to be included in Phase 2 at the discretion of Member States.

Under the ETS, through National Allocation Plans (NAPs), each Member State (MS) is obliged to allocate to eligible installations in the participating sectors under its jurisdiction a certain number of emissions permits or allowances, which in Phase 1 will apply only to emissions of carbon dioxide, but in Phase 2 may apply to other greenhouse gases as well. The NAPs must be agreed by the European Commission and will be expected to contribute to the MS's achievement of its target under the Kyoto Protocol, and therefore the achievement of the target for the EU as a whole. With some NAPs still to be finalised, it is expected that allowances will total around 2,800 $MtCO_2$/year in Phase 1, with five countries (Germany, Italy, Poland, Spain and UK) being responsible for about 68% of this. For Phase 1 the allocation of allowances to the power generation sector is also expected to be about two thirds of the total (Enviros 2004, pp.7-8). In the UK Phase 1 of the EU ETS will involve about 350 companies (Oxera 2004, p.5).

Eligible installations must show at the end of each year that they have allowances that cover their actual emissions for the year, either from their initial allocation or through purchase from other installations, through the developing carbon trading market. Allowances may also be generated through the flexible mechanisms of the Kyoto Protocol, the Clean Development Mechanism (CDM) in Phase 1, and both this and Joint Implementation (JI), in Phase 2. Some allowances may be reserved for new entrants. Up to 5% of allowances may be auctioned or otherwise sold in Phase 1, and 10% in Phase

2, but the rest must be allocated free of charge. Banking and borrowing of allowances are allowed between years within Phases and, to a limited extent and under strict conditions, between Phases 1 and 2. Failure to present enough allowances to cover emissions at the end of one year will incur a fine and roll the emissions reduction commitment over to the following year, although given substantially free allocation and the timetable of granting allowances and compliance, this is unlikely to be an issue except perhaps between phases.

3. INFLUENCES ON THE PRICE OF ALLOWANCES

- The price of emission allowances depends on a number factors, including the initial allocation, international linkages outside the EU, economic growth, the treatment of new entrants, and the cost of abatement
- Typical estimates of the price of emission allowances are €5-10/tCO_2 over 2005-07, and €10-15/tCO_2 from 2008-12

For the participating sectors in the EU ETS carbon emission allowances have now become a tradable commodity. Like any other commodity the most important influence on the price of allowances will be the balance between supply and demand. In this case the balance will be determined by:

- The initial allocation of allowances in the NAPs
- The extra allowances that come into the system through CDM and JI
- The growth of the sectors in the ETS
- The new entrants into the sectors (and what is done with the proportion of new entrants' reserves that is not taken up)
- The treatment of installations that cease production
- The opportunities for, and costs of, emissions abatement

It is generally perceived that the Phase 1 allocation of allowances has been relatively lenient. Enviros (2004, p.5) estimates that Phase 1 allocations will allow installations to increase their emissions by 5% over baseline emissions (in 2000/2001), which rises to 11% if new entrants' reserves are included. This suggests that Phase 1 prices will be quite low. However, if ETS sectors are to make a contribution to the overall emissions reductions required by the Kyoto Protocol, Phase 2 allocations will need to be significantly below those in Phase 1. This would put upward pressure on prices in 2008-2012.

While the ETS itself only includes installations in the EU, through the international mechanisms CDM and JI the price of allowances in the ETS will be influenced, perhaps significantly, by events outside the EU. On the supply side, it is not yet clear how many certified emission reductions or emission reduction units will become available through CDM and JI projects, or the mechanism through which, and extent to which, Russia in particular will be able to trade the potentially large amount of GHG emissions assigned to it under the Kyoto Protocol which may be surplus to its own requirements.

On the demand side, CDM, JI and Russian emission reductions will be sought by signatories to the Kyoto Protocol outside the EU, such as Canada and Japan, in order to help them meet their Kyoto targets, and by governments of the EU, in order to offset their domestic emissions (such as from households, transport and commerce) that are outside the ETS. There is also the position of the United States to consider. While it seems unlikely that the US as a whole will participate formally in the Kyoto Protocol

arrangements, some States may be associated with it in some way, taking on voluntary emission reductions. They may also add to the market demand for international emission reductions. There is thus considerable uncertainty about how international linkages will affect the price of ETS allowances.

There are similar levels of uncertainty about the cost of carbon abatement. Of crucial importance in this regard is the power generation sector, which as noted above holds about two thirds of allowances in Phase 1. Power generation is different from other sectors in that it can greatly affect its carbon emissions by fuel switching, particularly switching between coal and gas, with the latter having about half the carbon intensity of the former. However, decisions about fuel switching are affected by other considerations in addition to the costs of carbon allowances, most importantly the relative prices of the fuels in question (and it has never been easy to predict such prices), but also the impact of the EU's Large Combustion Plant Directive (which seeks to control emissions of SO_2 and NOx from, especially, coal-fired power stations). Also relevant are decisions about new entry, in particular relating to the allocation (or sale) of emissions allowances. Other things being equal it is likely that new CCGT (combined cycle gas turbine) generating capacity will put pressure on the use of marginal coal plant, and could thereby increase the extent of fuel-switching. However, whether or not such capacity is commissioned could be influenced by the terms of its access to allowances.

Other relevant issues include the treatment of closed plant (i.e. the period over which such plant would still be entitled to receive allowances), and the allocation mechanism for the period 2008-2012, in particular whether this will in any way be influenced by behaviour in Phase 1 (for example, there may be incentives for an installation to maintain emissions in Phase 1 if it is believed that this will lead to an increased allocation in Phase 2, when allowance prices might be higher). The view was expressed at the seminar that government has given repeated verbal assurances that Phase 2 allowances will not in any way be influenced by Phase 1 behaviour, but this position has not yet been officially confirmed.

Forward markets for carbon allowances have now existed for about two years, and they seek to take these and other factors into account. Data presented at the seminar (Lane 2005) showed that since May 2003 the allowance price has varied between about €5/tCO_2 (in May 2003) and about €13/tCO2 (in March 2004), and in February 2005 was about €8/tCO_2. By March 24th the price had risen to about €14/tCO_2 (Point Carbon 2005).

Table 3.1 sets out a range of estimates of and assumptions about the prices of carbon allowances in Phases 1 and 2 of the ETS. It is clear that the general view is that prices in Phase 2 will not be lower, and could be considerably higher, than in Phase 1. Judging by the prices at the time of the seminar (€7-8/t CO_2), the ICF Low estimate now seems too low for Phase 1, and the Low estimate for Phase 2 also seems out of line with the other views shown. The most recent estimate in the Table, Enviros (2005), would suggest that prices in the two Phases will tend towards the mid-high parts of the range of the earlier estimates, rather than the low end. In this light the use of an assumed allowance price of €10/t CO_2 by Reinaud (2004), and €5/t CO_2 (2005-07), €10/t CO_2 (2008-2012) and €25/t CO_2 (after 2012) by OXERA (2004, p.17) would all seem reasonable, although €5/t CO_2 for Phase 1 now seems at the lower end of the likely range.

Table 3.1 Estimates of and Assumptions about the Prices of Carbon Allowances, 2005-2012, from Different Studies, €/tCO2

Study	Phase 1: 2005-2007	Phase 2: 2008-2012
ICF (2003)		
Low	2	4
Central	5	10
High	10	20
Ilex (2003a)		
Low	5-7	5-7
High	15-18	19-25
Carbon Trust		
Low	5	5
Mid	10	10
High	15	25
Enviros (2005)	6-20 (with volatility)	10-25

Sources: ICF (2003), Ilex (2003a), Carbon Trust cited in OXERA (2004, pp.16-17)

4. THE IMPACTS OF ALLOWANCE PRICES ON EU ETS PARTICIPANTS: WINNERS AND LOSERS FROM THE ETS

- The EU ETS will result in both gains and losses for companies. Net gainers will be those firms which have low emissions relative to their initial allocation, low costs of abatement, an ability to pass on cost increases to their consumers and low exposure to the power generation sector. Net losers will display opposite characteristics.

The essential institutional innovation of the EU ETS is that, for the first time, it makes the emission of carbon dioxide (and in Phase 2 potentially of other greenhouse gases as well) a liability for the ETS installations. To accompany each tonne of emissions, an installation will have to present an allowance which, in the absence of the emission, it could have sold. This means that every tonne of carbon dioxide emissions now has an opportunity cost to ETS installations, which is not changed by the fact that the sectors have (in Phases 1 and 2) been largely or wholly given the emission allowances free of charge. Effectively the price of the emission allowance is now part of the marginal cost of each installation's production. Economic theory suggests that prices are set according to the marginal firm's marginal costs. According to this theory, which assumes that firms will seek to maximise their profits, it would be expected that firms will pass on the cost of the emission allowance in the prices that they charge consumers for their goods and services. In practice, firms that are exposed to international competition from producers operating outside the EU may not be able to pass on to their consumers the full cost of carbon allowances, and may have to absorb (some part of) it themselves, perhaps affecting their profitability and therefore competitiveness. For some non-EU producers there may be as yet no opportunity cost of GHG emissions, although it should be remembered that producers in other countries that are signatories to the Kyoto Protocol or whose governments are undertaking voluntary carbon-reduction measures may be subject to other carbon control measures that increase their costs. The potential effect of the EU ETS on competitiveness, and the issue of the possible allowance price pass-through to consumers, are discussed in more detail below.

The overall impact of the cost of emission allowances on a firm's costs will come from a number of different sources, both direct (from the cost of emission allowances to the firm) and indirect (from the impact of this cost on the prices of other products, including electricity) and is not straightforward to compute. First, however, it should be remembered that, in the UK at least, installations outside the power generation sector are being given their projected allowances from business-as-usual (BAU) activity, in relation to the sector average, free of charge. The installation whose activity evolves according to this average projection will therefore face no direct cost increase from the EU ETS. To the extent that the relevant firm can increase its prices to cover the marginal cost of emission allowances, it will gain from the emission allowances that have been freely allocated to it.

It is to be expected that some firms will be able to abate emissions at a lower cost than the price of the carbon allowance (Ekins 2005 presents evidence to show that the opportunities for low- or no-cost carbon abatement in UK energy-intensive sectors with Climate Change Agreements would seem to be substantial). These firms will be able to sell the emissions allowances (which they have been given free of charge) that they no longer need, and so will be made better off by the ETS. Similarly, firms whose activities evolve in such a way that their emissions are lower than the average projected under BAU will have excess emission allowances to sell, and so will be made better off by the ETS.

Firms that have higher emissions than the average projections under BAU (perhaps because they grow faster than projected), and that have abatement costs higher than the emission allowance price, will seek to buy allowances to supplement their initial allocation (clearly the existence of an allowance market depends on the existence of both buyers and sellers of allowances). These firms will experience a direct cost from the ETS.

As noted above, firms may seek to pass through in their prices to consumers the cost of allowances, whether or not they have actually incurred a direct cost increase because of them (it is this possibility that has led to speculation about such firms deriving 'windfall profits' from the ETS). This is the indirect effect of the ETS on consumers. In the UK this effect is likely to be easily most important in relation to power generation, because electricity is demanded by practically all consumers, and because, in the UK at least, the international competition for electricity is relatively limited, so that it may be easier for the power generation sector to pass through the cost of emission allowances in prices than for other sectors to do so. Power generation is also a key sector in the ETS because it has been allocated the majority of emission allowances in the ETS, and, in the UK, because it is the only sector whose initial emission allocation is below its BAU emission projections. For all these reasons, the impacts of the ETS on the power generation sector is discussed in more detail in the next section.

Firms' marginal costs of carbon abatement will vary over time. Up to a certain level (Enviros 2004, p.10, estimates 200 $MtCO_2$ across the EU), the short-run marginal costs (i.e. the abatement opportunities that are available to firms without undertaking major investments) are likely to be relatively low (Enviros 2004, p.10, estimates below €20/tCO_2). Once these abatement opportunities have been taken up, the only way to reduce emissions may be through relatively expensive cuts in production, which could increase short-run abatement costs substantially.

To the extent that firms make major investments in abatement (for example, building gas-fired power stations to substitute for coal-fired plant), abatement costs may rise much less steeply than suggested by the short-run abatement cost curve. However, firms will only make major investments if they are sufficiently assured of a long-run return. Estimates of the likelihood that the scheme will continue and the expected price of allowances are key factors in any calculation of the long-term return from carbon abatement investments. At present the details of the EU ETS beyond 2012, in particular the number of emission allowances that it will sanction, are very uncertain. This uncertainty will inevitably inhibit investments in emission abatement, the profitability of which is largely influenced by the long-term price of allowances.

Table 4.1: Characteristics of Firms Determining the Impact of the ETS

Firm	1. Emissions in relation to BAU 2. Cost of abatement in relation to allowance price	Implied allowance trading activity	Ability to increase price to reflect MOC of allowances	Extent of cost pass-through from or exposure to power generation sector	Likely winner/ loser from ETS
Firm A	1. Lower 2. Lower	Seller	High	Low	Winner
Firm B	1. Higher 2. Higher	Buyer	Low	High	Loser

Table 4.1 sets out the situation for two firms at different ends of the ETS winner-loser spectrum. Firm A, which has lower emissions than under BAU average projections, lower abatement costs than the allowance price, an ability to increase its prices to reflect the marginal opportunity cost (MOC) of allowances and low exposure to cost pass-through from power generation will be a seller of allowances and a likely winner from the ETS. Firm B, with opposite characteristics across these dimensions, will need to buy allowances and will be a likely loser. Most firms, with a mixture of these characteristics, will fall somewhere between these two extremes.

5. THE IMPACTS OF THE EU ETS ON THE POWER GENERATION SECTOR

- The power generation sector is likely to pass on most or all the opportunity cost represented by the price of emission allowances. This would result in it making perhaps substantial 'windfall profits'.
- It is not yet clear whether the price of emission allowances has yet affected electricity prices.

As noted above, power generation will receive two thirds of allowances in Phase 1 of the EU ETS, although in the UK the proportion is around 60% (OXERA 2004, p.3).

In work carried out for the Carbon Trust (2004), OXERA (2004, pp.18ff.) has projected the impact of the EU ETS on the profitability of the UK power generation sector, on the basis of its estimated allowance prices in different time periods (€5/tCO_2 in 2005-07, €10/tCO_2 in 2008-2012 and €25/tCO_2 after 2012), and the UK draft NAP put out for consultation by the Government in January 2004 (DEFRA 2004a). The estimation has a number of stages:

- Increase in the marginal cost of generation (including all or part of the opportunity cost represented by the allowance price)
- Pass-through of some proportion (for the power generation sector modelled to be 90%) of the allowance cost in the form of a price increase to the wholesale market
- Adjustment to output based on an assumed price elasticity of demand (-0.25)
- Abatement of emissions in response to the price of carbon allowances

Table 5.1 shows OXERA's results of these calculations for the UK power generation sector. The results show a significantly increased profitability for the sector because of the EU ETS: an increase in earnings of 47% in Phase 1, 63% in Phase 2 and 162% in Phase 3, with wholesale electricity prices over the different periods ranging from £25-30/MWh, an 8-31% increase (OXERA 2004, p.21). The increased earnings will be spread unevenly across the sector, with the most carbon-intensive generators benefiting least, and some even ending up as net losers from the scheme.

In some more detailed modelling of the same issue (the details of which cannot be rehearsed here), Ilex (2003b, p.53), on the basis of different allocation schemes to UK generators, before any UK NAP had been announced, reached a broadly similar conclusion about the potential for increased profitability of the power generation sector ("Overall the introduction of the EU ETS is largely positive for generators with potential for large windfall gains").

Table 5.1: Impact of the EU ETS on the Profitability of UK Power Generation

EU ETS period	Increase in marginal cost (%)	Increase in price (%)	Change in demand (%)	Change in profitability (%)[1]
2005-07	12	8	-3	47
2008-12	23	15	-6	63
2012-	49	31	-12	162

[1] Measured as earnings before interest, taxes, depreciation and amortisation (EBITDA)
Source: OXERA 2004, p.20

OXERA's 8, 15 and 31% modelled price increases amount to increases of 0.18, 0.35 and 0.71p/kWh for its assumed allowances prices of €5, 10 and 25/tCO_2. This is very similar to the results presented by Nind (2005), which showed price increases (for 100% cost pass-through) of just below 0.2, just below 0.4 and about 0.75p/kWh for carbon allowance prices of €5, 10 and 20/tCO_2, although the Nind results were for 2005, whereas OXERA's were for different ETS phases (see Table 5.1), and used the May draft NAP (DEFRA 2004b), although this differed little from the January consultation NAP (DEFRA 2004a).

Ilex 2003b (p.53) found that the EU ETS could increase profits for the power generation sector even if emission allowances were auctioned (a topic that is returned to below), explaining its reasoning thus: "This arises as the market price is set with reference to a marginal generator that may be using more carbon permits per unit of output than an infra-marginal generator." A numerical example that illustrates this is given in Annex 2.

Nind was not able to detect any effect so far of the carbon price on either power prices or generation patterns. However, Global Insight (2005, and Sikorski 2005) believes that there is evidence that allowance prices have already increased power prices in the UK

(though not in other EU countries) by about €3/MWh (Global Insight 2005, p.8). They believe the most important factor in this differential effect is the more competitive market for generation that exists in the UK compared to other EU countries. It remains an open question whether the effect they found is a real differential effect between countries or owes more to the fact that one would expect competitive markets to be more transparent and cost-reflective, and it may therefore be easier to detect such small effects in such markets.

OXERA's 90% cost pass-through is the result of a modelling assumption of profit maximisation in the circumstances of the EU ETS, but other assumptions are possible, including that generators only increase prices to the extent necessary to maintain their pre-EU ETS profitability (when the price increases were calculated to be 0.4%, 5.6% and 12.8% in the three periods, Carbon Trust 2004, p.13); or that generators choose to pass through a lower proportion of the allowance cost in order to increase their market share, rather than maximising profitability. Ilex (2003b, pp.16-17) expressed this possibility thus: "Initial reactions from UK vertically integrated (VI) players appear to suggest that cost pass-through will not occur, but this may reflect 'positioning'. In theory for a VI player that is perfectly hedged between its own supply and demand and has sufficient carbon allocations for their own needs, increasing retail prices to their customers may not appear a sensible strategy. … higher prices may cause some customers to switch … Why lose customers when the cost base has not changed?" Arguments might be different for non-VI generators, but they would still run the risk of losing market share if they increased prices but their competitors did not. There is no consensus about the pass-through issue (and its identification *ex post* is likely to be uncertain). However at the seminar, there was no strong dissenting position from the proposition of full or substantial cost pass-through to the wholesale market, with suppliers perhaps distinguishing between industrial and household customers in pass-through thereafter. Carbon Trust 2004 (p.23) considers that a plausible range of cost pass-through is 30-90%, and Ilex (2003b) modelled 0, 50 and 100% cost pass-through. Perhaps the best that can be done with modelling estimates is to use such ranges for sensitivity analysis.

A number of other market effects are possible as generators consider their market positions in this new situation: suppliers may not pass on the full wholesale price increase to retail consumers; large suppliers may discriminate in the price changes between large and small customers; vertically integrated energy companies may subsidise their supply businesses from their increased generation profits, resulting in lower price increases to final consumers. These issues are complex and subject to great uncertainty. Certainly the seminar arrived at no consensus on them, although the view was expressed (Lane 2005) that independent retailers were likely to be losers from the ETS.

6. THE IMPACTS OF THE EU ETS ON OTHER SECTORS

- The likely rise in electricity prices (4% for households, 10% for large industry) is the most significant indirect effect of the EU ETS on other sectors.
- Despite this rise, other sectors in the EU ETS are likely to have increased profitability because of the EU ETS, because of their ability to increase their prices to reflect the price of the allowances which they have been allocated.
- In contrast, the aluminium sector, which is outside the EU ETS, is likely to experience reduced profitability because of the rise in electricity prices.

The exposure of other sectors to the EU ETS will depend on whether they are participants in it, and the extent to which they are exposed to the price increases (especially in respect of electricity) that may come from it. At the seminar this issue was explicitly (and separately) addressed by Grubb, Owen and Radley (all 2005), and was also the subject of papers which have been reviewed for this report by OXERA (2004), who did the modelling for Carbon Trust (2004), which in turn provided the basis for the Grubb (2005) seminar presentation; and by Reinaud (2004) from the International Energy Agency, who attended the seminar.

Carbon Trust (2004, p.25) has estimated that, assuming 60% pass-through of marginal costs, an allowance price of €10/tCO_2 would translate into fossil fuel price increases as shown in Table 6.1. On this evidence, as Carbon Trust (2004) concludes, it is really only the impact on electricity prices that is likely to be of importance to consumers.

Table 6.1: Estimated Increase in Final Prices of Fuels at a Carbon Allowance Price of €10/tCO_2 (assuming 60% pass-through of marginal costs)

	Large industry	Households
Electricity	10%	4%
Fuel oil	0.9%	0.6%
Petrol and diesel		0.1%
Natural gas	0.2%	0.1%

OXERA (2004) estimated the impacts of the EU ETS on other industrial sectors in the same way as it had estimated its impacts on electricity generation, except that it also needed to take into account the estimated increase in the price of electricity. The sectors studied in OXERA (2004) were cement, pulp and paper (newsprint), iron and steel (cold-rolled flat steel) and aluminium. Of these, only the aluminium sector is not a participant in EU ETS.

Table 6.2 gives the results of OXERA (2004)'s estimate of the impact of the EU ETS on these sectors.

The first obvious point arising from Table 6.2 is that aluminium, the only sector not in the EU ETS, is the only sector that is actually made less profitable by it. All the other sectors have increased profitability because of it. This is because these sectors are able to more than offset their increased costs because of the EU ETS with price increases, but for aluminium the increased prices reduce demand to such an extent that profits decline. For cement and flat steel, the increase in profitability is less in the third period than it was in the second, whereas for newsprint (and electricity, see Table 5.1) the change in profitability increases through the periods. OXERA (2004, p.33) explains this

difference as due to differential exposure to non-EU competition, with those with relatively high exposure doing less well. Other important factors in the results are the assumptions about the price elasticity of demand, which drive the demand reduction due to the increased prices, and the degree of supplier concentration (OXERA 2004, p.37).

Table 6.2: Impact of the EU ETS on the Profitability of Various Industrial Sectors

EU ETS period	Increase in marginal cost (%); % passed on to consumers	Increase in price (%)	Change in demand (%)	Change in profitability (%)[1]
Cement				
2005-07	27 ; 66	6	-4	6
2008-12	55 ; 66	11	-8	13
2012-	136 ; 66	28	-21	7
Newsprint				
2005-07	1 ; 83	0	0	3
2008-12	1 ; 83	1	-1	6
2012-	3 ; 83	2	-2	9
Cold-rolled flat steel				
2005-07	3 ; 67	2	-3	8
2008-12	7 ; 67	3	-5	17
2012-	4 ; 67	8	-13	4
Aluminium				
2005-07	3 ; 66	1	-3	-16
2008-12	5 ; 66	3	-6	-31
2012-	13 ; 102	10	-24	-20

[1] Measured as earnings before interest, taxes, depreciation and amortisation (EBITDA)
Source: OXERA 2004, various tables

Reinaud (2004) provides only limited opportunities for comparison with the above figures, because her analysis is EU-wide, rather than UK focused, because it assumes that sectors must cut their carbon emissions (by 2% or 10%), whereas in UK all sectors apart from power generation have been allocated emission allowances that match average projections of their emissions, and because it limits cost pass-through to that required for the sector to maintain constant profitability margins. The study looks at the same sectors as OXERA (2004). It assumes that a €10/tCO_2 allowance price would increase electricity prices by 11%, which would be fully passed through to consumers. This, and the sectors' own need to reduce emissions, would increase industrial costs. If industrial prices increased to maintain profitability, demand for the affected products would be reduced. This is where the study's quantitative analysis ended, while it was acknowledged that there would be impacts on trade flows which needed further investigation.

Table 6.3 sets out the results of the study. It is interesting that some of the price elasticities used in this study differ markedly from those in OXERA (2004), illustrating the kind of uncertainty in these calculations. Table 6.3 shows that aluminium is the sector likely to experience the greatest cost increase even though, being outside the EU

ETS, it does not have to purchase allowances to make up the 2% shortfall allocated to other sectors.

Table 6.3: Sectoral Implications of the EU ETS with a 2% Shortfall in Allocated Allowances

	Steel (Basic Oxygen)	Steel (Electric Arc)	Cement	Newsprint	Aluminium
Price elasticity					
1. OXERA	-0.62	-0.62	-0.27	-0.5	-0.8
2. Reinaud	-1.56	-1.56	-0.27	-1.88	-0.86
Cost increase (%)	0.7	0.8	1.9	1.1	2.4
Change in demand[1] (%)	-0.7	-1.2	-0.5	-2.1	-2.0

[1] Assuming constant profitability margin
Source: Reinaud 2004, pp.9-10; OXERA 2004, p.14

Owen (2005) made the point that while a 4% electricity price increase for households (see Table 6.1) may not seem much, it comes on top of price increases from the Renewables Obligation and Energy Efficiency Commitment, which together could start to be significant in terms of their impact on low-income consumers, and therefore on fuel poverty. Had some or all of the allowances been auctioned, this would have raised some revenue, which could have been used to offset some of these price increases for those on low incomes. The issue of auctioning is returned to below.

7. THE IMPACTS OF THE EU ETS ON COMPETITIVENESS

- In addition to costs, effects on competitiveness depend on exposure to competition from non-EU firms, and perhaps on differences in implementing the EU ETS within the EU.
- The sector most vulnerable to non-EU competition as a result of the EU ETS seems to be the aluminium sector.
- Intra-EU trade effects from the EU ETS are uncertain, but modelling suggests that they are likely to be small. The most sensitive sectors in the UK seem to be steel and cement, in terms of different decisions about allocation, and steel, food, chemicals and pulp and paper, in addition to aluminium, as a result of electricity price increases.

Cost increases are only one element in the possible impact of the EU ETS on industrial competitiveness. Another important factor, emphasised by Radley (2005) among others, is the extent of global competition in the relevant market, such that producers may be unable to pass on the cost increases in both the domestic and export markets. This factor was taken into account in the OXERA (2004) modelling, and is one reason why the aluminium sector, in a very competitive global market, fared relatively badly from the ETS. Moreover, if it is assumed that the cement sector cannot pass through any cost increase because of global competition, then its profitability too decreases (by1%, 3% and 34% in the three trading periods, OXERA 2004, p.26), rather than being increased by the EU ETS, as shown in Table 6.2.

Carbon Trust (2004) examined two major factors relating to the competitiveness of UK firms: exposure in non-EU markets, and the impacts of differential treatment in the EU ETS within the EU, which might be especially significant given the greater freedom and extent of intra-EU trade. With regard to the former, aluminium smelting seemed to be "the only major UK sector that might suffer significant loss of competitiveness, due to non-EU competition" in the period to 2012 (Carbon Trust 2004, p.25). If aluminium smelting were simply relocated to non-EU countries, then clearly this would result in the displacement of the related carbon emissions, rather than their reduction.

The issue of intra-EU effects is more complex. On the face of it, if there is a single carbon allowance price in the EU ETS, then all EU generators face that price and the price of electricity will increase by the same amount (ignoring any differences in the carbon intensity of the marginal generator in different countries). Carbon Trust (2004, p.27) cites business fears that "different EU countries will implement the EU ETS in different ways and with different stringency of allocation and enforcement", but it should be noted that the first-order result of leniency in these matters would tend to reduce the emission allowance price across the EU, thereby equally benefiting producers in all countries.

However, it is doubtless possible that political interventions and distortions in the market could serve to give advantage to producers in some countries compared to others. There is a feeling in UK industry, on the evidence of different National Allocation Plans (NAPs), that some other EU countries have been excessively generous with their emission allowances, which could adversely affect costs and long-term profit and loss position of UK companies in relation to their EU competitors (Carbon Trust 2004, p.28). However, the modelling in Carbon Trust (2004) suggests that these effects, if they exist, are small. The steel sector is sensitive to both differences in sectoral allocation and electricity cost pass-through, especially as competition may not permit the levels of cost pass-through predicted in Table 6.2. Only the cement sector also seems significantly affected by allocation decisions, while differences in electricity price effects could have a significant effect on the UK food, pulp and paper and chemicals sectors, in addition to aluminium, as already discussed. Carbon Trust (2004, p.29) makes the point that over-generous NAP allocations in Phase 1 of the EU ETS may require more drastic adjustment in Phase 2 as countries have to meet their legally binding Kyoto targets.

8. CONCLUSIONS

- The 4% and 10% increases in electricity prices for households and business that seem likely from the EU ETS will not have a major impact on most households and firms.
- However, this will not be the case for energy-intensive firms, especially those outside the EU ETS, like aluminium.
- It is also not likely to be the case for fuel-poor households, especially when this impact is added to those from the Renewables Obligation and the Energy Efficiency Commitment.
- Competitiveness effects generally are likely to be small, but could be significant in some sectors, especially aluminium.
- Concerns about intra-EU market distortions from the EU ETS could be removed by allowing a greater role to the auctioning of emission allowances.

- Greater international buy-in for the need for emissions reductions would alleviate concerns about extra-EU competitiveness and trade effects, and about the displacement of GHG emissions.

The price of allowances in the EU ETS is still subject to both short and long term uncertainty. While estimates of €5/tCO_2 in Phase 1 seem plausible and in line with the projections in Table 3.1, they now seem to be at the lower end of the likely range. In fact at the time of the seminar February 22nd, the price was €8.5/tCO_2, and by March 24th had risen to about €14/tCO_2 (Point Carbon 2005). Phase 2 estimates of €10/tCO_2 likewise seem plausible at the current time, but also at the low end of the likely range. They could be considerably higher if the Kyoto targets begin to bite. Post-2012 price estimates depend entirely on assumptions made about post-Kyoto emissions agreements.

A €10/tCO_2 allowance price could increase electricity prices by around 10% for industry and 4% for households. For most industries and households such a price increase will not be a major concern, but this will not be true for electricity intensive companies, or for low-income households, once the impacts of the Renewables Obligation and the Energy Efficient Commitment on energy prices are also considered. The combined effect of these energy-saving and emission-reduction policies could have significant implications for fuel poverty, and on the achievement of the Government's fuel poverty targets for 2010 (its abolition for vulnerable households) and 2016 (its complete abolition). If it is true that household energy prices need to rise in order to finance energy-saving and emission-reduction schemes, and to increase the incentive for households to save energy themselves, then arguably more policy attention will need to be given to the implications of this for fuel poverty, if the fuel poverty targets are to be met.

Companies are likely to pass any cost increases from the EU ETS, and the opportunity cost of the allowances themselves, through to consumers, to the extent consistent with profit maximisation (full cost pass-through may be limited by competition and other factors, as discussed above). The analysis presented at the seminar suggested that most sectors would emerge net winners from the EU ETS, with this being especially true for power generation. There is some political risk for the EU ETS here from a public perception that generators are profiting twice from the ETS, being able to sell surplus allowances as well as charge the public for allowances which they were given free of charge in the first place.

As Ilex (2003b, p.17) notes, for prices and consumers the effect of full cost pass-through is the same as if allowances had been auctioned, with the difference that with auctioning the relevant revenues would accrue to the Government rather than the generators and could be used to offset other taxes. It may be that such a perception reinforces any impetus towards auctioning allowances post-2012. Certainly auctioning would reduce the kind of intra-EU market distortions discussed above, and the kind of disadvantages faced by non-vertically integrated retailers and potential disincentives to new entrants noted by Lane (2005). At the seminar there was a sense that auctioning would play a significantly greater role in the EU ETS post-2012 than at present (when it is at most minimal, and is non-existent in some countries).

Impacts on companies' competitiveness will only occur where significant impacts on costs are combined with significant exposure to international market competition, such that costs cannot be passed on in price rises. The most exposed sector discussed in this report is aluminium smelting, which is not yet a participant in the EU ETS, while other

sectors that may be affected are iron and steel, cement, food, pulp and paper and chemicals. The major concern about UK competitiveness effects seems to derive from distortions in intra-EU trading positions arising from differential treatment of sectors in the National Allocation Plans, rather than from non-EU competition. It should also be remembered that aggregate sectoral analyses may conceal significant impacts in sub-sectors or even in particular companies.

Overall, however, there are no grounds at present for thinking that EU ETS will have major negative impacts on EU or UK business relative to foreign competitors. But within Europe care should taken that future emission allocations are certainly not more distorting of competition that those of Phase 1, and greater international buy-in to the need for greenhouse gas emission reduction generally could enable concerns about both climate change (in terms of both emissions reduction and avoidance of displacement of emissions) and competitiveness to be simultaneously addressed.

Paul Ekins
24 June 2005

ANNEX 1
PRESENTATIONS AND REFERENCES TO SOURCES USED IN THIS REPORT

PRESENTATIONS (in order of presentation)

Moselle, B. 2005 'Emissions Trading: Impacts on Electricity Consumers – Outline of Main Issue for the Seminar', Ofgem, London

Turner, G. 2005 'Marginal Abatement Costs and Future Allowance Prices', Enviros Consulting, London

Nind, A. 2005 'Implications of the EU-ETS for the Power Sector and Electricity Prices', Ilex Energy Consulting, Oxford

Grubb, M. 2005 'Price and Competitiveness Implications of the EU ETS: Modeling in the Context of Imperfect markets', Carbon Trust, London

Lane, G. 2005 'A Practitioner's View', Centrica, London

Sikorski, T. 2005 'European Power Prices: Influences on Prices', Global Insight, London

Owen, G. 2005 'The EU-ETS – Impact on Domestic Consumers', Centre for Management under Regulation, University of Warwick

Radley, S. 2005 'Impact on Industrial and Commercial Consumers', Engineering Employers' Federation, London

REFERENCES

Carbon Trust 2004 'The European Emissions Trading Scheme: Implications for Industrial Competitiveness', July, Carbon Trust, London

DEFRA (Department for the Environment, Food and Rural Affairs) 2004a 'Draft UK National Allocation Plan for the EU Emissions Trading Scheme', January, DEFRA London, http//:www.defra.gov.uk/corporate/consult/eu-etsnap/index.htm

DEFRA (Department for the Environment, Food and Rural Affairs) 2004b 'UK National Allocation Plan for the EU Emissions Trading Scheme', May, DEFRA London, http//:www.defra.gov.uk/corporate/consult/euetsnap-stagethree/index.htm

EC (European Commission) 2003 'Directive 2003/87/EC of the European Parliament and of the Council of 13 October establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC', Official Journal of the European Union, L275/32, 25.10.2003

Enviros 2004 'European Emissions Trading Scheme: Executive Briefing Two', August, Enviros Consulting, London

ICF 2003 'EU Power Markets and CO_2 Emissions Trading – A Detailed Analysis of the Competitive Implications of the Proposed EU Emissions Trading Scheme and allowance Allocation on EU Power Markets (2003-2020), ICF Consulting, Fairfax VA

Ilex 2003a 'A Review of Cost-Effectiveness and Carbon Savings Data for the UK Climate Change Programme', December, Ilex Energy Consulting, Oxford

Ilex 2003b 'Implications of the EU ETS for the Power Sector', a report to DTI, DEFRA and OFGEM, September, Ilex Energy Consulting, Oxford

Global Insight 2005 'What Influences Power Prices Across Europe? Background Detail', February, Global Insight, London

Kruger, J. & Pizer, W. 2004 'The EU Emissions Trading Directive: Opportunities and Potential Windfalls', Discussion Paper 04-24, April, Resources for the Future, Washington DC

OXERA 2004 'CO_2 Emissions Trading: How Will It Affect UK Industry?', Report for the Carbon Trust, July, OXERA Consulting, Oxford

Point Carbon 2005 http://www.pointcarbon.com/, consulted March 24th 2005

Reinaud, J. 2004 'Industrial Competitiveness under the European Union Emissions Trading Scheme', December, IEA Information Paper, IEA (International Energy Agency), Paris

ANNEX 2

HOW THE EU ETS COULD INCREASE PROFITS IN THE POWER GENERATION SECTOR EVEN IF EMISSION ALLOWANCES WERE AUCTIONED

The key theoretical insight here is that, in a competitive market, the price of a good is equal to the marginal cost of the marginal producer of that good (i.e. the producer that produces the last unit of the good to be demanded). All other producers, the 'infra-marginal' producers, will have a lower marginal cost, and will therefore make a profit from the price as set by the marginal producer.

Now assume that, in the UK, all electricity is generated by coal and gas-fired power stations. Further assume that the coal stations, the marginal producers, all have a marginal generating cost of £20/MWh, so that the price of electricity is £20/MWh. If gas-fired generators, the infra-marginal producers, have a generating cost of £15/MWh, they will make a profit of £5/MWh.

Now assume that the price of auctioned emission allowances is £10/tCO_2, and that this translates into £10/MWh for carbon-intensive coal, but only £5/MWh for less carbon-intensive gas. Assuming full pass-through of the allowance price, the price of electricity, still set by the coal-fired generator, will rise to £30/MWh, but the costs of the gas-fired generator will only have risen to £20/MWh, so that it now makes a profit of £10/MWh, £5/MWh more than without the EU ETS.

Similar reasoning will show that, if the gas-fired (less carbon-intensive) generator is the marginal producer, then the profitability of the sector will be reduced by the EU ETS.

In reality, of course, profits would be reduced if demand was reduced by the increased electricity price (as is likely), and this and other complexities, such as perhaps markets not being fully competitive, and the marginal plant switching between gas and coal at different times of the day and year, make it very difficult to predict the actual impact on profits of an EU ETS with fully auctioned allowances, but the above example makes clear the possibility of increased profits for the power generation even with fully auctioned permits.