

UK EMISSIONS TRADING FROM 2002–2004: CORPORATE RESPONSES

Malcolm Hill*, Laurie McAulay and Adrian Wilkinson*****

** Professor of Russian and East European Industrial Studies
Loughborough University Business School, Loughborough,
Leicestershire LE11 3TU, United Kingdom,
Tel.: (44) (0) 1509 223102, Fax: (44) (0) 1509 223962,
Email: m.r.hill@lboro.ac.uk*

*** Lecturer in Accounting and Financial Management*

**** Professor of Human Resources Management*

ABSTRACT

The UK was the first country to implement emissions trading as a policy instrument to reduce greenhouse gas emissions across the whole of the economy. The paper therefore commences with a description of the UK Emissions Trading Scheme and then continues with a discussion of incentives for UK companies to engage in emissions trading. It then outlines a case for research of companies' experiences of "direct participation" in the Scheme, and presents results obtained from case studies of a set of companies which are "direct participants". These illustrate the impact of emissions trading on income generation as well as cost savings. The paper then concludes with the observation that emissions trading will take on increased importance with the introduction of the EU Emissions Trading Scheme and the implementation of the Kyoto Protocol in 2005, and that further research is therefore required into energy and carbon costs and their possible influences on facilities location.

THE UK EMISSIONS TRADING SCHEME

Introduction

The UK has an international obligation through its commitments to meet EU obligations to the Kyoto Protocol, to reduce its 1990 baseline greenhouse gas emissions by 12.5 per cent during the 2008–2012 commitment period. In addition to this ambitious internationally agreed target, the UK government has set an even more demanding national objective of a 20 per cent reduction of 1990 baseline CO₂ emissions by 2010 (IEMA, 2001, p. 9). These targets are to be achieved by a number of policy instruments for emissions reductions from "stationary sources" in industry and the residential sector, and "mobile sources" in transport. The particular focus of this paper, however, is on corporate responses to emissions trading for stationary

sources, as the UK was the first country to implement this innovative and market-driven approach to reduce greenhouse gas emissions across the whole of the economy ("Framework for the UK Emissions Trading Scheme", 2001, p. 35).

The UK Emissions Trading Scheme aims to reduce greenhouse gas emissions from energy production, and also from industrial processes and materials. Emissions reductions from energy production are to be achieved from energy-saving procedures and technologies to reduce the quantity of fossil fuel combusted at an installation ("direct emissions"), or the quantity of electricity consumption and consequent emissions required for its generation ("indirect emissions"). Coefficients are used to convert energy consumption to tonnes of CO₂ emitted, namely 0.15 from combustion of 1 MWh of natural gas (IEMA, 2001, p. 53) and 0.43 from fossil fuel combustion to generate 1MWh of electricity (Steen and Vrolijk, 2002). To avoid double counting, electricity generators are not included in the scheme except for savings in on-site electricity consumption or combustion of fuels used for purposes other than electricity generation ("Framework for the UK Emissions Trading Scheme", 2001, p. 35). Direct emissions of specified non-CO₂ greenhouse gases from industrial processes were expected to be reduced by substitution or lower consumption of relevant gases or materials, or the introduction of techniques to reduce their emissions. Standardised conversion factors were used to calculate the CO₂ emission equivalents for non-CO₂ greenhouse gases.

"Direct" participation in the UK Emissions Trading Scheme

Registration

It was intended that the Emissions Trading Scheme would attract a wide range of companies as "direct participants", and interested parties were required to submit documentary evidence of sources of emissions ("source list") for approval and consequent registration by February 2002. Registered direct participants were then entitled to bid from April 2002 for targeted emission reductions over a five year period until 2007, at defined "incentive prices" for emissions reductions. It was the world's first emissions trading scheme across all industrial sectors except for fossil fuels used in electricity generation: the Danish system which had been introduced some fifteen months earlier applied only to the electricity industry, and the allowances were not due to be allocated until 2003. The UK scheme, on the other hand, focused indirectly on emissions reductions from the electricity sector through the meeting of reduction targets for electricity consumption.

Auction

The first round of an auction to establish an "incentive price" for emissions reductions specified incentive monies of some £215M as the maximum total outlay available for the Scheme from the government, and the multiple of total "reduction bids" (in tonnes of CO₂ equivalent) and "auction price" (per tonne of CO₂ equivalent) was not allowed to exceed that sum. At the initial proposed incentive price, however, the multiple far exceeded the maximum planned outlay, and so the price was reduced on a "descending clock" principle to invite a new round of bids at a reduced incentive price. Following several iterations of this process, reconciliation between bids and prices was finally

reached in March 2002, such that the overall ceiling of incentive payments by the Government was not exceeded. Annual allowances over a five year period were then issued ("UK Emissions Trading Scheme: Frequently asked Questions").

Incentives

As outlined above, the incentive price was based on the final auction price per tonne such that the total outlay by the government did not exceed £215M, and an additional requirement was introduced such that no one company could receive more than 20 per cent of the incentive monies. The final incentive price was £53.37 per tonne of CO₂ equivalent, with just over 4M tonnes CO₂ equivalent being accepted as the total of successful bids from 34 "direct participants" ("UK Emissions Trading Scheme: UK emissions trading scheme results...", 2002). Although this incentive price may seem extremely generous at first sight, the annual reductions would be cumulative over the five year period, and the total accumulated emissions would therefore be some three times the annual reductions (or some 12 Mtonnes of CO₂ equivalent) between 2002 and 2007.

This accumulation therefore reduced the incentive figure by a factor of three to some £17.79 per tonne of CO₂ equivalent before tax, or some £12.45 after tax (DEFRA, 2002) but that figure would still appear to be a credible stimulus for emissions reductions to compensate for the "Climate Change Levy", although the incentive was not explicitly stated by government as payment to mitigate Levy charges. The Climate Change Levy had been introduced into the UK business sector (excluding transport and fuel for electricity generation) in April 2001 to reflect the environmental costs of greenhouse gas emissions. That Levy consisted of a supplement of 0.43p/kWh in the case of electricity (i.e. some 15 per cent of the average electricity price at that time), and a supplement of 0.15p/kWh in the case of gas and coal (Steen and Vrolijk, 2002, Vrolijk [ed.], 2002, p. 266) (i.e. some 12 per cent of the average gas price at that time). That rate of levy therefore implied a charge of £10 per tonne of CO₂, assuming the conversion ratio of 0.15 tonnes of CO₂ per MWh for gas (IEMA, 2001; Steen and Vrolijk, 2002) referred to above, and a gas-fired electricity generation efficiency of some 35 per cent.

Furthermore, the incentive price would appear to have been particularly attractive to those companies emitting greenhouse gases from industrial processes having a higher global warming effect than carbon dioxide, as a comparatively small reduction in these emissions could therefore provide large reductions in equivalent CO₂ emissions.

Sanctions

In cases where targets are not met in each commitment year, and a company has not purchased either sufficient allowances (which could be purchased from April 2002) from companies who had over-fulfilled their commitments, or adequate quantities of electricity generated from "renewable" or "high grade combined heat and power (CHP)" sources to cover the shortfall, then a fine may be imposed of £20 per tonne of CO₂ equivalent or twice the mean market price per tonne of CO₂ equivalent, whichever is the highest. The number of allowances in the following year would then be reduced by the shortfall plus a penalty factor of 1.3 ("UK Emissions Trading Scheme;

Frequently Asked Questions"). For companies failing to meet their targets therefore, the purchasing of allowances would be an attractive option, especially if permit prices were far lower than the incentive price.

"Climate Change" participants

At the time of introduction of the Climate Change Levy in April 2001 (see above) "Climate Change Agreements" (sometimes referred to as Climate Change Levy Agreements [CCLAs]) were also made available to companies in designated industrial sectors using specified processes covered by EU Integrated Pollution Prevention and Control (IPPC) regulations. These Agreements facilitated exemptions of up to 80 per cent of the Levy in exchange for commitments to meet agreed targets for energy savings over a ten-year interval. Failure to meet the targets, however, would lead to the loss of the exemption available from the signing of the Agreement, unless allowances were purchased from companies having a surplus. A gateway was also provided to the UK Emissions Trading Scheme for companies with Climate Change Agreements, either indirectly through the trade association co-ordinating the Agreement across an industrial sector, or directly through a company's registration as a "climate change participant" in the Emissions Trading Scheme. This gateway enabled climate change participants to purchase allowances from direct participants, although adjustments had to be made between "relative" targets related to per unit of output which were covered by some Climate Change Agreements, and the "absolute" targets irrespective of volume of output, which were operated by the Emissions Trading Scheme.

CORPORATE RESPONSES TO "DIRECT PARTICIPATION"

Introduction

Compared to the Climate Change Levy which was criticised for having an adverse effect on UK manufacturing competitiveness through increased energy prices, and Climate Change Agreements which were criticised for applying only to certain sectors (mainly energy intensive industries having processes covered by IPPC regulation) (IEMA, 2001, pp. 15, 16; Ananova, 2001; EEF, 2002), emissions trading was given a relatively warm welcome from industry and commerce (ETG, 2000). This was probably because emissions trading provided an opportunity for energy efficient companies to sell unused emission allowances to less efficient over-emitting companies who might otherwise incur a financial penalty, and also because many of the elements of the system were based on recommendations made earlier by industry through the Advisory Committee on Business and the Environment (ACBE) and the Emissions Trading Group (ETG). These recommendations included the introduction of financial incentives for successful achievement of reduction targets by direct participants, and voluntary participation in the scheme (ACBE, 1998, pp. 11–15; ETG, 1999).

The response to the scheme was not overwhelming, however, as only 34 companies participated directly, including only seventeen manufacturing companies. In addition, nine (including one manufacturer) of the forty seven registered companies did not take part in the subsequent auction, and a further four (also including one manufacturer, who informed the authors that they preferred to concentrate on the meeting of their Climate Change Agreements) withdrew during the bidding process (ENDS, 2002).

Research Questions

In view of this apparently low response rate of the British corporate sector to direct participation in the UK Emissions Trading Scheme, it was considered to be important by the authors to assess the motivations of those companies which had registered for the Scheme. This assessment would include an evaluation of the importance of emissions trading to the company of the three topics specified by DEFRA as influencing companies' direct participation in the scheme, namely a response to financial incentives obtainable for the meeting of agreed targets for emission reductions and associated cost reduction through improved energy efficiency; an opportunity for "learning by doing" in advance of the opening up of emissions markets; and an opportunity to enhance company reputation through evaluated environmental performance ("UK Emissions Trading Scheme: Frequently Asked Questions"). The first set of research questions (see section 1, Table 1) were therefore designed to identify company objectives to be met from participation in the Scheme, and those objectives were placed in the context of levels of carbon dioxide emissions from the company and its targets through any climate change agreements.

It was expected by the authors, however, that before registration as participants in the Scheme, companies would have to make major decisions based on estimates of investment and process costs for emission reductions, and prices of allowances and incentives, as well as fines for non achievement of voluntary targets. It was

Table 1: Topics covered in Structured Interviews

1. Company Objectives:

- (a) reasons for the organization's choice to register for the UK's Emission Trading Scheme;
- (b) quantity of agreed carbon dioxide reduction by the organization;
- (c) percentage of the organization's total carbon reduction accounted for by agreed reductions through the Emissions Trading Scheme;
- (d) whether the organization has also signed a Climate Change Agreement, and if so, the reasons for the signing of the Agreement and the quantity of carbon dioxide to be reduced;

2. Operational Decisions and Process Costs:

- (a) methods used by the company to reduce carbon dioxide emissions
- (b) methods used for estimation of the expected price of a tonne of carbon dioxide equivalent and associated price uncertainties;
- (c) methods used by the company to estimate the costs for reducing the tonnages of carbon dioxide equivalent;

3. International Issues:

- (a) whether major differences between the British system of emissions trading and EU proposals were seen as problematic;
 - (b) whether the organization intended to engage in global emissions trading;
 - (c) whether the organization was re-evaluating its strategy for global location of facilities and international technology transfer as a result of opportunities presented through Joint Implementation and the Clean Development Mechanism.
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consequently considered important by the authors to investigate the methods used by companies to reduce carbon dioxide emissions, and whether they assessed the various risks, costs and income streams associated with emissions trading (see section 2, Table 1). Finally, it was also considered important to assess the perceived impact of major international developments on UK companies. These included the then anticipated EU 2003 Directive on emissions trading, and "flexibility mechanisms" available through the Kyoto Protocol from 2008 (see section 3, Table 1).

Research Methodology

At the time of commencing this research a report was being prepared for publication by the Climate Change and Strategy Group of Enviro Consulting Ltd., based on responses to postal questionnaires from two target groups, namely the 34 direct participants in the UK Emissions Trading System and a sample of 34 non-participants. For this particular research, however, the present authors decided to gather data on the practice of emissions trading in UK companies by structured interviews during 2002 and 2003, with executives from a set of five organizations which had already commenced direct participation in the UK's Emissions Trading Scheme. Although case studies are usually smaller in number than samples using other methodologies because of the time involved in establishing contacts and arranging and conducting interviews, structured interviews were considered to provide the best means of obtaining the degree of detail required in this research. In addition, these case study interviews were supplemented by discussions with governmental and other industrial specialists as the research progressed.

Interviewees and Data

The job title and responsibility of the interviewees was expected to differ from company to company, but they were all expected to include those executives responsible for energy policy and savings. In addition, although information obtained during the structured interviews was expected to vary with the particular case depending upon the size of the organization and its degree of international orientation, it was considered important to focus discussions around the research questions listed in Table 1.

Selection of Companies

As the selection of the organizations to be studied would clearly exert a significant influence on the results to be obtained from this research, care was taken in the selection process. It was decided to divide the 34 original direct participants in the UK's Emissions Trading Scheme into three groups according to the quantities of their emission reduction targets reported by ENDS (2002), and to select case study companies from each of these categories as follows.

Seven organizations (or 20 per cent of the total direct participants) accounting for some 80 per cent of the total targeted emission reductions.

All of these organizations were from the chemicals and energy sectors and six of them were emitters of greenhouse gases having a far higher radiative forcing effect than CO₂ such as methane (CH₄), nitrous oxide (NO₂) or hexafluorocarbons (HFCs), where

major reductions could be obtained in tonnes of CO₂ equivalents from a comparatively minor absolute reduction in greenhouse gas emissions. The experiences of several of these companies had already been discussed in various reports (for example BPAmoco, 1999; ENDS, 2002; Nicholls, 2003), and consequently it was decided to select only one organization from this category.

A further group of seven organizations (or an additional 20 per cent of the total direct participants) accounting for a further 17 per cent of emission reductions

These organizations were also high emitters of greenhouse gases, but less intensive emitters than those in category (a) above. This category included two retailing companies which emitted HFCs, and five companies which carried out operations having high levels of CO₂ emissions. It was decided to select two companies from this category.

A further group of 20 manufacturing and service organizations (or almost 60 per cent of the total direct participants) which collectively accounted for some 3 per cent of total emission reductions

There was a strong case for focusing on this latter group of organizations in the manufacturing and service sectors, as they were more numerous than the other two categories, and also included a more diverse range of industries. Furthermore, as they included only one company having emissions of HFCs, the greenhouse gas reductions in the remaining nineteen companies were likely to be achieved by lower direct and indirect CO₂ emissions through “good housekeeping” and energy saving (Felgate, 2003), rather than relying on major investments in process innovations. Two organizations were chosen from this category including one manufacturing company and one organization from the service sector.

The five organizations finally chosen included a university, three manufacturing organizations including two from the engineering sector and one materials processor, and an electricity utility. Each organization was engaged in the reduction of CO₂ emissions through energy savings in fuel or electricity consumption in their operations, and their targeted reductions by the end of the five year period trading varied from between 5 per cent and 22 per cent of their baseline emissions. A summary of the results obtained from carrying out structured interviews in the selected set of organizations is provided below in the next section of this paper.

INFORMATION FROM THE INTERVIEWS

Company Objectives

Financial benefits

A major benefit from direct participation in the Emissions Trading Scheme perceived by all of the participants in this research was the incentive income to be gained from meeting targets for emissions reductions. The incentive income of £12.45 per tonne of CO₂ after tax was considered to provide significant compensation (depending on mitigation costs) for the Climate Change Levy (assumed to be a rate of £10 per tonne of CO₂) and was also apparently higher than the cost savings available through Climate Change Levy Agreements (i.e. £8 per tonne of CO₂ assuming the maximum

of 80 per cent refund at an implied Levy rate of £10 per tonne of CO₂). Furthermore, even if the targets could not be met through energy saving procedures and investment, allowances were initially available through the Scheme at the rate of £5.33 per tonne of CO₂, which was far lower than the penalty cost of £20 per tonne.

In addition, those companies which had Climate Change Agreements and had also registered with the Emissions Trading Scheme as climate change participants, could transfer excess allowances through the two systems using a "gateway" to convert "relative" targets based on emissions reductions per unit volume of output, to "absolute" targets. This procedure provided a source of allowances for companies not otherwise likely to meet their Climate Change Agreement targets, and thereby lose their Levy refund.

Direct participation in the emissions trading scheme had also acted as a catalyst to address energy savings in all of the organizations interviewed. They all stood to gain long-term energy savings from the achievement of emission reduction targets, and four of the five organizations should also obtain major long term cost savings per unit of output.

"Learning by doing"

The second advantage reported by all of the participants in this research was that of "learning by doing" which should be of further assistance as they, or organizations within the same corporate group, have plant or processes likely to be included in the EU Emissions Trading Scheme. Furthermore, as a consequence of their international operations, such learning by doing would also be useful for four of the five organizations participating in this survey, as they may wish to participate in global emissions trading, Joint Implementation, or the Clean Development Mechanism following the implementation of the Kyoto Protocol.

Public perception

The third advantage reported by all of the participants in this research related to the advantages from being seen as an environmentally aware organization by both the public and shareholders alike. This was deemed to be particularly important to those organizations which set targets for that activity.

Operational Decisions and Processing Costs

Energy Savings and Income Generation

Four of the five companies included in this research were achieving their targets by energy savings through reductions in the use of natural gas, and all five companies were achieving savings in the purchase of electricity. As the operational procedures and investments introduced to achieve such savings appeared to be successful, such operational decisions were viewed not only as "cost savers" through increased energy efficiencies, but also as "income generators" through the consequent receipt of incentive payments for emissions reductions and the potential sale of emissions allowances.

Perceptions of Risk

The Emissions Trading Scheme provided an incentive for all of the organizations interviewed in this research to pay some attention to risk assessment of incentive

payment prices, allowance prices, and target compliance, in order to arrive at realistic targets. In two of the cases this risk assessment was comparatively detailed, using models provided by consultants and insurance companies. Another company noted the growing culture of target compliance within their organization, which raised the importance of realistic assessment of targets for emission reductions.

As a result of this research, it is considered that risks associated with the UK Emissions Trading Scheme can be classified according to political, economic, market and technological factors, which are also interlinked. The political risks have been relatively small as the allocation of permits was carried out according to voluntary targets and defined governmental procedures, although targets could be renegotiated in the future if the original baselines are considered to have been incorrect. Market risks have also been low, as the customers' perceptions were almost certain to be favourable, although a company's prices could increase as a consequence of high costs of mitigation. There were higher levels of technical risk, however, arising from possible non-compliance in data capture, information processing or plant performance. The majority of the risks, though, would appear to be economic, as a consequence of some of the possible cost implications of non-compliance through technical failure, the possible price variations in energy and emissions allowances, and short term cost increases arising from investment outlays in energy saving procedures and technologies or possible adverse effects on plant performance. As the Scheme evolved, it became apparent that many of these risks could be averted cheaply as a consequence of the generally low prices of allowances in relation to incentive payments. These low allowance prices were generally attributed to favourable baselines for some large emitters of non-CO₂ greenhouse gases, although there were some price rises when trading activity increased during periods of auditing for compliance by climate change participants (see below: "Comparisons with other research").

International Issues

Three of the organizations had equipment or processes covered by the EU Emissions Trading Scheme, but as direct participants in the UK Scheme they also had the right of opting out of the EU system until 2008 (see below). In addition, these same three organizations were member companies of multinational corporations, and were therefore able to gain potential advantages from Joint Implementation and the Clean Development Mechanism, which facilitate investment in energy-saving installations outside the UK but the allocation of a proportion of the consequent emissions reductions to the UK investor. At the time of the completion of this research, however, the further development of these mechanisms was contingent upon the implementation of the Kyoto Protocol.

COMPARISONS WITH OTHER RESEARCH

Surveys by postal questionnaire

As this research has been based on a comparatively small number of companies using a structured interview methodology to obtain detailed information, it is useful to compare the results with those published in a survey by *Enviros Consulting* (2003),

based on research by Kröger (2002). That survey, which used postal questionnaires, achieved a 56 per cent response rate from direct participants in the Emissions Trading Scheme, of which 33 per cent reported that they enrolled in the Scheme to obtain the financial incentive, and 63 per cent reported that they would not have participated in the scheme without that incentive. Seventeen per cent of the respondents participated to develop trading experience, 25 per cent participated to demonstrate environmental initiative, and a further seventeen per cent participated to improve energy efficiency (Enviros Consulting, 2003, pp. 6, 7).

In this present case study research of a group of organizations engaged in direct and indirect CO₂ savings, however, it was found that the proportions were higher for participants joining for reasons of financial incentives, energy savings and the public relations benefits obtainable from enhanced environmental performance. The differences in the results could be explained by sample size or the differences in methodology selected, as the questionnaire methodology used by Kröger (2002, p. 72) asked organizations to report the main motivating factor for the firm to join the UK Emissions Trading Scheme as a direct participant. The structured interview methodology used in this present research, on the other hand, asked the organizations to expand on all of the reasons for organizations to directly participate in the scheme. In spite of these differences, both research studies provide useful information on direct participation in the UK Emissions Trading Scheme.

Review by the National Audit Office

The UK Emissions Trading Scheme was also reviewed by the UK National Audit Office and the Parliamentary Accounts Committee during 2004. Both of these reviews praised the innovative nature of the Scheme, but drew attention to the small number of direct participants, possibly as a consequence of the short time scales required to gather and present the necessary data prior to participation in the auction, which in its turn was driven by DEFRA's wish to develop trading experience in advance of the introduction of the EU Emissions Trading Scheme in 2005. The National Audit Office did criticize, however, the setting of baselines for four of the six companies accounting for some fifty per cent of the total targeted reductions through the Scheme, as consultants had estimated that only some 66 per cent of these companies' reductions could be attributable to the Scheme (National Audit Office, 2004, p. 19). Each of these four companies were achieving targets through the reduction of greenhouse gases with a far higher relative global warming effect than carbon dioxide through process improvements and rationalization of facilities, some of which had been previously installed or were in the process of installation as a means of meeting regulatory requirements.

These comments from the National Audit Office echoed a previous criticism by the ENDS Report (ENDS, 2002) that the scheme should have been stricter in terms of the setting of baselines from which to calculate subsequent emission reductions, and should also have totally excluded any savings from previous "business as usual" decisions to meet European Integrated Pollution Prevention and Control (IPPC) requirements, or to rationalise facilities to retain competitiveness. Furthermore, there was also a possibility that a few companies with large emission reductions could exert a major influence on prices and quantities of allowances in the trading market. The ENDS report had also

concluded that as a consequence of the voluntary nature of the Scheme and generous levels of some baselines particularly for some larger companies whose reduction targets for non-CO₂ greenhouse gases accounted individually for some 10–20 per cent of total reductions covered by the scheme (ENDS, 2002), the incentive payment would far exceed the likely market price for carbon emissions allowances.

This view was subsequently confirmed when the Scheme commenced, although the inclusion of climate change participants also appears to have influenced prices of allowances. These prices commenced at €8 per tonne of CO₂ in April 2002 and increased to €19 in October 2002, which preceded the emissions settlement period for “climate change” participants for whom there was a shortage of allowances as these had not been issued at the commencement of the Levy Agreements. Many climate change participants therefore had to buy from “direct” participants who had been issued with allowances at the commencement of the Scheme, and following the emissions settlement period the price then fell to less than €5 in April 2003 as a consequence of most direct participants meeting their targets for 2002–3 (National Audit Office, 2004, pp. 24, 25).

In four of the five organizations studied in this present research, however, it did not appear that baseline emissions were particularly generous, and emission reduction targets were achieved through efficiency improvements to reduce either direct or indirect emissions, which clearly matched one of the objectives of the Scheme. It is important to note, however, that all of the organizations included in this present research were directly or indirectly reducing carbon dioxide emissions only, rather than emissions of greenhouse gases with higher radiative forcing effects for which the National Audit Office and ENDS considered generous baselines to be set in some cases.

CONCLUSIONS

This research has demonstrated that the three items specified by DEFRA (“UK Emissions Trading Scheme: Frequently Asked Questions”) as influencing companies’ direct participation in the UK Emissions Trading Scheme, and listed in “research questions” above, have been the main incentives for companies to join the Scheme. Furthermore, information from the companies interviewed has also demonstrated that decisions related to energy savings were viewed not only as “cost savers” through increased energy efficiencies, but also as “income generators” through the consequent receipt of incentive payments for emissions reductions and the potential sale of emissions allowances. In addition, organizations were seen to be addressing attention to the assessment of risks associated with target non-compliance and variations in allowance prices, but at the time of completing this study, decisions on international issues related to emissions trading and facilities location were awaiting the introduction of the EU Emissions Trading scheme and the implementation of the Kyoto Protocol. These conclusions lead to suggestions for further research as outlined below.

SUGGESTIONS FOR FURTHER RESEARCH

The EU Emissions Trading Scheme

At the conclusion of this present research, a draft of the UK National Allocation Plan for the EU Emissions Trading Scheme (“EU Emissions Trading Scheme, UK Draft

National Allocation Plan...", 2004) was made available for comment in January 2004, and a modified version ("EU Emissions Trading UK National Allocation Plan...", 2004) was then forwarded to the Commission in April 2004 for approval by September to meet the deadline of commencement of the Scheme in January 2005. That Scheme, however, differs from direct participation in the UK Emissions Trading Scheme in several important ways.

Firstly, the EU Emissions Trading Scheme is a compulsory "cap and trade" scheme for CO₂ emissions from installations in defined carbon dioxide intensive industries, either as a consequence of their energy intensity and/or the propensity of materials utilized to emit carbon dioxide during processing. These industries included "energy activities", namely combustion installations, oil refineries and coke ovens; "production and processing of ferrous metals", namely iron and steel production; "minerals industries", namely glass manufacturing, cement, clinker and lime production, brick and tile manufacturing, and ceramic products; and "other activities", namely pulp and paper production. For each defined industrial sector, capacity thresholds were set for the inclusion of installations in the Scheme: for example, greater than 20MW thermal capacity for combustion installations, and a manufacturing capacity of greater than 2.5 tonnes per hour for production of iron or steel. ("Proposal for...", 2001). The Scheme does, however, contain an opt out provision for those installations which should be included in the scheme as a consequence of the carbon intensity, but which are already registered participants in the UK Emissions Trading Scheme, provided that their emission targets are at least as demanding as those required by the European Scheme.

Secondly, the compulsory feature of the system means that fines will be levied for failure to meet targets or to purchase allowances to meet any shortfall, but there will be no financial incentives available for meeting the compulsory targets as in the case of the UK Emissions Trading Scheme. When compared with the results of the research outlined above, however, it is likely that cost savings should continue to occur as a consequence of energy savings (although such cost savings will depend on the costs of mitigation), but income generation will depend upon emissions trading alone and not from the receipt of incentive payments. Thirdly, during 2005–2007, the EU scheme will focus only on CO₂ emissions directly from fossil-fuel combustion or defined processes, and not indirect emissions from electricity savings or the reduction of emissions of other greenhouse gas emissions having a higher radiative forcing effect than CO₂ ("EU Emissions Trading Scheme: UK Draft National Allocation Plan...", 2004) as in the UK Scheme, although emissions from these other gases may be "opted in" after 2008.

Furthermore, the European scheme will be extended to a large number of installations: approximately 1,000 installations will be covered by the UK National Allocation Plan compared to some 34 direct participants in the UK Emissions Trading Scheme. The volume of emissions to be reduced will consequently be far higher through the National Allocations Programme than through the UK Emissions Trading Scheme, although the percentage reductions from any individual installation may not necessarily be higher in the EU scheme than for its UK counterpart.

As a consequence of the compulsory nature of the EU scheme for defined installations and the absence of incentive payments for target compliance, it is likely that there will be increased levels of risk for companies participating in this scheme compared to its British

predecessor. It will therefore become important for companies to pay more attention to energy efficiency and risk analysis in emissions trading, particularly as direct participants in the UK Scheme have the right to opt out of the EU scheme until 2008. This research has shown that direct participation in the UK Emissions Trading Scheme has led to innovative management behaviour to reduce greenhouse gas emissions through energy savings, and future research should therefore extend this present study of UK emissions trading to participants in the EU Emissions Trading System, comparing the experiences of a sample companies from a range of other member states. These studies should also assess the degree to which such innovative behaviour is maintained in an environment which is prescriptive rather than voluntary for those installations mandated to be in the scheme.

Energy Costs

Although the prescriptive EU scheme may be successful in achieving higher levels of emissions reductions than the voluntary UK system in view of the larger number of installations covered, energy costs may increase as a consequence of the compulsory inclusion of specified installations. "Carbon costs" will probably vary between individual members of the EU according to their individual reduction targets, the content of each country's national allocation plan, and the possibility of cheap allowances emanating from the accessions countries in Eastern Europe. Some estimates of allowance prices vary between €3 and €25–30 per tonne of CO₂ (Ilex, 2003, Lane, 2004), which are a reflection of the range of expected mitigation costs, with the majority view approximating to €10–€15 per tonne (Brannvoll, 2004; ENDS, 2000a; Karmali, 2004; Lane, 2004) although recent traded prices have been nearer €30 as a consequence of increased gas prices causing power stations to use more coal. Estimates have also been made on the likely effects of the expected range of EU carbon allowance prices on the price of electricity, varying between increases of 5% at a carbon allowance price of €5–25 per tonne of CO₂ (Ilex, 2003), to 37% at coal-fired power stations for a carbon allowance price of €15 per tonne (Karmali, 2004). These estimates, however, are open to a range of variables such as the types of power stations operated at the margin of demand, the degree of liberalisation of electricity markets, and the level of international competition in these markets (Blyth, 2004). Future research will therefore be necessary to monitor the variations in prices of emissions allowances, and to relate these to electricity prices.

Facilities Location

The estimates for electricity prices can also be used as a basis to estimate their effects on the competitiveness of various industrial sectors, particularly in the energy intensive industries (such as chemicals and paper), and especially those that also emit carbon dioxide during industrial production (such as cement and iron and steel). Estimates for cost increases in these industries vary between 2–3% of value added at a carbon price of €5 per tonne to 8–15% of value added at a carbon price of €25 per tonne (DTI, 2004; ENDS, 2004a; ENDS, 2004b; Brannvoll, 2004). Although the research on a sample of direct participants in the UK Emissions Trading Scheme described in this paper revealed that companies considered the costs of carbon as a secondary factor influencing facilities location, this view may change to a primary factor following the implementation of the Kyoto Protocol and the introduction of the

EU Emissions Trading Scheme, particularly if fuel prices remain at a high level. Energy intensive companies, particularly those having installations covered by the EU Emissions Trading Scheme may consider additional carbon mitigation costs to be a final factor affecting competitiveness and consequently decide to relocate in non-Annex 1 countries (such as China or India) or Annex 1 non-ratifying countries (such as USA) causing a process of "carbon leakage".

There is a counterview, however, that the cost consequences of carbon mitigation can be removed through the implementation of energy saving technologies, and that the introduction of these technologies will create a basis for long term competitive advantage, particularly if fuel prices continue to rise. The degree to which this can be achieved, however, depends upon the technologies available, the age of the current production equipment and the level of financial resources available for this investment.

REFERENCES

- ACBE (Advisory Committee on Business and the Environment) (1998), *Climate Change: a strategic issue for business*, DETR/DTI, London.
- Ananova (2001), "Climate change levy will 'damage firms'", filed 01.45, 15 January 2001, http://www.ananova.com.news/story/sm_172714.html?menu=
- BPAmoco (1999), "Greenhouse Gas Emissions Trading in BPAmoco", BPAmoco Internal Company Document, November.
- Branvold, F. (2004), "Managing the indirect impact of the ETS", IQPC Conference on European Emissions Trading 2004, 23–24 March, Hotel Le Plaza, Brussels
- DEFRA (Department for Environment Food and Rural Affairs) (2002), "The Emissions Trading Scheme: Auction Analysis and Progress Report", October 2002.
- DTI (Department of Trade and Industry) (2004), "Competitiveness, Trade and Regional Implications of EU Emissions Trading Scheme" (<http://www.dti.gov.uk/energy/sepn/cuctsimplications.pdf>, Retrieved August 9, 2004)
- EEF (Engineering Employers' Federation) (2002), *The Climate Change Levy: First year assessment*, EEF, London.
- ENDS (Environmental Data Services Ltd.) Report (2002), "Hot air" blows a gaping hole in emissions trading scheme, March 2002, Issue No. 26.
- ENDS Report (2004a), "Impact of emissions trading on electricity prices is 'overstated'", February 2004, ENDS Report 349, February, pp. 6–7.
- ENDS Report (2004b), "Global carbon market starts to take off", ENDS Report 353, June, pp. 3–4.
- Enviros Consulting (2003), "A Quantitative Study of the Direct Entry UK Emissions Trading Scheme", Enviros Consulting Ltd., London, March 2003.
- ETG (Emissions Trading Group) (1999), *Outline proposals for a UK emissions trading scheme*.
- ETG (Emissions Trading Group) (2000), "Financial Incentives for UK Emissions Trading", News Release, 24 July 2000.
- "EU Emissions Trading Scheme: UK Draft National Allocation Plan for 2005–2007", DEFRA, January 2004.

- "EU Emissions Trading Scheme: UK National Allocation Plan 2005–2007", DEFRA, March 2004.
- Felgate, G. (2003), "Precious joules", *Financial Management*, February 2003, pp. 24, 25.
- "Framework for the UK Emissions Trading Scheme", DEFRA, London, August 2001 (<http://www.defra.gov.uk/environment/climatechange/trading/pdf/trading-full.pdf>).
- IEMA (Institute of Environmental Management and Assessment) (2001), *Managing climate change emissions: a business guide*, IEMA, Lincoln.
- Blex Energy Consulting (2003), "Implications of the EU ETS for the Power Sector". A report to DTI, DEFRA and OFGEM, September 2003.
- Karmali, A., (2004), "Planning in the Utility Sector with EU ETS", Paper presented at Carbon Expo, 11 June 2004.
- Kröger, K. (2002), "A critical assessment of the UK Emissions Trading Scheme", Unpublished dissertation for the degree of M.Sc. in Environmental Management, University of Nottingham.
- Lane, G. (2004), "Impacts of EU ETS on competition within the internal electricity market", (<http://ceps01.link.be/files/CEPS5Feb2004.ppt> accessed 4 August 2004)
- National Audit Office (NAO) (2004), *The UK Emissions Trading Scheme: A New Way to Combat Climate Change*, Report by the Comptroller and Auditor General (HC 517 2003–2004, April 2004.
- "Proposal for a Directive of the European Parliament and of the Council establishing a framework for greenhouse gas emissions trading within the Community and amending Council Directive 96/61/C" (2001), Commission of the European Communities, Brussels, 23. 10. 2001.
- Nicholls, M. (2003), "Oil firms learn trading lessons", *Environmental Finance*, February 2003, pp.13–15.
- Steen, N., Vrolijk, C. (2002), "United Kingdom: power markets and market policies" in Vrolijk, C. (ed.), *Climate Change and Power: Economic Instruments for European Electricity*, The Royal Institute of International Affairs, Sustainable Development Programme/ Earthscan, London.
- "UK Emissions Trading Scheme; Frequently Asked Questions"; <http://www.defra.gov.uk/environment/climatechange/trading/faq.htm>
- "UK Emissions Trading Scheme: UK emissions trading scheme results: 11–12 March 2002"; <http://www.defra.gov.uk/environment/climatechange/trading/auctionwin2.htm>
- Vrolijk, C. (ed) (2002), *Climate Change and Power: Economic Instruments for European Electricity*, The Royal Institute of International Affairs Sustainable Development Programme: Earthscan, London.

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