The Climate Confusion

Implications of the EU Emissions Trading Directive for the UK Climate Change Levy and Climate Change Agreements

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Abbreviations and acronyms

AAU	Assigned Amount Unit
ACE	All Cost Effective
CBI	Confederation of British Industry
CCL	Climate Change Levy
CCA	Climate Change Agreements
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CHP	Combined Heat and Power
DEFRA	Department of Environment, Food and Rural Affairs
DETR	Department of Environment, Transport and the Regions
DTI	Department of Trade and Industry
ECA	Enhanced Capital Allowance
EEBPP	Energy Efficiency Best Practice Program
EEC	Energy Efficiency Commitment
EPA	Environmental Protection Act
ERU	Emission Reduction Unit
ETS	Emissions Trading Scheme
ETSU	Energy Technology Support Unit
ETSU	Energy Technology Support Unit (now incorporated into
EU ETS	EU Emissions Trading Scheme
EU	European Union
FGD	Flue Gas Desulphurisation
	Future Energy Solutions at AEA Technology)
GHG	Greenhouse Gas
IET	International Emissions Trading
IPPC	Integrated Pollution Prevention and Control
JI	Joint Implementation
LAAPC	Local Authority Air Pollution Control
LCP	Large Combustion Plant
LCPD	Large Combustion Plant Directive
LEC	Levy Exemption Certificate
MCA	Multi Criteria Appraisal
NETA	New Electricity Trading Arrangements
RO	Renewables Obligation
ROC	Renewables Obligation Certificate
SDC	Sustainable Development Commission
UK ETG	UK Emissions Trading Group
UK ETS	UK Emissions Trading Scheme
UKCP	UK Climate Programme

Executive Summary

Key Findings

- The proposed EU Emissions Trading Scheme (EU ETS) is incompatible with existing UK climate policy. There are a number of number of reasons for this, but of particular importance is the differing treatment of emissions from electricity generation
- The Climate Change Levy (CCL) and Climate Change Agreements (CCAs) took several years to negotiate and were anticipated to remain stable until 2013. But the EU ETS could be introduced as early as 2005. Coexistence of the two is probably untenable. While there are a number of options for modifying the CCL/CCA package, all involve trade-offs and all are likely to opposed by various groups.
- The potential interactions between the EU ETS and the CCL/CCA package are complex and raise four key issues: a) the economic impact upon different groups and the extent to which this depends upon the method of allowance allocation; b) ‘double regulation’ and the extent to which this is seen as imposing unfair burdens on particular groups; c) the ‘ownership’ of carbon emissions and the ‘double counting’ problems that arise if ownership is disputed; and d) the differential treatment of target groups and the difficulties of demonstrating ‘equivalence of effort’.
- There are considerable differences in the scope of the instruments, in terms of the sectors, sites, portions of sites and individual emission sources that are directly or indirectly affected. As a consequence, any policy options are likely to create problems of double regulation and differential treatment.
- There are also differences in the timing of the instruments, which is one reason why the UK has sought an opt-out of Phase 1 of the EU ETS (2005-2007). A major overhaul of UK climate policy will be required by at least 2007, and most probably before that date.
- The CCA targets are different in form and probably weaker than those required under the EU ETS, which creates problems for opt-out provisions. Also, the CCL/CCA package has multiple objectives, including protecting domestic consumers and UK coal producers, promoting energy efficiency and avoiding a ‘windfall’ to nuclear power. The political importance of these objectives is changing, but each is threatened by the EU ETS.
- Allowance prices in the EU ETS could be driven to low levels if the scheme is interfaced to other trading schemes and/or the international carbon market after 2008. This could justify the retention of the CCL and/or the CCAs as a ‘backup’ to ensure some degree of domestic action. Alternatively, interfaces between the EU ETS and the international carbon market could be strictly controlled. This issue is of critical importance to the future shape of UK and EU climate policy. But the UK has only limited control over the evolution of the EU ETS and forecasts of future allowance prices are highly speculative.
- The existing UK policy mix is excessively complex and the relationship between different instruments is poorly understood. Any changes should aim to simplify this mix and to improve economic efficiency. Policy development should be based upon clear principles and long-term goals. The CCAs should be seen as a transitional measure only. In the long term, organisations in the public, commercial and industrial sectors should either be paying a carbon tax (on fuel consumption only) or participating in the EU ETS.

Origins of the climate confusion

Over the last three years, the UK has developed a complex, elaborate and interdependent set of climate policies which are intended to deliver both the UK's Kyoto obligations and its domestic target of a 20% reduction in CO_2 emissions by 2010. Some elements of this policy mix, such as the Climate Change Levy (CCL), represent a significant political achievement given the strength of industrial opposition, while others, such as the UK Emissions Trading Scheme (UKETS) and the Renewables Obligation (RO), are important and innovative policy experiments. This policy mix is now fully operational, delivering emission reductions and attracting interest from around the world. But parallel to these developments, the European Commission has been developing the European Climate Change Programme (ECCP). This proposes a wide range of instruments and initiatives and includes as its centrepiece a draft Directive for a greenhouse gas emissions trading scheme (the EU Emissions Trading Scheme or EU ETS) which will cover some 45% of EU emissions. If this proposal is approved, it will create the largest and most ambitious trading system ever implemented. The design of the EU ETS represents a pragmatic compromise between economic efficiency and political acceptability and there appears to be a good chance that it will be introduced in 2005 as planned. *But it is fundamentally incompatible with existing UK climate policy.*

If the Directive goes ahead as planned, the UK government will be faced with a choice between either accepting the coexistence of the EU ETS with UK climate policy, or replacing or modifying a number of policy instruments only a couple of years after they were introduced. The first option leads to double regulation, complexity and additional cost burdens for affected groups, while the second implies changing a complex and finely balanced policy mix which took several years to negotiate and was anticipated to remain stable until 2013. Neither option is attractive and both will attract opposition. The extent of disruption will depend on the nature of the changes that are proposed, but at the time of writing the UK government does not appear to have given a great deal of thought to the specific options available.

This report provides an in-depth exploration of the potential interactions between the EU ETS and the UK Climate Change Levy (CCL) and Climate Change Agreements (CCAs). While the EU ETS has implications for a number of climate policy instruments, it is the impact on the CCL/CCA package that is of greatest importance. The aim of the report is to explore the nature of the issues that arise from this interaction, to identify ways in which conflicts can be avoided and to provide practical suggestions for the future development of UK climate policy.

If the EU agrees to a start date of 2005 for the EU ETS, the UK government will need to consider options for reforming the CCL and CCAs immediately. Delaying the introduction of the EU ETS by one year will give only limited breathing space before major changes need to be made. Even if the UK is successful in securing an opt-out of the Directive up to 2008, it will still be faced with a major overhaul of climate policy well before the planned end date of the existing CCAs. There is a need, therefore, for a debate on the preferred shape of climate policy during the first Kyoto commitment period (2008-2012) and beyond. It is this which should form the basis of future policy development and not short-term expedients. This report aims to contribute to this debate.

The potential interactions between the EU ETS and the CCL/CCA package can be confusing. The report charts a course through this confusion by examining in turn:

- the *scope* of the instruments, where scope means the sectors, sites, portions of sites and individual emission sources that are directly or indirectly affected;
- the *objectives* of the instruments and the extent to which these reinforce or conflict with one another;
- the *operation* of each instrument and the interactions between them assuming that they exist in parallel; and
- the *timing* of the instruments in relation to each other and the Kyoto commitment period,

Following this, the report explores the *options* that are available to make the implementation of the EU ETS more effective, equitable and politically feasible. On the basis of this analysis, the final section makes some specific *recommendations* on the future development of UK climate policy.

Understanding the climate confusion

The potential interaction between the EU ETS and the EU ETS raises four generic issues:

- *Regulatory impact and cost incidence*: The issue here is the economic impact of different policy instruments and the extent to which the costs will be borne by consumers, employers, suppliers or shareholders. This can best be estimated through economic modelling, but different approaches can lead to very different results. For emissions trading, a central issue is how the allowances are distributed. Free allocation amounts to a subsidy to participating firms, while auctions allows the government to raise revenue which may be used to compensate affected groups and improve the efficiency and effectiveness of the scheme. An important result from economic theory is that, while the choice between auctioning and free allocation may lead to different costs for the participating firms, there should be no difference in the costs passed on in product prices. So for example, electricity consumers will face the same increase in electricity prices, regardless of whether allowances are allocated free to electricity generators or whether they are required to purchase them in an auction. Whether this theoretical result will hold in practice, however, is open to question.
- *Interaction and double regulation:* The issue here is the extent to which any apparent ‘double regulation’ will be seen as imposing unfair burdens upon particular target groups. While ‘double regulation’ is a negative term, there may be many instances where the interaction between policy instruments may be either acceptable or positively beneficial. To assess whether this is likely to be the case in any particular instance, it is necessary to examine the multiple objectives of each instrument and the obligations and incentives they place upon individual target groups.
- *Ownership of emissions and double counting:* The issue here is the ‘ownership’ and ‘control’ of carbon emissions and the problems that arise if ownership is disputed. For example, the EU ETS gives the ownership of emissions from electricity generation to power stations, while much of UK climate policy gives the ownership to electricity

consumers. Ownership disputes fall into three categories: a) double slippage, where the regulatory coverage of emissions is lost; b) double coverage, where two instruments give ownership of the same physical emissions to two separate parties, or to the same party under two separate terms; and c) double crediting, where disputing claims over the ownership of emissions allow two separate carbon allowances or carbon credits to be generated from a single abatement action. Each type of problem introduces complexity into the regulatory situation and double crediting may threaten the environmental integrity of an emissions trading scheme.

- *Equivalence of effort*: The issue here is the extent to which different groups are treated differently by environmental policy instruments and whether the obligations imposed upon one group can be deemed equivalent to those imposed upon another. Differential treatment may be challenged on legal, political or environmental grounds and is of central importance in the political debate over environmental policy. Demonstration of equivalence of effort may be required as a means to avoid differential treatment when an installation, company, sector or Member State is exempted from a particular policy instrument. But in practice, differences in the scope, form and stringency of policy instruments may make equivalence of effort extremely difficult to assess.

Different policy options have different implications for each of these issues and any option will involve trade-offs between efficiency, equity and political feasibility. This points to the need for multi-criteria assessment of policy options with explicit weighting of policy objectives.

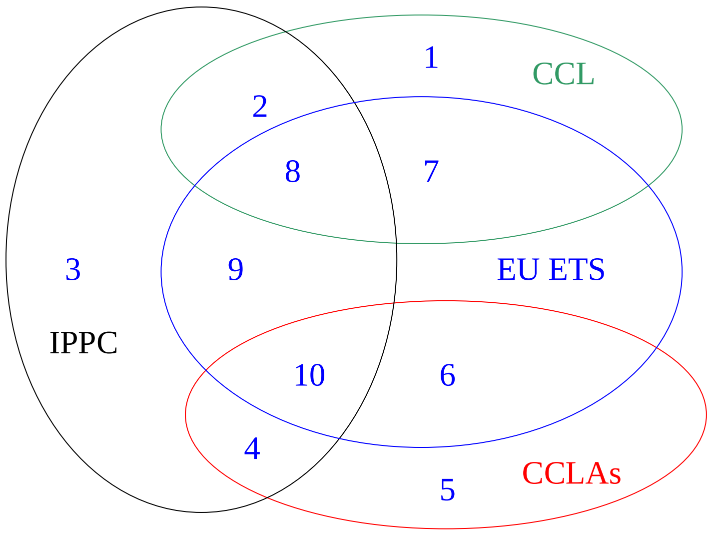
Confusion over instrument scope

The scope of both the CCAs and the EU ETS is based on that of the Integrated Pollution & Prevention Control (IPPC) Directive. Despite this, there are considerable differences in scope which are likely to create problems of differential treatment and double regulation. The differences occur at four levels:

- *Sectoral coverage*: Differences in the sectoral coverage of the CCL, CCAs, IPPC & EU ETS suggest that individual sites in the public, commercial, manufacturing and energy sectors may face one of **ten** combinations of the four instruments (Figure E.1). While the importance of each of the labelled regions in Figure E.1 varies, each contains real sites and real physical emissions.
- *Site coverage*: Differences in the coverage of individual technologies *within* an individual site expands the number of possible combinations of instrument coverage from ten to **eighteen.** The differences relate in particular to the coverage of combustion plant and process plant emissions and to the size of the main combustion plant.
- *Emissions coverage*: Further complications are introduced by the differences in coverage of CO_2 versus other GHGs, combustion versus non-combustion CO_2 emissions, and combustion emissions from different fossil fuels.
- *Electricity coverage*: A final layer of complexity is provided by the differing incentives each instrument creates for reducing emissions from electricity generation. Each instrument gives a different mix of direct and indirect incentives to both the supply and demand side of the electricity market, with the result that each instrument incentivises a

different mix of abatement options. Particular complications are introduced by the inconsistent treatment of electricity from various renewable sources.

Figure E.1 Confusion over instrument scope: overlaps between the target groups for the EU ETS, IPPC, CCL and CCAs



Confusion over instrument objectives

The core objective of the three instruments is the same: the reduction of carbon emissions from the target groups. But they differ in terms of their relative stringency and the importance they give to various subsidiary objectives

The stringency of the EU ETS is at present unclear and the proposed allowance allocation criteria include both top-down and bottom up elements which are potentially contradictory. But there is a strong possibility that the targets required under the EU ETS will be more stringent than those currently applicable under the CCAs (quite apart from the fact that these will be absolute, rather than relative targets). This has important implications for either the use of CCAs targets as a basis for allocation in the EU ETS, or the use of opt-in or opt-out options within the EU ETS at the national, sector, company or installation level.

The stringency of the EU ETS will be determined in the first instance by the size of the cap. But an important complication is the possibility of interfacing the EU ETS to other trading schemes or to the Kyoto mechanisms after 2008. A combination of the withdrawal of the US from Kyoto, the surplus 'hot air' in the allocations to Russia and the Ukraine, and the generous sink provisions negotiated at Marrakesh has created the possibility of very low carbon prices after 2008. In this context, any interface between the EU ETS and the international carbon market could have the effect of reducing the EU ETS allowance price and substituting allowance purchase for domestic abatement

The design of the CCL/CCA package reflects multiple objectives, including the desire to protect domestic consumers, energy intensive industry, and UK coal producers, together with promoting energy efficiency and avoiding a 'windfall' to nuclear generators. Each of these objectives is threatened by the introduction of the EU ETS, although in each case the political importance of the objective has changed since the CCL was introduced and is likely to have changed further by 2005 or 2008. In particular, a nuclear 'windfall' may now be positively helpful to government objectives given the current financial problems of British Energy. Nevertheless, it is clear that the proposed Directive raises major issues of UK energy policy (particularly supply security) and social policy (particularly fuel poverty).

Confusion over instrument operation

In practice, it is very unlikely that the EU ETS could coexist with an unchanged CCL/CCA package. But the 'coexistence' scenario provides a useful framework to explore the potential interactions between the instruments. The report examines these interactions in turn for four separate target groups, which are each affected by a different combination of instruments:

- *Group 1*: CCL only;
- *Group 2*: CCL and EU ETS;
- *Group 3:* CCA only;
- *Group 4*: CCA and EU ETS.

The interactions for each Group are complex and include several overlapping examples of double regulation, double coverage and double crediting. The interactions can be grouped into four categories:

- *price* - *price*: where the indirect impact of the EU ETS on electricity prices is additional to the direct price impact of the CCL;
- *price* - *target*: where the indirect impact of the EU ETS on electricity prices is additional to the direct impact of a target under the CCAs;
- *target* - *price*: where the direct impact of an emissions target under the EU ETS is additional to the direct price impact of the CCL;
- *target* - *target*: where the direct impact of a target under the EU ETS is additional to the direct impact of a target under the CCAs.

Table E.1 summarises the interactions within these four categories.

Table E.1 Categorising the potential interactions between the EU ETS and the CCL/CCA package

Type of interaction	EU ETS	CCL/CCA package	Category
price - price	indirect price	direct price	Group 1 electricity
price - price			Group 2 electricity
price - target	indirect price	direct target	Group 3 electricity
			Group 4 electricity
target - price	direct target	direct price	Group 2 fuel
target - target	direct target	direct target	Group 4 fuel
no interaction	-	-	Group 1 fuel
	-	-	Group 3 fuel

The scale and consequences of each interaction depends upon a range of factors, the most important of which is the allowance price in the EU ETS. If the allowance price is very high, double regulation could lead to substantial economic impacts for affected groups and therefore create pressure to modify the CCL/CCA package. Conversely, if the allowance price is very low, the economic consequences of the double regulation could be relatively small and therefore acceptable. But forecasts of future allowance prices are highly speculative.

Of similar importance is the underlying trends in industrial energy prices. For example, gas prices increased by 18% in real terms between 1995 and 2001, while electricity prices fell by 23%. Recent reductions in wholesale electricity prices have created a crisis in electricity generation and there seems little prospect that electricity prices will increase substantially in the near future. The reduction in industrial electricity prices between 2000 and 2002 more than offset the price increase from the CCL.

In a context of low energy prices and low allowance prices, there may be some appeal in retaining some or all of the CCL/CCA package unchanged, in order to maintain downstream incentives to improve energy efficiency (the ‘backup’ scenario). This would also ensure the continuation of policy initiatives currently funded by the CCL such as Enhanced Capital Allowances (ECAs). Allowance auctioning in the EU ETS could provide an alternative source of revenue to the CCL, but in practice it is unlikely that more than a fraction of allowances will be auctioned, even in Phase 2. The UK government opposes auctioning in the EU ETS, despite the economic arguments in its favour. But theory suggests that the consequences of the *price-price* and *price-target* interactions in Table E.1 should be independent of the method of allowance allocation.

The coexistence of the EU ETS and CCL/CCA package is likely to create substantial administrative complexity for the energy intensive companies in Group 4, who would have two separate regulatory targets and would be simultaneously participating in two separate trading schemes. This seems a clear case of redundancy in regulation. But in other instances, the choice is not so clear-cut. For example, the double regulation of electricity for Group 1 sites may be considered acceptable in order to incentivise downstream electricity efficiency.

Confusion over instrument timing

There are important differences between the timing of the EU ETS, the CCL/CCA package and the Kyoto commitment period. The EU ETS is in phase with Kyoto, but is due to begin well before the CCAs end. In contrast, the CCAs extend beyond the end of the Kyoto commitment period, but targets are only negotiated up to 2010. The timing of the CCAs is established but the timing of the EU ETS is uncertain and could be subject to delay. The CCAs also include emissions trading provisions as part of the UK Emissions Trading Scheme (UK ETS), but at present this scheme does not extend beyond 2006. In addition, the possibility of trading allowances prior to the commitment period and banking allowances into the commitment period may create difficulties for Member State compliance.

The situation would be greatly simplified if the UK could negotiate an opt-out of the EU ETS up to 2008, thereby postponing the point at which changes need to be made. The fact that the UK is one of the few Member States which is on course to meet its burden sharing obligations may provide a rationale for this. It is unlikely, however, that the UK could secure an opt out beyond 2008, and this could be counterproductive if it restricts the access of UK companies to the international carbon market.

The issues raised by a transition to the EU ETS in 2005 are identical to those raised by a transition in 2008 - it is merely the political context that would have changed.

Reducing the confusion – policy options

Both the CCL/CCA package and the EU ETS may be modified in a variety of ways to reduce the negative impacts of interaction. While any changes to the CCL/CCAs are the responsibility of the UK government (although subject to clearance under State Aid rules), modifications to the EU ETS require agreement at the EU level.

All options involve trade-offs, so the evaluation will depend upon the relative weight given to different policy objectives. The desirability of particular options may also depend on contextual factors which are uncertain or unknown.

The report examines two or more policy options for each of the four Groups listed above. The selection is not exhaustive, but is intended to illustrate the difficulties that arise and the nature of the trade-offs that can be made. Each option is appraised using a multicriteria framework, with equal weight given to environmental effectiveness, economic efficiency, administrative simplicity, impacts on industrial competitiveness and political acceptability. The appraisal compares the option with the coexistence scenario. The results are summarised in Table E.2.

Table E.2 Summary evaluation of options for modifying the CCL/CCA package or the EU ETS

Options	Description	Score
Group 1	*Coexistence scenario*	*14*
1a	Modify CCL rate for electricity	14
1b	Remove CCL on electricity	16
1c	As for 1b, and make CCL a carbon tax	18
Group 2	*Coexistence scenario*	*12*
2a	Remove CCL on electricity	14
2b	As for 2a and exempt Group 2 from CCL	15
Group 3	*Coexistence scenario*	*10*
3a	Remove CCL on electricity	9
3b	As for 3a and change CCA to fuel only	11
3c	As for 3b and allow opt-in to EU ETS	13
Group 4	*Coexistence scenario*	*7*
4a	Replace CCA with EU ETS and exempt from CCL	12
4b	As for 4a and allow opt-out from EU ETS	8

Note: The total score is the sum of the individual scores for each of five evaluation criteria, where: 1 = very poor, and 5 = very good.

The multicriteria assessment is subjective and in practice different stakeholder groups may both different scores to each option and give different weightings to each criteria. Nevertheless, the analysis suggests that:

- All of the options offer an improvement on the coexistence scenario. In other words, leaving the CCL/CCA package unchanged is likely to be the worst possible option.
- The majority of the options improve economic efficiency at the expense of environmental effectiveness. But most of the options which improve economic efficiency also improve political acceptability.
- Allowing opt-ins to the EU ETS can offer a number of advantages, particularly if combined with restrictions on the fungibility of EU ETS and UK ETS allowances. In contrast, the opt-out option scores badly on all criteria except political acceptability.
- Removing the CCL from electricity offers a number of advantages, as does exempting EU ETS participants from the CCL.

Eliminating the confusion – policy recommendations

The report recommends that greater priority should be given to economic efficiency and administrative simplicity when developing policy options. The principles and considerations which underlie this choice are as follows:

- *Need for change*: The EU ETS will provide the framework for trading in the long-term, whether the UK joins in 2005 or 2008. But coexistence of the EU ETS with the existing CCL/CCA package appears untenable. This means that evaluation of possible changes to the CCL and CCAs needs to begin now.

- *Goals*: The development of policy options should not be based upon short-term expedients, but upon clear principles and long-term goals. For climate policy, a stable an effective policy framework is required during the commitment period. This means that policy should be developed by *working back* from where we want to be in 2008, rather than making minor adaptations to the existing mix.

- *Complexity*: The existing UK policy mix is excessively complex and the relationship between different instruments is poorly understood by individual target groups. Hence, any changes should aim to simplify this mix and not to add further complexity.

- *Objectives*: The objectives of individual policies should be clear. At present, the efficiency of the CCL is undermined because it is trying to meet several objectives at once in a manner that is far from transparent. Whether or not all these objectives are sensible, it should be possible to achieve several of them by combining a more efficient price instrument with supplementary measures to ameliorate unwanted impacts on, for example, the fuel poor.

- *Carbon pricing*: Energy users in all sectors should pay for carbon emissions, whether through taxation or emissions trading. In the long term, organisations in the public, commercial and industrial sectors should *either* be paying a carbon tax *or* participating in a trading scheme. The CCAs should be seen as a transitional measure only. Supplementary policies will be required to address other barriers to energy efficiency and to achieve other policy objectives (e.g. promoting renewables). But for each target group, only a single instrument should be used for carbon pricing.

- *Revenue raising*: Revenue recycling should be used to enhance the economic efficiency, environmental effectiveness and political acceptability of a carbon tax (as with the CCL). Similar benefits are only possible with the EU ETS if allowance auctioning is used. A pragmatic solution is to auction a small proportion of the allowances initially, and to increase that proportion over time. While industrial opposition to allowance auctioning is understandable, there appears to be no good reason why the UK government should continue to oppose *any* allowance auctioning in the EU ETS.

- *Electricity:* The treatment of electricity emissions is of central importance. The EU ETS gives ownership of these emissions to electricity generators (direct allocation), while UK climate policy gives ownership to electricity consumers (indirect allocation). The former is preferable because: first, it gives ownership of electricity emissions to the companies directly responsible for the control of those emissions, thereby incentivising both fuel switching and energy efficiency; and second, it facilitates cross-border electricity trade in the EU.

- *Targets:* Absolute targets are to be preferred over relative targets because of their greater environmental integrity and consistency with the national emission targets under Kyoto. The argument that absolute targets provide a ‘cap on growth’ is difficult to defend in the context of global carbon trading and projections of low allowance prices.

- *Trading:* Allowance based trading (i.e. EU ETS) is to be preferred over baseline and credit trading (i.e. CCAs) due to its greater economic efficiency, lower transaction costs and consistency with the Kyoto framework.

- *Supplementaritry:* A combination of the US withdrawal from Kyoto, excessive ‘hot air’ and generous sink provisions means that the international carbon market during the first commitment period is likely to be oversupplied. This creates a real risk that abatement in the EU will be achieved through purchasing cheap hot air rather than through domestic action. But domestic abatement may be incentivised by either restricting the interface between the EU ETS and the international carbon market, or by retaining (or establishing) 'backup' regulations for EU ETS participants. This is an important and difficult policy choice for the UK, since future allowance prices are highly uncertain and the UK has only limited control over the future evolution of the EU ETS. However, since both the Commission and other Member States would like the EU ETS to encourage domestic abatement, there appears a good chance that the import of hot air into the EU ETS will be restricted. This suggests that 'backup' regulations should be abandoned as they are likely to undermine economic efficiency, be more complex to administer and lead to additional costs for the target groups.

These principles and considerations lead to the following recommendations for changes to the policy mix when the EU ETS is introduced:

- The CCL should be removed from electricity and extended to all fossil fuels. The CCL should replace excise duties on oil products.
- The basis of the CCL should change from energy to carbon content.
- The level of the fuel-only CCL should be increased and the existing programmes funded by the CCL should continue.
- Eligible installations should join the EU ETS and their existing CCA agreements should be terminated.
- CCA facilities not eligible for the EU ETS should renegotiate their agreements such that the targets relate to fuel consumption only.
- Participants in the EU ETS should be exempt from the CCL.
- Before 2008, any trading between the UK ETS and the EU ETS should be controlled by a Gateway. After 2008, there should be no trading between the two schemes

The analysis has also suggested that opt-in provisions at the installation or sector level could be a valuable addition to the EU ETS, while opt-out provisions at this level appear undesirable. A preferable approach may be to expand the sectoral coverage of the EU ETS over time.

The recommendations are conditional upon restrictions being placed on the import of hot air into the EU ETS. If these conditions are not met, 'backup' regulations should again be considered.

The changes proposed above will be far more difficult to implement by 2005 than by 2008. A national opt-out of Phase 1 therefore appears an attractive alternative as a transitional measure.

1. Origins of the climate confusion

The traditional approach to environmental policy making focuses on the design, development and implementation of individual policy instruments. In turn, analysts spend much time studying the relative merits of different approaches and in advocating market-based alternatives to traditional regulations. But the policy space is becoming increasingly crowded. Multiple instruments are employed to meet multiple objectives, leading to inevitable interactions. While this interaction can be complementary and mutually reinforcing, there is also the risk that different policy instruments may interfere with one another and undermine the objectives, operation and credibility of each.

Nowhere is this more the case than within climate policy. Over the last three years, the UK has developed a complex, elaborate and interdependent set of climate policies which are intended to deliver both the UK's Kyoto obligations and its domestic target of a 20% reduction in CO_2 emissions by 2010. Some elements of this policy mix, such as the Climate Change Levy (CCL), represent a significant political achievement given the strength of industrial opposition, while others, such as the UK Emissions Trading Scheme (UKETS) and the Renewables Obligation (RO), are important and innovative policy experiments. This policy mix is now fully operational, delivering emission reductions and attracting interest from around the world. But parallel to these developments, the European Commission has been developing the European Climate Change Programme (ECCP) (CEC, 2001b). This proposes a wide range of instruments and initiatives and includes as its centrepiece a draft Directive for a greenhouse gas emissions trading scheme (the EU Emissions Trading Scheme or EU ETS) which will cover some 45% of EU emissions (CEC, 2001a). If this proposal is approved, it will create the largest and most ambitious trading system ever implemented. The design of the EU ETS represents a pragmatic compromise between economic efficiency and political acceptability and there appears to be a good chance that it will be introduced in 2005 as planned. *But it is fundamentally incompatible with existing UK climate policy.*

If the Directive goes ahead as planned, the UK government will be faced with a choice between either accepting the coexistence of the EU ETS with UK climate policy, or replacing or modifying a number of policy instruments only a couple of years after they were introduced. The first option leads to double regulation, complexity and additional cost burdens for affected groups, while the second implies changing a complex and finely balanced policy mix which took several years to negotiate and was anticipated to remain stable until 2013. Neither option is attractive, both will attract opposition and both run the risk of stranded investment. The extent of disruption will depend on the nature of the changes that are proposed, but at the time of writing the UK government does not appear to have given a great deal of thought to the specific options available.

This report is one of three which examine the complex interactions between the EU ETS and selected instruments within UK climate policy.[2] The focus of this report is the interaction between the EU ETS and the UK Climate Change Levy (CCL) and Climate Change Agreements (CCAs). The aim of the report is to:

[2] The first report explores the interaction between the EU ETS and the Integrated Pollution Prevention and Control (IPPC) Directive, the Renewables Obligation (RO), and the Energy Efficiency Commitment (EEC) (Smith, 2002a). The third report will explore the interaction between the EU ETS and the UK Emissions Trading Scheme.

- explore the potential interactions between the EU ETS and the CCL/CCA package;
- explore the nature of the issues that arise and to identify ways in which conflicts can be avoided and synergies created;
- improve understanding of policy interaction, both in general terms and between these specific instruments; and
- develop suggestions for the future development of UK climate policy.

The CCL is a downstream energy tax, while the CCAs are negotiated agreements with energy intensive manufacturing industry. The reason for grouping them together is that they operate as a package: the incentive for adopting a CCA is exemption from 80% of the CCL, while the penalty for failing to meet the targets under the CCAs is a return to paying the full rate of the CCL.[3]

The close linkage of the CCL and the CCAs means that it is impossible to discuss the future development of one instrument without at the same time discussing the future development of the second. For example, one option to facilitate the introduction of the EU ETS is to make electricity exempt from the CCL. But this would mean that CCA companies would no longer receive any benefit from adhering to their electricity targets.[4] A modification to the CCAs is likely to be required, but this could be costly, time-consuming and unpopular. It therefore follows that any policy options that are developed must consider the CCL/CCA package as a whole, and not just each instrument individually.

The situation is further complicated by the trading provisions that have been developed for the CCAs. These mean that the CCA companies are also a part of the UK Emissions Trading Scheme (UK ETS) (Sorrell, 2001a). However, the trading provisions are an addition to the basic negotiated agreements and were only finalised after the core elements of the agreements had been established (Smith, 2001). This report will discuss the implications for the CCA trading provisions, but the implications for the wider UK ETS, and in particular the 'direct participants', will be discussed in a separate report.

1.1 Report structure

The remainder of this section describes the current status and likely evolution of the proposed EU Directive. Section 2 introduces four generic themes that are particularly relevant to the interaction between the EU ETS and the CCL/CCAs. These are:

- regulatory impact and cost incidence;
- interaction and double regulation;
- ownership of emissions and double counting; and
- equity, competitiveness and equivalence of effort.

[3] Further details on the CCL and CCAs are given in Smith (2001) and Sorrell (2001a). This report builds upon the characterisation and analysis presented in these earlier reports.
[4] Strictly, that component of their targets that relates to electricity consumption.

Sections 3-5 provide a detailed examination of the potential interaction between the EU ETS and the existing CCL/CCA package, assuming that the EUETS is implemented while the CCL/CCA package remains unchanged. In practice, this is very unlikely, but the assumption provides a useful framework for analysis. These sections aim to identify how and why the two policies affect each other, and the impact on directly and indirectly affected target groups. The analysis is broken down into three stages:

- Section 3 examines the overlaps in the *scope* of the instruments, where scope means the sectors, sites, portions of sites and individual emission sources that are affected by each instrument.
- Section 4 examines the overlaps in the *objectives* of the instruments and assesses the extent to which these reinforce or conflict with each other.
- Section 5 examines the interaction between the *operation* of each instrument and assesses whether the instruments are likely to be reinforcing, neutral or conflicting if they coexist.

Section 6 examines the timing of the proposed EU ETS, both in relation to the CCL/CCA package and to the Kyoto commitment period, and examines the desirability of the UK opting out of the EU ETS in the period up to 2008. Following this, section 7 explores the options that are available to make the implementation of the EU ETS more effective, equitable and politically feasible. These options relate both to modifying the Directive itself (e.g. introducing opt-in provisions) and modifying the design and operation of the CCL and CCAs. The objective here is to explore the issues that arise under different policy options and to identify ways in which conflicts can be avoided. This allows conclusions to be drawn about policy interaction in general terms, as well as making specific policy recommendations.

Finally, section 8 provides a summary of the key themes and conclusions.

1.2 Status of the EU Directive

The analysis of the EU ETS in this report uses the proposals in the published draft Directive (CEC, 2001a), the main elements of which are summarised in Table 1.1.

Table 1.1 Key elements of the proposed EU ETS

Design feature	
Timing	• 1st period 2005-2007 • 2nd period 2008-2012, to coincide with the first Kyoto Protocol commitment period.
Type of target	• Absolute targets for all facilities.
Sectors included	• All combustion plant >20MW thermal input, including power generators • Oil refineries, coke ovens, non-ferrous metals, cement clinker, pulp from timber, glass and ceramics • NOT chemical, food and drink or waste incineration sectors
Size of market	• 4000-5000 installations • 45% of EU carbon dioxide emissions
Allocation	• Free during 1st period (2005-2007) • Possible partial or full auctioning 2008-2012 • National allocation plans to be reviewed by EU for potential state aid.
Greenhouse Gases	• Only CO_2 in 1st period. • Other gases could be brought in for 2nd period, but more work on monitoring protocols is required.
Emission reduction projects	• EC will prepare a separate instrument on project-based mechanisms. • Could include projects eventually depending on environmental integrity.
Links with Kyoto mechanisms	• Designed to be compatible with Kyoto emission trading. • Kyoto Protocol project mechanisms likely not included in first EU compliance period. This will depend on the development of international rules.
Links with other schemes	• Mutual recognition of allowances with other systems is possible (e.g., Accession Countries)
Land-based sequestration (sinks)	• Ineligible.
Monitoring Reporting Verification	• Common monitoring, verification and reporting obligations to be elaborated. • Verification through third-party or government authority.
Allowance tracking	• Linked/harmonised national registries with independent transaction log. • To be based on Kyoto Protocol registry guidelines and US Acid Rain Program.
Compliance	• 50 Euro/ton penalty across EU, or twice the market price, whichever is higher (2005-2007) • 100 Euro/Ton penalty across EU, or twice the market price whichever is higher(after 2008)
Banking	• Banking across years within each compliance period • Member States can determine banking from first compliance period (2005-2007) to first Kyoto Protocol commitment period (2008-2012).
Review of system design	• Review in 2006.

Source: CEC (2001a); Irving (2002)

The proposed Directive is the subject of intense negotiation and it is likely that changes will be made before it is finally implemented. At the time of writing (October 2002), several amendments have been proposed by the European Parliament, but these have not been accepted by the Commission (ENDS, 2002a). Ministers failed to reach agreement at the Environment Council meeting in October 2002, so the Directive will now be debated at the December meeting. If agreement is not reached, the prospects of Phase 1 of the scheme beginning in 2005 look fairly slim. But even if agreement is reached, it will still be a major challenge to get all the domestic legislation in place in time for a 2005 start. Problems may arise with allowance allocation, both within and between Member States, and with modifying existing legislation such as the CCL/CCA package. As a consequence, the proposed start date of 2005 for Phase 1 of the EU ETS may be optimistic.

The elements of the proposed Directive that have proved particularly contentious during the negotiation process include the following:

- *National opt-out*: The Directive is intended to be mandatory in the 2005-2007 period, but this is opposed by the UK and Germany. These hold a large share of the total number of votes and if one or two smaller Member States join them, they will have a blocking majority. Germany wants to opt-out of the scheme up to 2008, in order to protect its negotiated agreements, but is more open to a mandatory scheme post 2008. A national opt-out up until 2008 is also preferred by the UK government, in order to avoid modifications to its existing policy framework. But in both cases, the requirement that national industry is 'regulated by other policies and measures that represent at least a similar economic effort in terms of emissions abatement.' (CEC, 2000) is likely to prove challenging to demonstrate.

- *Sector/company/installation opt-in or opt-out*: An alternative to a national opt-in/opt-out is to allow individual sectors/companies/installations to choose whether or not to join the scheme. For example, the UK would like opt-in provisions to allow direct participants in the UK Emissions Trading Scheme to be able to join the EU scheme since, at present, all would be excluded. There are a number of means through which this could be achieved, but all create a range of problems and are likely to increase the burden of administering the scheme.

- *Sectoral coverage*: A number of Member States consider that the proposed sectoral coverage is inadequate. In particular, there is a view that the chemicals sector should also be included (although this is opposed by Germany). There is, however, broad support for regulation under IPPC as the basis for inclusion.

- *Gas coverage*: The proposal to confine the pre-2008 scheme to CO_2 has been subject to some criticism. The Commission argues that monitoring protocols are inadequate for other GHGs, but the UK argues that adequate monitoring protocols are already being used effectively in the UK ETS.

- *Allocation*: This will inevitably be highly controversial. At present, there is no consensus on the overall CO_2 limits, the rules for allocation between individual installations, or the sole use of free allocation[5] in the initial period. Most Member States want free allocation, but the European Parliament has proposed auctions for 15% of the allowances. Furthermore, the allocation criteria listed in Annex 3 of the Directive are potentially contradictory.

- *Interfaces:* Many business groups would like to see the scheme opened up to Certified Emission Reductions (CERs) from Clean Development Mechanism (CDM) projects and to Emission Reduction Units from Joint Implementation (JI) projects during Phase 1, while during Phase 2 they would like access to Assigned Amount Units (AAUs) from International Emissions Trading (IET). The Commission has promised a second Directive on interfaces to JI and CDM, but both the Commission and the European Parliament are

[5] The term 'grandfathering' is often used to refer to free allocation. But it is more precise meaning is free allocation of permits on the basis of *historic* emissions (hence the idea of inheritance). Permits can be allocated free according to other rules, such as emission benchmarks, which may not include any reference to historic emissions.

opposed to the import of AAUs since they would like the Directive to ensure emission reductions within the EU, rather than encourage the purchase of ‘hot air’. The European Parliament has voted to exclude CERs from the scheme during Phase 1, and to prevent the import of CERs or ERUs from sink or nuclear projects during Phase 2. But given the likely fungibility of international carbon commodities after 2008, such rules may be difficult to apply. Furthermore, the Commission has proposed potential bilateral interfaces with other emissions trading schemes which may themselves have different rules for interfacing with the international market. Any such interfaces run the risk of reducing allowance prices and thereby reducing the incentive for domestic emission reductions.

2. Understanding the climate confusion

To analyse the potential interaction between the EU ETS and the CCL/CCA package, it is necessary to examine four generic themes:

- regulatory impact and cost incidence;
- policy interaction and double regulation;
- ownership of emissions and double counting;
- differential treatment and equivalence of effort

This section explores each of these themes in turn, building upon earlier work from the INTERACT project (Sorrell, 2001b).

2.1 Regulatory impact and cost incidence

A key issue is the likely economic impact of a proposed policy instrument upon different groups, including consumers, shareholders, suppliers and employees. To estimate this with any confidence would require economic modelling, but some general comments may be made.

2.1.1 Identifying cost incidence

Two important distinctions are:

- between short-run and long-run costs; and
- between direct and indirect impacts.

In the short-run, capital is fixed and the scope for behavioural change is limited. For example, firms faced with an energy price increase may have only limited scope for reducing energy consumption through improved housekeeping. In the long-run, however, all inputs are variable. Firms may substitute capital for energy through new investment. The time horizon over which this can be achieved will depend upon the nature of the technology - for example, power stations have longer lifetimes than domestic appliances. This means that the short-run versus long-run distinction may be more usefully seen as a continuum - the relevant question is the cost impacts for a particular group over a specified period of time. If the cost impacts are large, existing capital may become uneconomic (‘stranded assets’). And in all cases, changing factor prices may stimulate technological innovation.

Individual policy instruments *directly* affect a particular target group by imposing rules and obligations on that group. For example, the EU ETS requires participants to meet an emissions cap. These obligations will impose costs on the target group and may incentivise behavioural change, such as investment in energy efficiency. In turn, these costs may be passed on to other groups, such as shareholders and consumers. For example, the costs resulting from the emissions cap on electricity generators may be passed on to electricity consumers in the form of higher electricity prices. These groups are *indirectly* affected by the policy instrument. But the causal chain flows further, extending ultimately throughout the economy. For example, firms faced with higher electricity prices may pass a portion of these costs on in higher product prices and this in turn will have impacts on consumption, investment and welfare.

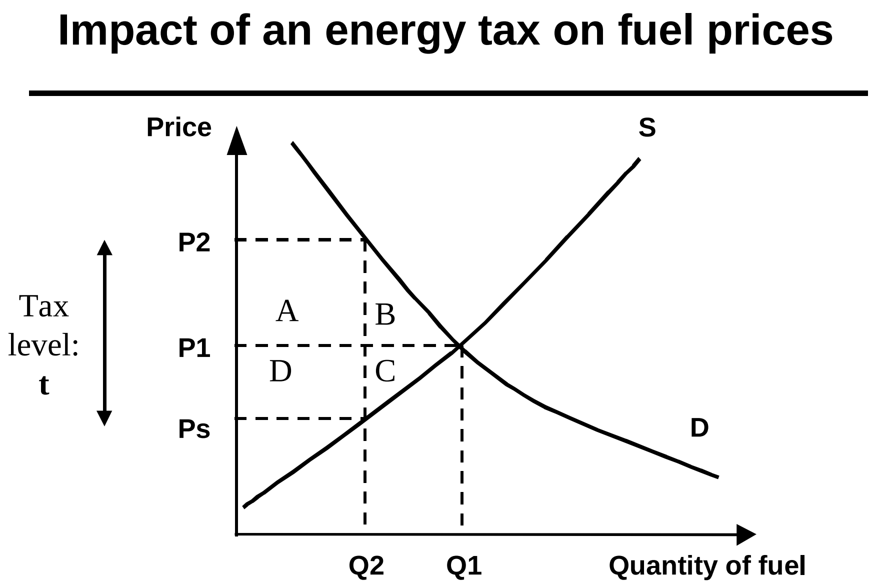
In determining cost impacts, we must therefore distinguish whether direct or indirect impacts are being considered, and the time period over which these are being assessed. *Partial equilibrium* economic models confine attention to direct impacts,[6] while *general equilibrium* models take into account full indirect impacts throughout the economy. Both may accommodate behavioural change over different time periods, although the results will depend finely on the model's scope, structure and assumptions (e.g. assumed elasticities). *Input-output* models take both direct and indirect impacts into account, but cannot accommodate behavioural change. Different techniques can lead to very different results.[7]

At each point in the economy, economic actors can pass the costs resulting from a policy instrument either forwards to buyers or backwards to suppliers of factor inputs (Cramton and Kerr, 1998). For example, industrial companies subject to an energy tax may either increase product prices (pass to consumers), reduce the consumption or unit price paid for supply inputs (pass to suppliers) or reduce dividends and capital gains (pass to shareholders). In each case, the extent to which costs can be passed on will depend upon the market situation of the firm and the elasticities of demand and supply. An individual firm in a competitive product market is a price taker, and faces a horizontal demand curve. If this firm faces a price increase while other firms do not, there will be no scope for it to increase its product prices - the cost increases must be absorbed by lower returns. However, if all firms in a particular product market face a similar price increase, a portion will be passed on to consumers (unless demand is perfectly elastic) while a portion will be borne by firms. This is illustrated in Figure 1.1 which shows the impact of an energy tax on the market for fuel.

[6] In the example given here, the direct impacts here would include the electricity price increases faced by industrial consumers, but would not follow the economic consequences of the resulting increase in product prices.

[7] For example, the regressive impact of energy taxes is generally estimated to be less in general equilibrium studies than in partial equilibrium studies (Caslert and Rafiqui, 1993).

Figure 1.1 Impact of an energy tax on fuel prices



Tax raises consumer price to P2. Suppliers receive Ps
Quantity consumed reduces to Q2

Prior to imposing the tax, quantity Q1 of fuel clears the market at price P1. The government then imposes a specific[8] tax, t, which means that the price of consumer pays must exceed the net price the seller receives per unit sold by t. This leads to a consumer price P2, a supplier price Ps and a reduction in the volume of fuel sold to Q2. At this point:

- the government receives *revenue* equivalent to A+D;
- there is a loss in *consumer surplus* equivalent to A+B (consumer surplus = difference between consumer valuation and price paid);
- there is a loss in *producer surplus* equivalent to D+C (producer surplus = difference between total revenue and total cost);
- there is a *dead-weight loss* equivalent to B+C (dead-weight loss = (change in producer surplus + change in consumer surplus) – government revenue)

Consumer prices do *not* increase by the full value of the tax, t. Instead, they only increase by (P2-P1). The size of this price increase will depend upon the relative elasticities of demand and supply. The fraction of the tax that is borne by consumers is given by:

Es / (Es + Ed)

Where Es = elasticity of supply ((dQ/Q)/(dP/P)); and Ed = elasticity of demand.

[8] A *specific* tax uses a fixed per unit rate for all levels of consumption (e.g. p/kWh). An *ad valorem* tax, such as VAT, would use percentage rates. This is an important distinction for energy taxes as unit energy price (p/kWh) reduces as consumption levels increase. A specific tax would have a greater impact on large energy users than an ad valorem tax.

Again, in the short-run demand for fuel may be relatively inelastic. But in the longer run, consumers can invest in new and more energy efficient equipment

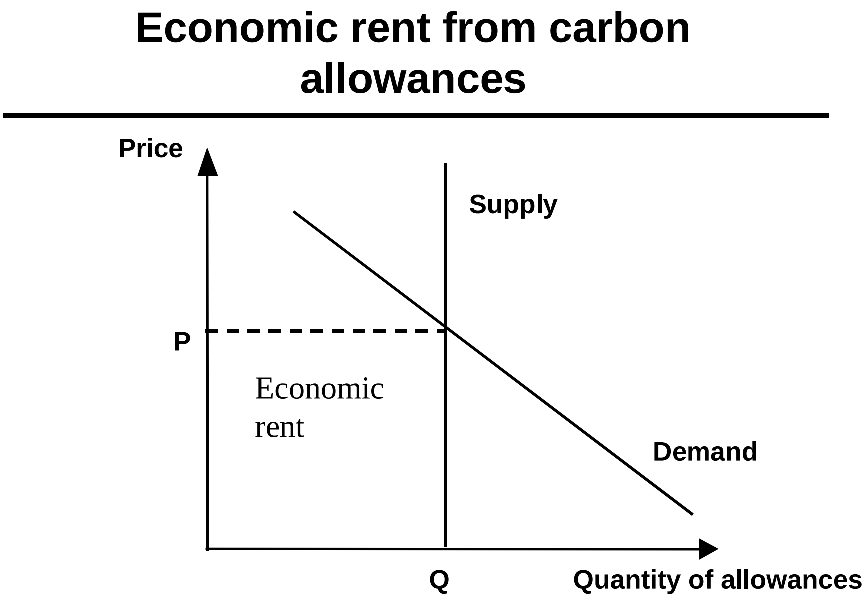
2.1.2 Economic rent

Climate policy aims to reduce carbon emissions through reducing fossil fuel consumption. It attaches a price to carbon emissions, either explicitly or implicitly, which reflects an emerging scarcity in a resource – the ability of the atmosphere to absorb CO_2 emissions. This effectively translates into an emerging scarcity in fossil fuel resources which are currently required as an input to production. *Economic rent* is defined as the difference between what firms are willing to pay for an input less the minimum amount necessary to buy and use that input. The *producer surplus,* illustrated in Figure 1.1, is that sum of economic rents earned from all scarce inputs. The fuel tax erodes producer surplus by reducing the economic rent on fossil fuel inputs. A portion of the rent is captured by the government in the form of revenue, which may be recycled in a variety of ways. For example, the revenue could be used to reduce government borrowing, reduce labour, consumption or capital gains taxes, or compensate directly affected groups. This in turn will have indirect effects throughout the economy. A number of studies have suggested that overall gains in economic efficiency may be achieved through using the revenues to reduce other forms of ('distortionary') taxation (Parry, 1997). This has become know as the 'double dividend' debate (Pezzey and Park, 1998).

These considerations are particularly important to the choice between auctioning and free allocation of permits in an emissions trading scheme. Allowances represent a new input to production whose supply is fixed. As illustrated by Figure 1.2, the price of allowances is determined by the intersection between the demand and supply curves and the economic rent is equal to the entire value of the allowances. Since this may greatly exceed the total expenditure on compliance by all participating firms (typically by a factor of ten or more), the capture of this rent is a question of the utmost political importance. With free allocation of permits, this economic rent is allocated free to participating firms, while with auctions, the economic rent is captured by government (unless the auction revenues are redistributed to the bidders). Since the revenue generated by auctions may be used either to reduce other forms of taxation, and thereby improve overall economic efficiency, or to compensate affected groups, auctions tend to be strongly advocated by economists (Cramton and Kerr, 1997).[9] But industry is equally strongly opposed to any auctioning proposals and considerations of political feasibility have dictated that free allocation remains the preferred choice in all existing and proposed schemes to date. A potential compromise that balances the objectives of efficiency, equity and political feasibility is a *hybrid* scheme, in which a proportion of the allowances are allocated free and the rest auctioned. Pezzey (2002) has explored this in detail and recommends that firms receive enough free permits so that their shareholders suffer no *significant* overall loss of welfare.

[9] Auctions have the additional benefit of providing a clear price signal for allowances. But this is secondary to the issue of economic rent and revenue raising.

Figure 1.2 Economic rent from carbon allowances



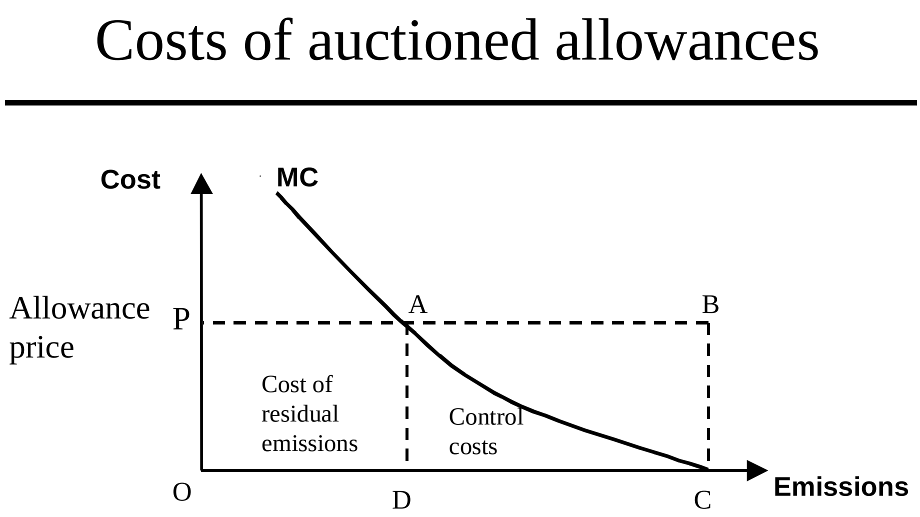
2.1.3 The impact of a trading scheme on product prices

An important and (to non-economists) counterintuitive result from economic theory is that, while the choice between auctioning and free allocation may lead to different costs for individual firms, *there should be no difference in the costs passed on in product prices*. This result rests on a number of assumptions including:

- all firms in a particular product market are covered by the allowance program;
- firms are profit maximising and take rational decisions about entry and exit;
- there is perfect competition (no market power) in both the product and allowance market;
- product prices are not subject to economic regulation (an important assumption for the electricity industry); and
- the capital market is perfect.

With an auction, firms incur costs for abatement plus the allowances purchased in the auction which are used to cover residual emissions (area OPAC in Figure 1.3). Both are real accounting costs. With free allocation, firms only incur abatement costs (area ACD), including the net cost of any acquisition of allowances. But the allowances used to cover residual emissions have an *opportunity cost* in that they could be sold on to the allowance market. The assumption is that this opportunity cost will be treated identically to real accounting costs in a firm's pricing decisions. Firms will treat their use of allowances to cover emissions as if this incurred a cost *even if* the firms received the allowances for free.

Figure 1.3 Costs to an individual firm with allowance auctioning



Original emissions = OC; Emissions after permit scheme =OD
Uncontrolled costs with permit scheme = OPBC
Costs after permit scheme = Control costs ADC + Allowance costs OPAD = OPAC
At the optimum, marginal abatement costs = permit price for all sources

With both free allocation and auctions, the choice to increase output (and consequently emissions) has a cost equal to the market price of allowances multiplied by the consequent emissions. This is an opportunity cost with for freely allocated allowances and a ‘real’ accounting cost with auctioned allowances. The rational firm should treat these in an identical manner. Viewing the situation another way, the wealth consisting of grandfathered allowances represents a *lump-sum profit* which should not influence product pricing decisions Product pricing should be based upon marginal costs, not historic costs. In the long-run equilibrium:

- the marginal abatement cost of all firms will be equal, and equal to the market price of allowances;
- the product price will be equal to long-run marginal cost, where this cost includes opportunity costs;

This result may be demonstrated algebraically. We have:

$$\text{Profit} = P(q)*q - CF - CV(q) - A[AB] – PP*AU - PP*[E(q) - AU – AB – G]$$

Where:
P(q) = the firms inverse demand curve,
q = product quantity,
E(q) = unconstrained emissions for output q
CF = fixed costs,
CV(q) = variable costs
AB = Abated Emissions

A[AB] = abatement cost, which is increasing in abated emissions AB
AU = number of allowances purchased at auction
PP = allowance price in auction which is equal to allowance price in allowance market (perfect information assumption)
G = no. of freely allocated allowances

The number of allowances that have to be bought or can be sold on the allowance market is then just [E(x)-AU-AB-G], the last term in the equation.

For auctioning G = 0, while for free allocation AU=0.

The firm faces the problem to maximise total profits and to cover all emissions through primary allocation (auction or grandfathering), abatement, or purchasing emissions on the allowance market. Since the firm is assumed to be a price taker in both the product and allowance markets, it takes P and PP as given and picks output q and abated emissions AB to maximise profits. Hence, for maximising profits, we take (partial) derivatives with respect to output q and with respect to abated emissions AB and equate both to zero:

$$(1)\ P(q) + q*dP(q)/dq - dCV(q)/dq - PP*dE(q)/dq = 0$$

$$(2)\ -dA/dAB + PP = 0$$

If the firm is a price taker in the product market, then dP(q)/dq = 0 and the product price is fixed at P. We can rewrite (1) as:

$$(1)'\ P = dCV(q)/dq + PP*dE(q)/dq$$

Where: P = product price

Equations (1) and (1)' show that firms chose output such that the marginal production costs plus the marginal costs for covering emissions associated with the additional output are just equal to the product price. From equation (2) we see, that optimising firms choose the level of abatement such that the marginal costs of abatement are equal to the price of allowances in the market, i.e. firms abate up to the point where they are indifferent between abating internally or buying on the market. Since the price of allowances PP is equal for all firms, in equilibrium, marginal abatement costs are equal across all firms. Thus, emissions trading results in an efficient allocation of resources in the economy.

The important point is that G does not feature in either equation. In other words, the level of freely allocated emissions (G), which is fixed and not a function of current output, does not affect the company's decisions. This implies that a firm which is required to acquire all its permits through an auction (G=0) will not take any different decisions on either output (q) or abatement (AB) compared to a firm which receives permits free of charge. The equation shows that the firm will always regard higher emissions as costs. Higher emissions mean foregone allowance sales, which is an opportunity cost.

In theory, therefore, the difference between auctioning and free allocation lies in the capture of the economic rent, rather than the cost increases for consumers. With free allocation, the economic rent is captured by the participating firms. This is equivalent to a lump sum subsidy and will increase the value of the participating firms, thereby making shareholders wealthier. With auctioning, the economic rent is captured by the government and may be used in a variety of ways throughout the economy, including compensating affected groups. But the price impact for the consumers of the firms products will be identical in both cases. The price impact results solely from the emission target (i.e. the scarcity value of carbon) and the corresponding abatement costs.

Whether this counterintuitive result holds in practice will depend upon the validity of the assumptions behind the economic model. For example, agency problems and other factors within firms may move them away from profit maximising behaviour (Jensen and Meckling, 1976) or a firm may be able to exercise market power. In the US Acid Rain Program the participating electricity generators were subject to utility regulation, which distorted product pricing by valuing allowances at historic cost (zero) rather than opportunity cost (Sorrell, 1994). In the case of the UK, the electricity generation market is liberalised with relatively limited market concentration, so neither of the last two problems should apply.

The result may also not hold in practice as a consequence of political objections to firm's pricing decisions. As indicated above, free allocation is equivalent to a lump sum subsidy from the government to the participating firms which acts to increase shareholder wealth. But in theory the pricing decisions made by the firms ignore this subsidy. Consumers face the same price impacts as in an auctioning scheme, but without the compensating use of auction revenues. This may be viewed politically as a form of *double charging*. Consumers pay once as taxpayers, in creating the subsidy, and a second time as consumers in purchasing the sector's products. The difficulty here is that the subsidy does not result from explicit use of taxpayers money, but results instead from the social creation of scarcity (carbon emissions) and the foregoing of the corresponding economic rent (in the form of auction revenues) that result from this scarcity. The 'inequity' of this arrangement is therefore less obvious than with an explicit subsidy.

In practice, political objections to product pricing decisions may be relatively weak. First, it may be difficult to demonstrate the explicit link between the emissions cap and final product prices - industry will have private information on production costs and many other factors are likely to complicate the picture. Second, the processes by which government could intervene, such as through competition law, will be indirect, inefficient, time-consuming and costly.

2.2 Interaction and double regulation

2.2.1 Policy interaction

In a crowded policy space with multiple policy instruments, it is very likely that individual target groups will be directly or indirectly affected by more than one instrument. For example, energy intensive manufacturing installations in the UK are currently; i) regulated under the Integrated Pollution Prevention and Control (IPPC) Directive; ii) subject to targets under the CCAs; iii) paying 20% of the CCL; and iv) incurring additional costs for electricity as a result of the Renewables Obligation.[10] These four instruments all have a primary or subsidiary objective of reducing carbon emissions and all are affecting energy intensive manufacturing installations.

If we expanded this list to include the other environmental policy obligations that affect energy intensive manufacturing installations (e.g. the Large Combustion Plant Directive) the picture would become more complex. And it would become very complex indeed if we included all the other, non-environmental policy instruments that also affected these installations (e.g. competition policy). In principle, policy instruments that are targeted at very different objectives should be relatively free of interaction. But a notable feature of climate change is that energy use is implicated in practically all economic activities and hence affected by a wide range of government policies. For example, policies to improve air quality by reducing the sulphur content of fuel will lead to increased energy use and hence increased CO_2 emissions from oil refineries. This means that there is very likely to be both interaction between climate policy instruments (internal interaction), and interaction between climate and non-climate policy instruments (external interaction). In both cases we may have:

- *interaction between policy objectives*: where the achievement of the objectives of one policy is likely to affect the achievement of the objectives of another policy; and
- *interaction between policy obligations and incentives*: where the operation of one policy is likely to affect the operation of another policy.

Since all actions imply opportunity costs there is a sense in which no two policies are entirely neutral. Indeed, the cumulative burden of regulation is a common focus of complaint by business and is used as a rationale for deregulation, even where the measures are targeted at different problems. But in the INTERACT project, our focus is on the (internal) interaction between individual climate policy instruments.

2.2.2 Double regulation

Double regulation may be loosely defined as: ‘a situation where an individual target group is affected by two or more instruments that have very similar objectives.’

The term suggests that there is redundancy in the policy mix and that having two or more instruments operating together to achieve a similar objective is unnecessary and is leading to excessive costs. An example could be where a participant in a carbon emissions trading scheme is also subject to an energy or carbon tax, where both have the primary objective of reducing CO_2 emissions. This situation already exists in the UK (direct participants in the UK ETS remain subject to the CCL) and may well become more common with the future implementation of the EU ETS.

The European Commission, in the development of the European Climate Change Programme (ECCP), has stated that is wishes to ‘...set up a coherent and co-ordinated framework of policy instruments, avoiding double or multiple regulation…..’ (CEC, 2001b). Unfortunately, the ECCP does not consider policy interaction in a systematic way and instead simply lists the policies it would like in addition to the EU ETS.

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[10] The Renewables Obligation gives targets to electricity suppliers to purchase a certain quantity of renewable electricity, rising to 10% of the total in 2010. Since renewable electricity is more expensive than fossil fuel electricity, the additional costs will be passed on to electricity consumers.

‘Double regulation’ is a negative term, but some forms of double regulation may be acceptable to the parties involved. For example, compliance with the UK Renewables Obligation in 2010 is expected to lead to an average electricity price increase for all types of consumer of 4.4% compared to 1999. At the same time, many of these consumers will be paying the CCL on electricity consumption, which at the current rate of 0.43p/kWh leads to an average 13.7% increase in electricity prices above 2001 levels for industrial consumers (3.135p/kWh). Taking both instruments together, the total increase in electricity prices for industrial consumers is likely to exceed 15%.[11] Since both the CCL and the Renewables Obligation have a primary objective of reducing CO_2 emissions, this could be viewed negatively as double regulation. But in practice, this has not been the case. The coexistence of these two measures has proved broadly acceptable.[12] There are two reasons for this:

- *Multiple objectives*: Each instrument has multiple objectives, and the full set of objectives could not be achieved by either instrument acting alone. For example, the objectives of the Renewables Obligation include encouraging the innovation and diffusion of renewable energy technologies, reducing technology costs, improving energy security and ameliorating conventional pollution problems such as acid rain. Reducing carbon emissions is only one objective and while the Renewables Obligation aims to encourage economic efficiency in renewables deployment, it recognises that renewable energy does not offer the lowest cost carbon abatement option in the short-term. Government support of renewable electricity is justified by these wider policy objectives and the acceptance of the Obligation suggests that these have legitimacy.
- *Reinforcing incentives*: The net effect of the two instruments acting together may be greater than either acting alone. For example, electricity from ‘new renewable’ sources is exempt from the CCL, and this may act as an important demand side boost to renewables to complement the supply side obligation on electricity suppliers. The net result may be faster, greater or lower cost deployment of renewables than would have been achieved by the Obligation acting alone.

The term ‘double regulation’ therefore oversimplifies a complex reality. There may be many instances where double regulation is either acceptable or positively beneficial. To assess whether this is the case it is necessary to examine (Sorrell, 2001b):[13]

- *The nature of the objectives:* The objectives of each policy must be systematically compared, taking into account the likely changes required of the target groups to meet the policy objectives. Each pair of objectives may then be classified as: a) *counterproductive,* where the achievement of one objective is likely to undermine the achievement of another; b) *neutral,* where the achievement of one objective is likely to have no or minimal effect on the achievement of the second objective; or c) *reinforcing,* where the achievement of one objective is likely to reinforce the achievement of another. In practice, this judgement is one of degree, distinguishing objectives which are slightly counterproductive from those which are inherently incompatible.

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[11] This assumes that the additional costs incurred by suppliers in purchasing renewables are passed on equally to all electricity consumers. But some of the costs may be recouped by selling renewable electricity at a premium price, while at the same time renewables are exempt from the CCL. The precise impact on individual consumers and for individual kWh of electricity may therefore be different.

[12] Which is not to say that the policy process was entirely straightforward. For an account of the political debates leading up to the introduction of the CCL, see Smith (2002b).

[13] In some cases, this analysis could use quantitative modelling, but this report will use qualitative methods.

- *The nature of the obligations and incentives*: Each instrument imposes obligations and incentives on the target groups which will encourage behavioural change. As with objectives, the obligations and incentives may be compared to identify their degree of compatibility. This may be considered as lying on a continuum from mutually reinforcing to direct conflict.

Hence, the objective is not to avoid 'double regulation', but to determine the circumstances in which interaction between two policies is either acceptable or unacceptable. This involves the evaluation of particular policy options against specified evaluation criteria, such as economic efficiency and political acceptability. In particular, the interaction should not be perceived to be placing an unfair burden on particular target groups.

Taking the example of the EU ETS, it is not immediately obvious that a participant in the trading scheme should be exempt from the CCL. To assess whether this is desirable will require an analysis of the overall objectives of each policy and of the nature of the obligations and incentives, including the size of the resulting price signals and the corresponding economic impacts. This is one of the objectives of this report.

2.3 Ownership of emissions and double counting

2.3.1 Trading scheme designs

There are two broad choices in the design of cap and trade schemes for CO_2 emissions:

- *Upstream*: An upstream scheme requires fossil fuel *producers*, together with processors and transporters to surrender allowances for the CO_2 emissions embodied in the fuel processed, transported or sold by them. Participants include oil refineries, coal producers and gas processing plants. Nearly all emissions from fossil fuels would be covered.
- *Downstream*: A downstream system requires fossil fuel *users* to surrender allowances for their emissions. Users could include electricity generators, industrial plants and commercial facilities. Administrative considerations are likely to confine this type of system to larger users and hence only a portion of fossil fuel emissions would be covered.

A *hybrid* scheme is also possible. In this, large users would be required to hold allowances for their emissions, while smaller energy users would be covered upstream by requiring fuel producers to surrender allowances for the fuels consumed by these users. In this way, comprehensive coverage of fossil fuel emissions could be achieved.

Each option has pros and cons, but the upstream scheme presents particular difficulties as it would effectively place a cap on the market for fossil fuels. If fossil fuel demand is inelastic in the short term, fuel prices may rise significantly, with negative effects for all classes of consumer including householders. The economic and equity consequences may be considered unacceptable, particularly for low income consumers. If allowances were freely allocated, energy producers would be receiving an extremely valuable asset, equivalent to a lump sum subsidy, which may be hard to justify in the context of high price rises.[14] Energy consumers

[14] A similar subsidy is implied by free allocation of allowances to fuel consumers in a downstream scheme, but here there may be a stronger argument that the subsidy is required to compensate for economic losses.

on the other hand, would be required to pay extra costs for their entire fuel purchases, in contrast to a downstream scheme with free allocation where consumers would only pay for the additional allowances required for compliance. From the perspective of consumer an upstream scheme with free allocation is similar to a carbon tax, but with the level of the 'tax' being unpredictable and without revenue recycling to the affected groups.[15] As a consequence, most practical policy proposals to date, including the EU ETS, have focused on downstream schemes. The Norwegian proposals are an exception, as these are for a hybrid scheme (Hassellknippe, and Hoibye, 2000).

If a downstream scheme is chosen, there is a further choice required on the treatment of electricity generation (Zapfel and Vanio, 2001):

- *Direct allocation*: Here, carbon allowances are allocated to electricity *generators* based on fossil-fuel use, with energy using organisations being required to hold allowances for on-site fossil fuel use.
- *Indirect allocation*: Here, carbon allowances are allocated to electricity *consumers* based upon electricity consumption and an assumed carbon intensity of electricity production and distribution. Energy users then hold allowances for *both* electricity consumption and the direct use of fossil fuels. Electricity generators are exempt from the trading scheme.

Direct allocation has been chosen for the EU ETS. Here, electricity prices will rise to reflect a portion of the marginal abatement cost for scheme participants. Electricity consumers participating in the trading scheme will make abatement decisions (i.e. choose between energy efficiency, substitution between electricity and fossil fuel, cogeneration, and use of the allowance market) based upon: a) an electricity price which has internalised the cost of carbon abatement; and b) the price of carbon allowances relating to their on-site use of fossil fuel.

In contrast, the UK ETS and the CCAs have chosen indirect allocation. This follows the political objective of preventing electricity cost rises from being passed on to domestic consumers. This would be hard to avoid if allowances were required for fossil fuel inputs to electricity generation.

2.3.2 Ownership and control of emissions

Ownership

As with upstream and downstream, both direct and indirect allocation have advantages and disadvantages and each option is internally consistent. But problems arise when attempts are made to either:

- make a transition from one type of scheme to another; or
- trade fuel, electricity or allowances between participants in two different types of trading scheme.

This is because the *ownership* of emissions may become disputed. 'Ownership' here is defined as the legal right to make use of a portion of the atmospheric commons as a sink for carbon emissions. Emission limits, whether fixed or tradable, are therefore understood as a

[15] If allowances are freely allocated there is no revenue to recycle.

form of property right over the atmospheric commons. Here, ownership is understood as having three elements (Furubotn, and Richter, 1997, p77):

- *ius utendi*: the right to make use of an asset;
- *ius fruendi*: the right to appropriate the returns from an asset; and
- *ius abutendi*: the right to change the form, substance and location of an asset, including sale to another at a mutually agreed upon price.

Fixed emission limits represent a limited form of property right over the use of the atmospheric commons. They give the holder the rights of *ius utendi* and *ius fruendi* but, since the emission limit is not tradable, they do not provide the right of *ius abutendi*. In contrast, allowances in an emissions trading scheme can be considered a fuller form of property right as they provide the holder with all three dimensions of ownership, including the right to sell the allowances and to benefit from the proceeds of that sale.

Control

In the simplest situation, the owner of an asset has full control over its use, which in turn dictates the income or utility derived from the asset. For example, an individual normally has full control over the use of her motor car. In more complex situations there is a separation between ownership and control. For example, stockholders have ownership of a company, but the responsibility for day-to-day operation and investment decisions is in the hands of the company managers.[16] In the case of emissions trading, downstream schemes and schemes with direct allocation allocate the ownership of the allowances to those organisations that have *direct* control over emissions (e.g. fuel users; electricity generators). In contrast, upstream schemes and schemes with indirect allocation allocate the ownership of the allowances to those organisations that have only *indirect* control over the corresponding emissions (e.g. fuel suppliers; electricity consumers).

The relative allocation of ownership and control has important implications for the operation of a trading scheme, including the incentives created for participants and the corresponding investment and behavioural changes. This is particularly important for the treatment of electricity. Here, electricity generators have full and direct control over the carbon intensity of electricity generation through investment and operational decisions, such as fuel switching. However, generators have only indirect and partial control over total electricity demand, through changes in electricity prices.[17] Changes in demand will lead to changes in emissions, but these changes derive from the operational and investment decisions of electricity consumers. These in turn face electricity costs which include the generation cost of electricity which has internalised the market price of carbon, together with the costs associated with other upstream and downstream regulatory interventions. In this respect, the generators are no different from any other participants in a downstream trading scheme: all participants have only partial control over the demand for their product and all participants may have product demand influenced by other factors including environmental regulations.

In contrast, electricity consumers have full and direct control over their electricity demand, through investment and operational decisions such as energy efficiency, but have *no* control

[16] This ‘principal-agent’ situation is the basis of an extensive economic literature (Milgrom and Roberts, 1992).

[17] A cap on generator emissions may incentivise generators to engage in demand-side management activities, if these can reduce demand and hence emissions at a lower cost than supply-side efficiency improvements or fuel switching. But this raises a number of complex issues regarding the structure of the electricity industry.

over the carbon intensity of electricity generation. Partial control could be envisaged through the use of 'carbon labelling' of electricity, but at present this option is not available in the UK. Instead, the carbon intensity of imported electricity is typically estimated using a fixed emission factor (see section 4.3). An important consequence of this is that there is likely to be a *discrepancy* between the estimated emissions calculated using the fixed carbon intensity factor, and the actual emissions from electricity generation. This discrepancy may be expected to increase with time.

Ownership disputes
Disputes over the ownership of emissions may arise both with traditional regulations, using fixed emission limits, and with emissions trading schemes. A dispute over ownership may arise, for example, where a source has a fixed emission limit and is at the same time participating in an emissions trading scheme. Both the fixed and the tradable emission limit given the source ownership rights over a portion of the atmospheric commons: if in this situation, a single source has been give two separate and overlapping property rights. However, this situation may equally be viewed as a particular type of double regulation. The more interesting situations result from disputes over ownership between two emissions trading schemes – for example, situations where an individual source is simultaneously participating in two emissions trading schemes. It is these situations which will be explored here. The problems that result can be grouped under three broad headings (Zapfel and Vanio, 2001):

- double slippage;
- double coverage; and
- double crediting.

The following sections discuss each of these problems in turn.

2.3.3 Double slippage

This is where the regulatory coverage of emissions is lost. It is particularly relevant to the trading of electricity between participants of two national trading schemes, where one has indirect accountability for the emissions from electricity generation and the other has direct accountability

Suppose country A has a trading scheme with indirect accountability, and country B has a scheme with direct accountability. And suppose country A exported electricity to country B. Emissions from country A would have increased as a consequence of the fossil fuel used in electricity generation. But no entity would have surrendered allowances as the generators in country A are not covered by the trading scheme and the electricity is not consumed by scheme participants. Similarly, no entity in country B would have surrendered allowances since their electricity consumers are not accountable for the emissions from electricity generation. The emissions are 'missed' by both trading schemes. Note that this would not have been the case if the electricity had been consumed in country A by participants in the trading scheme, since these would have surrendered allowances.

The importance of this problem can be overstated. If the electricity had been consumed in country A by some entity other than a participant in the trading scheme, then the same problem would result. This is because country A does not have full coverage of emissions from electricity generation. Emissions can be 'lost' within country A because of the incomplete coverage of its emissions trading scheme.

However, this scenario *would* be important for two neighbouring EU countries that have large inter-country electricity flows. The emissions associated with the exported electricity may be substantial, but neither the exporter or the importer would be liable. This could distort competition in the generation market – for example, electricity imports from country A could displace electricity from the national generators in country B, because the price of the latter includes carbon abatement costs but the price of the former does not. Cross-border trade in electricity is becoming increasingly important in the EU as the electricity market is being opened up to full competition. The possibility of double slippage and competitive distortions to the electricity market in this context is one of the primary reasons the Commission has proposed a harmonised EU trading scheme with direct allocation to electricity generators (Zapfel and Vaino, 2001).

2.3.4 Double coverage

This is the mirror image of the above scenario. Suppose country B exported electricity to a company in country A which was a participant in the latter's' trading scheme. Electricity generators in country B would need to surrender allowances to cover the emissions associated with this electricity. And the company purchasing the electricity in country A would also need to surrender allowances. In other words, two sets of carbon allowances would be surrendered for the same quantity of electricity. The emissions associated with that electricity would be covered twice by two separate trading schemes.

The allowances surrendered by the generator in country B would accurately reflect the associated emissions (assuming adequate monitoring etc.). In contrast, there would be a *discrepancy* between the allowances surrendered by the purchasing company and the actual emissions associated with the electricity, since the allowance calculations would be based upon an estimated emission factor for the generation mix in country A, not country B. This *discrepancy* between estimated and actual emissions is an inherent risk of an indirect system that estimates emissions from electricity consumption using a fixed emission factor. Moreover, it is worse for cross-border trade in electricity as the emission factor refers to a *different* national electricity system. But in this case, the discrepancy problem is overshadowed by the fact that emissions are covered twice (double coverage).

A similar scenario is possible if energy commodities (coal, oil, gas etc.) are traded between two countries, where one has an upstream trading scheme and one has a downstream scheme. Suppose country A had the upstream scheme, and country B the downstream scheme and that country A was exporting fossil fuel to country B. Fossil fuel exporters in country A may have to surrender allowances (to A's government) corresponding to the carbon content of the coal/oil/gas, while downstream consumers in country B may also need to surrender allowances (to B's government) corresponding to the carbon emissions from the fuel. As before, two sets of carbon allowances would be surrendered, this time for the same quantity of fossil fuel. In this case, there is no discrepancy problem but there is still a double coverage problem.

In practice, the above scenario is less likely than double coverage of electricity emissions. Under the Kyoto Protocol, Parties are accountable for the carbon content of fuels they produce and import, but not for the carbon content of fuels they export (since these lead to emissions in another country). This means that, in the above scenario, the fossil fuel exporter in country A was not need to surrender allowances for fossil fuel exports and the emissions would only be covered once. Since fossil fuel import/exports can be relatively easily tracked, implementing this should not present a major administrative difficulties. In contrast, it is much more difficult to account for cross border electricity trade since here the allowances are surrendered by generators when generating the electricity, while the electricity is traded by separate supply companies.[18] In principle, compensation mechanisms would be required which linked the volume of electricity exported to the generation from individual plants.

2.3.5 Double crediting

The third situation is where two sets of carbon allowances are *generated* from a single abatement action. Again, suppose country B has a trading scheme with indirect accountability, and country A has a scheme with direct accountability. Suppose further that an electricity generator in country A was exporting electricity to a company that was participating in country B's trading scheme. If the purchasing company reduced its electricity consumption, this would: a) free up allowances in country B's scheme that are owned by the purchasing company; and b) free up allowances in country A's scheme that are owned by the generator (since less electricity is generated, emissions are reduced). In this case, two sets of carbon allowances are freed up, or 'generated' from a single abatement action. The avoided emissions are 'credited' twice in two separate trading schemes.

Similar types of double crediting problem may arise if: i) an upstream trading scheme was introduced in a country which had an existing downstream trading scheme; or ii) a trading scheme with direct allocation was introduced in a country which had an existing trading scheme with indirect allocation (assuming, in both cases, that the existing scheme was left unchanged). The second of these situations is exactly that currently faced in the UK. The EU ETS is a cap and trade scheme with direct allocation. But the UK already has baseline and credit policy instruments with indirect allocation. These instruments allow for the generation of carbon credits from projects that reduce electricity demand. They include not only the CCAs but also the direct participants in the UK ETS, the project based element of the UK ETS, and the Energy Efficiency Commitment (EEC) on electricity suppliers (Sorrell, 2001a; Smith, 2002a). These instruments effectively give the 'ownership' of emissions associated with electricity generation to electricity consumers (indirect allocation). In contrast, a cap and trade scheme gives the 'ownership' of emissions to electricity generators (direct allocation). Coexistence of the two leads to both double coverage and double crediting problems. And coexistence will occur if the EU ETS is introduced in the UK, without first changing these existing policy instruments.

The problem is most clearly illustrated by the current proposals for emission reduction projects in the UK (Begg et al 2002). These are baseline and credit arrangements analogous to JI and the CDM, but for projects within the UK. One of the priority sectors for such projects is the non-domestic building sector (public, commercial and industrial buildings). Projects that reduce energy (fuel or electricity) use in these buildings may be eligible for carbon credits. The number of credits is calculated from the difference between actual energy consumption and an estimated counterfactual baseline. The carbon associated with electricity

[18] Problems could be avoided here if the ownership of the allowances was placed in the hands of electricity suppliers. Then it would be relatively simple to make the electricity exports exempt from the requirement to surrender allowances. However, allocating allowances to electricity suppliers creates a separation between the ownership and control of emissions and consequent difficulties with the operation of the trading scheme.

consumption in these projects is calculated using a fixed emission factor, similar to that used for direct participants in the UK ETS (Sorrell, 2001a). But at some point in the future the UK may join the EU ETS. If so, UK electricity generators will be required to hold allowances for their fossil fuel consumption. If the emission reduction project continues after this date, we will have a situation in which: a) the project is generating credits from reductions in electricity demand, which are allocated to the project developer; and b) the reduced electricity demand is also freeing up allowances from electricity generation, which are allocated to the generators. Again, two sets of carbon allowances have been generated, or 'freed up', from a single abatement action.

Similar problems apply to the coexistence of the EU ETS with the CCAs, direct participants in the UK ETS and the Energy Efficiency Commitments. In each case the same problem does *not* apply at present since the electricity generators are not participating in the UK ETS. They do not have allowances and hence no allowances are freed up.

2.3.6 The scale of the problem

Each of the above problems is theoretically possible in situations where either a transition is being made from one type of trading scheme to another, or participants in two separate trading schemes trade fuel, electricity or allowances with each other. As with double regulation, the relevant question is: does this matter?

The question is particularly important for double crediting, as in some circumstances this may violate the environmental integrity of an emissions trading scheme. If this is the case, one response could be that double crediting was unacceptable in principle. If so, this would seriously constrain the options for making a transition from one trading scheme to another, or for linking trading schemes. For example, it may not be possible to introduce the EU ETS into the UK without first changing the CCAs, Energy Efficiency Commitment and UK ETS.

At the other extreme, double crediting could be seen as a price worth paying for facilitating either the introduction or linking of trading schemes. A relevant analogy here is the existence of 'hot air' in trading schemes. Both the Kyoto framework itself, and the UK ETS have included some 'hot air' in the initial allocation. While this runs the risk of damaging the public credibility and environmental integrity of emissions trading, it has also greatly facilitated political consensus. Hot air has been seen as a quid pro quo for persuading both countries and companies to accept a binding emissions cap. In a similar manner, a small amount of double crediting could be seen as an acceptable price to pay to gain political acceptance of a particular policy option.

In practice, much is likely to depend upon the likely *scale* of the double crediting and the *timescale* over which it is anticipated to persist. For example, if only a small number of relatively small scale emission reduction projects are expected, the double crediting described above may be considered to be largely irrelevant. Conversely, if very large projects are expected, which will generate credits over a long period of time (e.g. life extension of nuclear power stations), then double crediting may be considered a serious problem. An assessment of the acceptability of double crediting may therefore require some quantitative estimates of the likely scale and timeframe. This may be easier to do for some policy options than for others.

2.4 Differential treatment and equivalence of effort

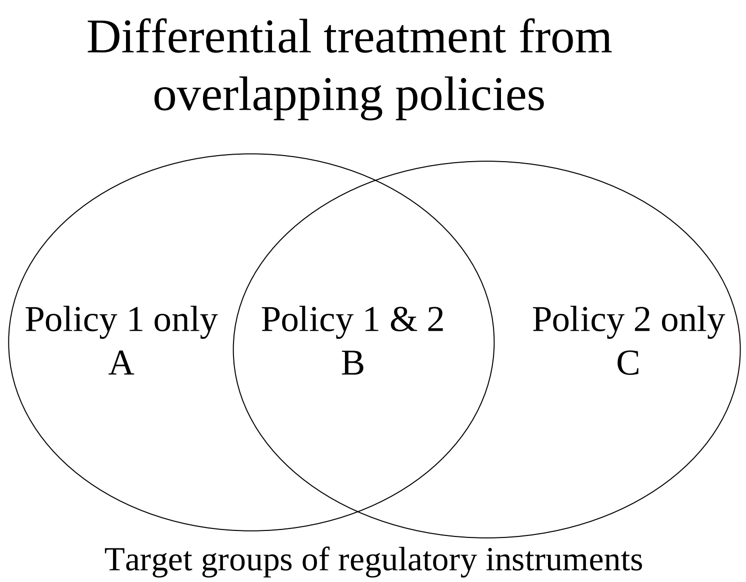
2.4.1 Differential treatment

The political debate over environmental regulation is dominated by concerns over distribution consequences and the potential impact on industrial competitiveness. Interest groups seek to minimise the impact of regulation, often to the detriment of economic efficiency or environmental protection. For climate policies targeted at industry, a primary focus of complaint is the *differential treatment* of companies or sectors. Typically, there are three areas where this concern may arise:

- between individual companies affected to different degrees by a particular policy;
- between companies affected by a policy and those not affected within the same country;
- between companies affected by a policy and companies in other countries which may be either unregulated or subject to different policies.

Of particular relevance here is the fact that differential treatment may result from individual companies being targeted by more than one policy. In Figure 1.4 for example, companies in area B are affected by policies 1 and 2, while companies in area A are only affected by policy 1.

Figure 1.4 Differential treatment from overlapping policies



Differential treatment is only relevant to competitor companies. So, for example, the fact that carbon emissions from the UK brewing industry are regulated more strictly than carbon emissions from the UK mechanical engineering industry should not be of concern. Similarly, the importance of differential treatment will depend upon the extent to which the sector or companies are exposed to international competition. The Dutch proposals for a national emissions trading scheme make a distinction between sheltered and exposed sectors, with the latter defined as having exports exceeding 15% of domestic production or competing imports exceeding 15% of domestic demand (Dutch CO_2 Trading Commission, 2002). In practice, exposure to international competition is a matter of degree. In addition, the impact of a policy on a sector's competitiveness will depend upon (Ekins and Speck, 1998):

- the nature, form and stringency of the policy;
- the speed of introduction of the policy;[19]
- the energy or carbon intensity of the sector's product and the scope for substitution towards products with a lower environmental impact;
- the opportunities available for improving energy efficiency; and
- the scope for technological innovation.

There are three grounds on which differential treatment could be a concern. First differential treatment may be subject to *legal* challenge under competition law at the national, EU and international (WTO) level. In this context, the EU internal market and associated state aid regulations are of particular importance. The political debate on the EU ETS has centred around the balance between harmonisation and subsidiarity and similar conflicts can be anticipated in the development of rules for allowance allocation (CEC, 2000; Egenhofer and Mullins, 2000). Article 87(1) on state aid in the EC Treaty states that:

> '… any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market.'

This state aid rules are complicated by certain exemptions, including those for environmental protection (OJ, 2001) and require legal interpretation in individual cases. Also, the rules refer to the *explicit* provision of resources to companies, and do not cover the exemption of firms or sectors from emission reduction requirements where these are not mandatory under EU law. Similarly, national regulations that *disadvantage* (as opposed to advantage) a Member State company compared to companies in other Member States would not be incompatible with state aid rules.

Differential treatment may also be challenged on *political* grounds if it is seen as creating competitive distortions. Political objections may carry weight even where competition law is not violated. The validity of such arguments is typically the subject of intense debate and it should be recognised that individual policies may damage the competitiveness of individual sectors while having a beneficial effect on the competitiveness of the economy as a whole. One difficulty here is that there is no unambiguous definition of competitive distortion. For example, if one Member State allocated permits for free and a second used auctioning, the firms in the first country will have improved their financial position relative to the second since they will have received a factor of production for free. But this cost advantage should have *no* impact on product prices. Firms with free allocation will have received a windfall profit, while firms that had to buy permits will have incurred a higher cash outflow and hence suffered a financial loss. So is this a competitive distortion? Woerdman (2002) has argued that ambiguity in EU law (particularly the state aid rules) makes it unclear whether such a

[19] Gradual introduction can avoid stranded assets and allow more energy efficient capital goods to be installed as part of the normal investment cycle.

situation would be considered as creating a competitive distortion or not. But whatever the legal interpretation, such a situation would inevitably be challenged on political grounds.

Finally, differential treatment may be challenged on *environmental* grounds if it appears to create a risk that pollution will be displaced from one sector to another, one country to another, or one type of installation to another. Empirical evidence suggests that investment decisions are overwhelmingly driven by factors other than environmental compliance costs, so this concern may be overstated (Jaffe et al 1995). However, since the costs associated with carbon abatement may exceed those for other pollutants, the scope for such displacement (carbon leakage) may be greater.

Some forms of differential treatment may be challenged on a combination of legal, political and environmental grounds. For example, stricter regulations for new plant as compared to existing plant (as is normal under traditional regulation) may both inhibit entry into a market and slow the diffusion of cleaner technology. Similarly, differential treatment may create perverse incentives that undermine economic efficiency and increase pollution. For example, if organisations are eligible for a derogation on an energy tax if their energy use is above a certain threshold, there may be an incentive for them to increase their energy use until they cross that threshold.

2.4.2 Equivalence of effort

A related concept which has gained prominence during the development of the EU ETS is *equivalence of effort*. Here, the concern is to ensure that comparable companies in different Member States are required to undertake measures of equivalent effort to reduce carbon emissions:

> 'Regarding the distribution of the economic burden to mitigate GHG emissions between sectors and between companies within sectors the principle is that there should be an *equivalence of effort* between all companies whether they are part of the trading scheme or not. This means that companies outside the trading scheme should be subject to policies and measures that are equally as demanding as emissions trading.' (CEC, 2000)

One interpretation of 'equally demanding' could be equal percentage cuts in GHG emissions. But companies and national economies differ substantially in GHG intensity, abatement potential and obligations under the burden sharing agreement, so a more appropriate interpretation would be (approximate) equality in marginal abatement costs (€/tCO_2). This is what an emissions tax or emissions trading scheme achieves (in theory), although the average or total costs faced by individual participants will differ. The flexibility in compliance offered by a trading scheme is not available under other types of regulation and this commonly leads to differential treatment according to the perceived 'affordability' of emission reduction. For example, the Air Framework Directive requires regulators to consider '…the economic situation of undertakings belonging to the category in question' (CEC, 1984). In principle, this means that the stringency of regulation may depend upon the competitiveness of a company or sector (Sorrell, 2002c).[20]

[20] With this, it is possible to envisage two similarly polluting industrial processes in different sectors where more demanding techniques are required for one than for the other, reflecting their differing competitive positions. In other words, a higher level of environmental gain could be obtainable for a given level of total investment if the investment were differently distributed.

Demonstrating equivalence of effort

Whatever interpretation is given, the demonstration of equivalence of effort is likely to pose severe practical difficulties. First, there may be substantial differences in the *scope* of different policy instruments. For example, suppose we were attempting to demonstrate the equivalence of existing negotiated agreements in one Member State with membership of the EU ETS in another. The negotiated agreements may cover both fuel and electricity use, while the EU ETS only covers fuel use. Similarly, the negotiated agreements may exclude process CO_2 emissions, while the EU ETS include process emissions. It is difficult to see how instruments can be considered equivalent when their scope of coverage is so different.

Second, there may be differences in the *form* of different policy instruments. For example, the negotiated agreements may have relative targets (energy use per unit of output), while the EU ETS has absolute targets (tonnes of carbon). There are three strong reasons why relative targets cannot be considered equivalent to absolute targets:

- Absolute targets gives certainty in the environmental outcome (assuming adequate monitoring and enforcement etc.), while relative targets do not. With relative targets, increasing output will lead to increasing emissions.[21]
- Absolute targets give scope for auctioning and hence revenue raising. The revenue may be used in a variety of ways to increase the economic efficiency of the scheme and to compensate affected groups. In contrast, relative targets implicitly use free allocation, so there is no scope for using revenue.
- Relative targets effectively act as a subsidy on production (Gielen et al, 2002). For example, if we compare two trading schemes for the same industrial group with relative and absolute targets, emissions will be higher in the relative scheme for the same level of marginal abatement cost and allowance price.

Finally, there may be differences in the *stringency* of different policy instruments, where stringency is defined in terms of marginal abatement costs. These, however, may be difficult to observe either ex ante or ex post. Industry has private information on abatement costs which is difficult and costly for the regulator to obtain. Furthermore, the motivation of the regulated party is to reduce the stringency of regulation by exaggerating estimates of abatement costs. This commonly leads to a gap between ex ante and ex post estimates of abatement costs (Bailey and Haq, 2001). While trading schemes provide a clear signal of marginal abatement costs in the allowance price, there is no comparable signal from measures such as negotiated agreements. Measuring and estimating abatement costs for such instruments is likely to prove burdensome for national regulators. It is considerations such as these which have led the Commission to propose a mandatory and harmonised emissions trading scheme, and to exclude the possibility of opting-in or opting-out of the scheme at a national, sector or company level.[22] For example, in commenting on the opt-in option, the 2000 Green Paper noted that:

> '...a differentiated implementation strategy would be highly complex to manage. In this case, the Community would have to have an active role in overseeing what the Member States were doing, and in evaluating the effect on competition between comparable companies in different Member

[21] In this respect, the relative target is similar to an emissions tax, but without the certainty of emissions control costs that a tax provides.

[22] Earlier drafts of the Directive included opt-out provisions, but these were excluded from the published version in 2001 (CEC, 2001a).

States. If different member States were to include different sectors and different gases, the various combinations could be too numerous to be able to ensure coherence and transparency.' (CEC, 2000)

Importance of equivalence of effort

Given these difficulties, it is important to ask whether the prominence given to equivalence of effort is appropriate. While it is true that differences in regulatory stringency may distort competition, this has to be set in the context of a host of other differences in both factor prices (e.g. energy, raw materials, labour) and broader fiscal and regulatory requirements (e.g. corporation tax). While harmonisation is proceeding in some of these areas in the EU, progress is relatively slow (e.g. energy taxes). This suggests that the differences in factor prices are likely to remain.[23] As an example, Table 1.2 shows industrial electricity and gas prices in the EU and G-7 countries expressed as a percentage of UK prices. This illustrates that Swedish electricity prices were only half those in the UK, while Japanese industrial electricity prices were more than twice UK levels. Variations in gas prices were smaller, and both electricity and gas prices may converge in the EU with further liberalisation of energy markets.

Table 1.2 Industrial electricity and gas prices in the EU and G7, compared to UK prices (1999)

	Industrial electricity prices (% of UK prices)	Industrial gas prices (% of UK prices)
Austria	121	143
Belgium	84	120
Denmark	105	
Finland	77	129
France	72	136
Germany	104	173
Greece	77	
Ireland	92	159
Italy	146	159
Luxembourg		
Netherlands	96	114
Portugal	144	
Spain	91	129
Sweden	51	
Canada	54	66
Japan	207	396
US	62	111
UK prices	***3.92p/kWh***	***0.56 p/kWh***

Source: DTI (2002)

In a similar manner, exchange rate fluctuations can dwarf for the impact of environmental regulations. For example, the deterioration in the terms of exchange as a result of the appreciation of sterling against European currencies increased the cost of exporting to Europe by between £22 billion and £29 billion between 1997 and 1999 (ECOTEC, 1999). This compares to the total of only £1 billion raised by the CCL. This problem has been mitigated

[23] The constant search for lower factor prices is a fundamental source of competitive advantage.

in the EU by the introduction of the Euro, but remains an issue for the UK. In general, it is clear that high factor prices and unfavourable regulatory or fiscal treatment can act together to worsen competitiveness. But it is equally clear that the competitiveness impacts of environmental regulation can be exaggerated (Ekins and Speck, 1998).

These issues are highly pertinent to examining implementation options for the EU ETS. For example, the UK would like to obtain an opt-out from the EU scheme up to 2008. This would mean that energy intensive UK industry would be subject to relative rather than absolute targets under the existing CCAs, and the UK electricity generators would not be regulated at all. Would the exemption of the UK generators violate internal market rules? Perhaps not, given that international electricity trade between the UK and the continent is relatively small and mostly consists of imports from French nuclear power stations. Similarly, would the relative targets under the CCAs be considered to be equivalent to the absolute targets taken on by competitor companies in other EU Member States?

2.5 Summary

Any analysis of the interaction between emissions trading schemes and other policy instruments raises difficult questions regarding four key issues:

- *Regulatory impact and cost incidence*: The issue here is the economic impact of different policy instruments and extent to which the costs will be borne by consumers, employers, suppliers or shareholders. This can best be estimated through economic modelling, but since different approaches can lead to very different results this still leaves considerable scope for disagreement. For emissions trading, a central issue is the capture of the economic rent from allowance distribution. Free allocation amounts to a lump sum subsidy to participating firms, while auctions allows the government to capture the rent and to use the revenue to compensate affected groups and improve the economic efficiency and environmental effectiveness of the scheme. While auctioning will have wealth impacts for participants, the impact on product prices should be identical to that with free allocation. Whether this theoretical result will hold in practice, however, is open to question.
- *Interaction and double regulation:* The issue here is the interaction between policy instruments and the extent to which any apparent 'double regulation' will be seen as imposing unfair burdens upon particular target groups. While 'double regulation' is a negative term, then may be many instances where policy interaction can be either acceptable or positively beneficial. To assess whether this is likely to be the case, it is necessary to examine the multiple objectives of each instrument and the obligations and incentives they placed upon individual target groups.
- *Ownership of emissions and double counting:* The issue here is the 'ownership' and control of carbon emissions and the problems that arise if ownership is disputed. It is particularly important where participants in two separate emissions trading schemes are trading fuel, electricity or allowances with each other. In general, emissions trading schemes are likely to be more effective when the ownership of allowances is closely aligned with the control over emissions. Ownership disputes fall into three broad categories: a) double slippage, where the regulatory coverage of emissions is lost; b) double coverage, where two instruments give ownership of the same physical emissions to two separate parties, or to the same party under two separate terms; and c) double crediting, where disputing claims over the ownership of emissions allow two separate

carbon allowances or carbon credits to be generated from a single abatement action. Each type of problem introduces complexity into the regulatory situation and double crediting in particular may threaten the environmental integrity of an emissions trading scheme. But the importance of double crediting will depend upon the scale of the problem and in many cases it may be overlooked.

- *Equivalence of effort*: The issue here is the extent to which different groups are treated differently by environmental policy instruments and whether the obligations imposed upon one target group can be deemed equivalent to those imposed upon another. Differential treatment may be challenged on legal, political or environmental grounds and is often of central importance in the debate over environmental policy instruments. Demonstration of equivalence of effort may be required as a means to avoid differential treatment when an installation, company, sector or Member State is exempted from a particular policy instrument. But in practice, differences in the scope, form and stringency of policy instruments may make equivalence of effort extremely difficult to assess. Furthermore, the importance of environmental regulations in determining the competitiveness of individual companies can easily be exaggerated.

The assessment of the scale and importance of each issue is far from straightforward and often contentious. While quantitative modelling may help in the assessment of policy impacts, qualitative judgements are still required on the relative desirability of different policy options. This will inevitably involve trade-offs between economic efficiency, equity and political feasibility. For example, exempting firms with existing negotiated agreements from a trading scheme may enhance political feasibility, while at the same time undermining economic efficiency and environmental effectiveness. Any judgement on the desirability of a particular policy option will therefore require multi-criteria assessment with explicit weighting of policy objectives.

3. Confusion over instrument scope

3.1 Introduction

In this section and the following three sections we assume that the EU Directive is implemented *without* changing the CCL/CCA package. In other words, we ask: 'what would happen if the EU ETS and the CCL/CCAs operated alongside each other?' The aim is to identify how and why the policies affect each other and the impact on directly and indirectly affected target groups.

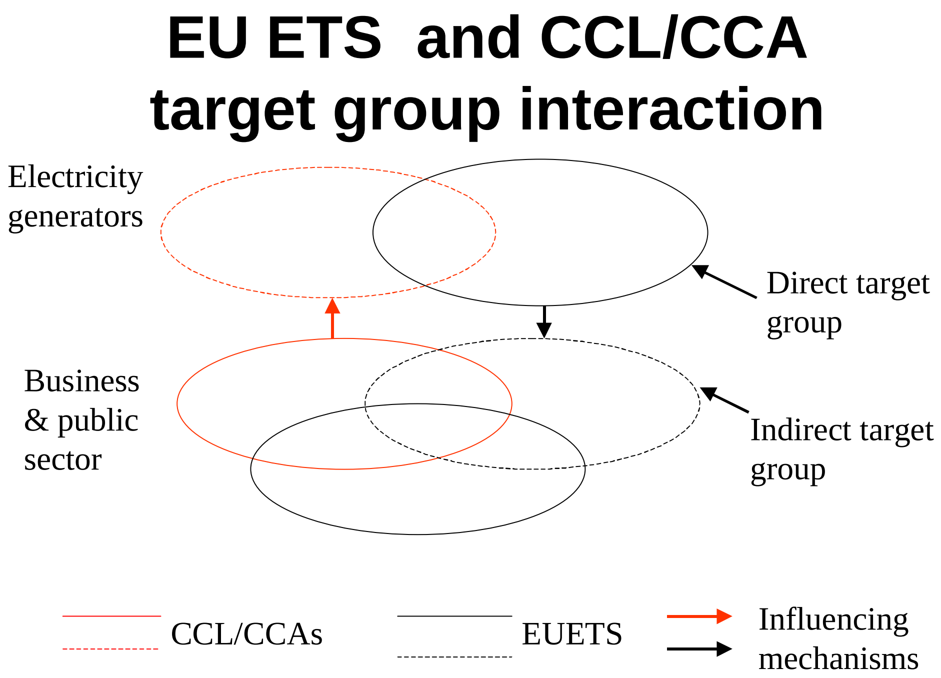
Scope means the *target groups* affected by the each instrument. A *directly* affected target group has rules and obligations imposed upon it directly by the policy. An *indirectly* affected target group is influenced in some way by the behavioural changes made by the directly affected target group (e.g. by a change in market prices). So for example, electricity generators are directly affected by the EU ETS, while electricity consumers are indirectly affected as they face higher electricity prices as a consequence of the abatement measures taken by electricity generators. Indirect effects permeate throughout the economy. But here we will confine attention to the most immediate indirect impacts - primarily those relating to electricity markets.

The interaction between the EU ETS and the CCL/CCA package is illustrated in Figure 3.1. It exhibits both the following forms:

- *Direct target group interaction*: the target group directly affected by the CCL/CCA overlaps with the target group directly affected by the EU ETS; and
- *Indirect target group interaction*: where:
  - the target group *directly* affected by the CCL/CCAs overlaps with the target group *indirectly* affected by the EU ETS; and
  - the target group *indirectly* affected by the CCL/CCAs overlaps with the target group *directly* affected by the EU ETS.

These interactions differ in their relative importance. Most of what follows focuses on direct target group interaction. The most important indirect interactions relate to the treatment of electricity and are discussed more fully in section 3.5.

Figure 3.1 EU ETS and CCL/CCA target group interactions



The target groups covered by the CCL and CCAs are outlined in Smith (2001) and Sorrell (2001a), while the target groups covered by the EU ETS are outlined in CEC (2001) and Sorrell & Smith (2002a). The following sections explore the nature of the overlaps between these groups under the following headings:

- Overlaps in sectoral coverage.
- Overlaps in emissions coverage.
- Overlaps in site coverage.
- Estimating the size of the target groups.
- Indirectly affected target groups and the treatment of electricity.

3.2 Overlaps in sectoral coverage

The sectors directly affected by the EU ETS overlap with those directly affected by the CCL. They also overlap with the sectors directly affected by the CCAs, which in turn form a subset of those directly affected by the CCL. The sectoral coverage of the CCA is largely based on the overlap between the CCL and the IPPC Directive, so the scope of the latter also needs to be explored. These overlaps are summarised below.

- *CCL:* The CCL applies to coal, gas and electricity use in the public, commercial, agricultural and industrial sectors. It does not apply to the transport and domestic sector, or to energy used by very small firms which are classified as domestic.[24] It also does not apply to the upstream energy sector, including power stations, and oil refineries. In other words, the CCL is a *downstream* energy tax, with electricity being taxed at the point of consumption in the public, commercial, agricultural and industrial sectors. Fuel use for electricity generation is exempt. The choice of a downstream electricity tax, rather than taxing the fuel used for electricity generation, derives from the political objective of shielding the domestic consumer from electricity price rises and has had profound consequences for the overall climate policy mix (section 4.2).

- *IPPC:* The IPPC Directive regulates a range of industrial processes, normally with a minimum size threshold. The sectors in which these are located are termed *IPPC sectors*. Not all sites in these sectors will be covered by IPPC as many fall below the size threshold. Table 3.1 summarises the processes covered by IPPC and the relevant size thresholds. Note that IPPC regulates large combustion plant (LCP, defined as >50MW thermal input), a category which includes thermal power stations. LCP may occur in IPPC sectors and non-IPPC sectors and are also regulated under the Large Combustion Plant Directive (LCPD).[25]
- *CCAs:* Sites that both pay the CCL *and* are regulated under IPPC are eligible for CCAs. But there are two important complications:
  - sites in an IPPC sector that fall below the IPPC size threshold may also become signatories to a CCA (i.e. there is no size threshold for the CCAs); and
  - sites in a small number of energy intensive sectors that fall outside IPPC (e.g. horticulture) are also eligible for a CCA.
- *EU ETS:* The EU ETS applies to a subset of installations regulated by the IPPC Directive, as indicated in Table 3.1. It can be seen that the EU ETS excludes some IPPC sectors altogether (e.g. chemicals, waste management), and also excludes individual activities within the IPPC sectors that are covered (e.g. coal gasification is not covered within the energy sector). The EU ETS covers the most energy intensive industrial processes (e.g. iron and steel), and also the upstream energy sector - including power stations and oil refineries. The sectoral coverage of the EU ETS is still being disputed, and may change during the negotiation process. The coverage may also be wider for Phase 2 than for Phase 1. However, the following discussion will use the proposals made in the published draft Directive(CEC, 2001a).

Table 3.2 summarises the sectoral overlaps between IPPC, the CCL, the CCAs and the EU ETS. It can be seen that the following combinations appear possible:

- CCL only;
- CCL and CCA;[26]

[24] Also exempt is fuel used by registered charities for non-business uses.
[25] The LCPD will not be discussed here, as it is primarily focused on the control of SO_2 and NOx. It is important to note, however, that the LCPD provides incentives to switch from oil and coal to (sulphur free) natural gas, which means that the LCPD will have consequences for CO_2 emissions. Similarly, the revised LCPD requires investors in new and replacement combustion plant to explore opportunities for CHP. The LCPD will have a particularly important impact upon coal-fired electricity generation plant, which will be required to either fit Flue Gas Desulphurisation (FGD) equipment or reduce the number of operating hours after 2008.
[26] CCA participants still pay 20% of the CCL.

- IPPC and EU ETS
- CCL, CCA and EU ETS;
- CCL, CCA, IPPC and EU ETS;

In practice, however, the situation is more complicated than this since there are differences in regulatory coverage within a single sector. For example, some sites in the non-ferrous sector are eligible for CCAs, while others are not. Figures 3.2 and 3.3 illustrate this in more detail. The text following the diagrams explain the logic.

Table 3.1 Definition of IPPC regulated activities, indicating those covered by the EU ETS

Sector	Activities	EU ETS
Energy	Combustion plant >50MW, excluding waste incineration	*
	Oil and gas refineries	*
	Coke ovens	*
	Cold gasification and liquifaction plants	
Ferrous metals	Metal ore roasting or sintering	*
	Iron and steel production (including casting) with capacity >2.5tonnes/hr	*
	Ferrous metal processing: a) hot rolling mills with capacity > 20 tonnes steel/hour; b) smitheries with hammers exceeding 50kJ, where power used exceeds 20 MW; and c) application of fused metal coats with imported exceeding 2 tonnes steel/hour	
	Foundries with production exceeding 20 tonnes steel/day	
Non ferrous metals	Installations for the production of non-ferrous crude metals from ore, concentrates or secondary role materials by metallurgical, chemical or electrolytic processes	
	Installations for the smelting of non-ferrous metals including recovered products with a melting capacity exceeding 4 tonnes/day for lead and cadmium or 20 tonnes/day for all other metals	
Minerals	Installations for the production of cement clinker in rotary kilns with capacity >500t/day, or lime in rotary kilns with capacity > 50 tonnes/day or in other furnaces with a capacity > 50 tonnes/day	*
	Installations for the production of asbestos and the manufacture of asbestos based products	
	Installations for the production of glass and glass fibre with melting capacity > 20t/day	*
	Installations for melting minerals substances including the production of mineral fibres with a melting capacity > 20 tonnes/day	
	Installations for the production of ceramics (including tiles, bricks, stoneware, porcelain) with capacity > 75t/day, and/or kiln capacity >4m^3 and we had a setting density per kiln exceeding 300 kg/m	*
Chemicals	Production on the industrial scale of a wide range of chemicals. A large number of categories are listed, none of which are covered by the EU ETS	
Waste management	Installations for the disposal or recovery of hazardous waste as defined in a) Directive 91/689/EEC; b) Directive 75/442/EEC; and c) 75/439/EEC (waste oils) with capacity > 10 tonnes/day	
	Installations for the incineration of municipal waste as defined in Directive 89/369/EEC on the prevention of air pollution from new waste incineration plants, and in directive 75/439/EEC on the reduction of pollution from existing waste incineration plants with a capacity exceeding three tonnes/hour	
	Installations for the disposal of non-hazardous waste as defined in Directive 75/414/EEC (headings D8 and D9 in Annex IIA) with capacity > 50 tonnes/day	
	Landfills receiving more than 10 tonnes/day or whether total capacity exceeding 25,000 tonnes	

Other	Industrial plants for the production of: a) pulp from timber or other materials; and b) paper and board; with capacity > 20 tonnes/day	*
	Plants for the pre-treatment (washing, bleaching etc.) or dyeing of fibres or textiles where capacity > 10 tonnes/day	
	Plants for the tanning of hide and skins where capacity > 12 tonnes/ day of finished products	
	Slaughterhouses with carcass production capacity > 50 tonnes/day	
	Treatment and processing for the production of food products from: a) animal materials which finished product capacity > 75 tonnes/day; b) vegetable raw materials which finished product capacity > 300 tonnes/day	
	Treatment and processing of milk, with quantity of milk received > 200 tonnes/day	
	Installations for the disposal or recycling of animal carcasses and animal waste with a capacity > 10 tonnes/day	
	Installations for the intensive rearing of poultry or pigs with more than: a) 40,000 places for poultry; b) 2000 places for pigs; or c) 750 places for sows	
	Installations for the service treatment of substances, objects or products using organic solvents (printing, coating, degreasing, waterproofing etc.) with capacity > 150 kg/hour or > 200 tonnes/year	
	Installations for the production of carbon or electric graphite by means of incineration	

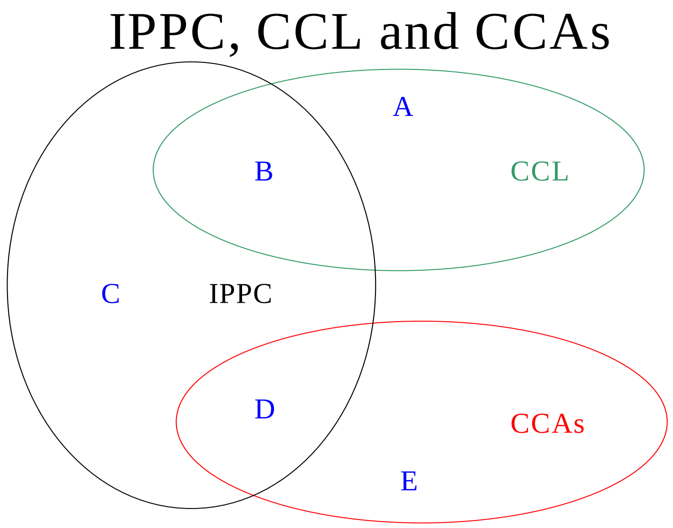
Table 3.2 Sectoral overlaps between IPPC, the CCL, the CCA, and the EU ETS

Sector	Contains CCL paying sites	Contains IPPC sites	Contains CCA sites	Contains EU ETS eligible sites	No. of potentially applicable regulations
Energy industry					
Coke		✓		✓	2
Oil refining		✓		✓	2
Gas production		✓		✓	2
Manufacturing industry					
Iron and Steel	✓	✓	✓	✓	4
Non-ferrous metals	✓	✓	✓	✓	4
Non metallic metals	✓	✓	✓	✓	4
Bricks	✓	✓	✓	✓	4
Cement	✓	✓	✓	✓	4
Glass	✓	✓	✓	✓	4
Potteries	✓	✓	✓	✓	4
Chemicals	✓	✓	✓	✓	4
Mech. Engineering	✓	✓	✓	✓	4
Elec. Engineering	✓	✓	✓	✓	4
Vehicles	✓	✓	✓	✓	4
Food, Drink and Tobacco	✓	✓	✓	✓	4
Textiles, leather and clothing	✓	✓	✓	✓	4
Paper	✓	✓	✓	✓	4
Plastics and Rubber	✓	✓	✓	✓	4
Other Manufacturing	✓		✓	✓	3
Water	✓		✓		2
Construction	✓				1
Mining	✓				1
Public Sector	✓				**1**
Commerce	✓				**1**
Agriculture					
Horticulture	✓		✓		2
Other agriculture	✓				1
Transport					
Domestic					

Note: While a sector may contain sites eligible for regulation under each instrument, this does not mean that *all* sites in the sector are eligible. In many cases, only a fraction of sites will be eligible.

Figure 3.2 shows the relationship between the target groups for IPPC, the CCL and the CCAs. The groups numbered A to E are summarised in Table 3.3.

Figure 3.2 Relationship between target groups for IPPC, CCL and CCAs



Sites in the energy industry, manufacturing, commerce & the public sector

Table 3.3 Distinguishing overlapping target groups for IPPC, the CCL and CCAs

No.	Regulations	Description
A	CCL only	The great majority of sites in the public, commercial, agricultural and industrial sectors are eligible for the CCL and not regulated under IPPC. Sectors include mining, mechanical engineering and electrical engineering. A small number of sites, including registered charities and those below a size threshold, are exempt from the CCL.
B	CCL and IPPC	Sites in the manufacturing sector which are regulated under IPPC are eligible for inclusion in a CCA. But some sites may have chosen not to join a CCA. No data is available on the size of this group, and such a choice would appear unlikely given the financial benefits of a CCA. But it nevertheless remains a possibility.
C	IPPC only	The majority of sites in the upstream energy sector are regulated under IPPC, but are not eligible for the CCL since the latter is a downstream tax. This is a very important category in terms of overall emissions as it includes power stations, oil refineries and coke ovens.
D	IPPC and CCA	Sites in the manufacturing sector which are regulated under IPPC are eligible for inclusion in a CCA. Here, IPPC is being taken as a proxy for energy intensive industry. The great majority of eligible sites have taken up this opportunity and have entered a CCA. This group includes most of the large, energy intensive manufacturing sites such as iron and steel, chemicals and paper.
E	CCA only	While eligibility for a CCA was initially defined as regulation under IPPC, this was challenged on competition grounds. The eligibility criteria were subsequently widened to include: a) sites in an IPPC sector that fall below the IPPC size threshold; and b) sites in a small number of energy intensive sectors that fall outside IPPC (e.g. horticulture). This means that a large number of sites are signatories to a CCAs, but are not regulated under IPPC.

Note: CCA companies pay 20% of the CCL.

Figure 3.3 illustrates how the target groups for the EU ETS map onto the target groups for IPPC, the CCL and CCAs. The regions marked 1 to 10 each contain real sites, with corresponding GHG emissions. Some of these regions (e.g. region 9) are likely to account for a much larger proportion of emissions than others (e.g. region 2). But each region needs to be considered when assessing the implications of implementing the EU ETS. The picture is complex and illustrates how boundary issues may severely complicate the implementation of the EU ETS.

Figure 3.3 Relationship between target groups for the EU ETS, IPPC, CCL and CCAs

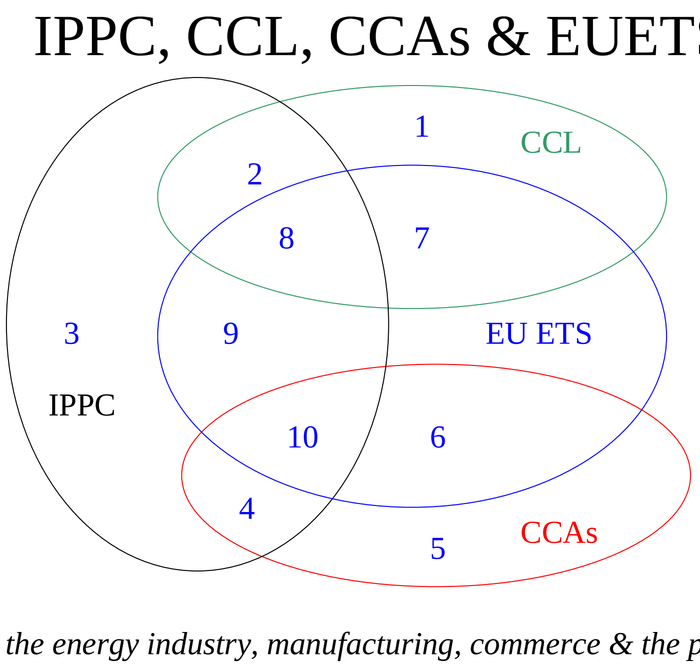


Table 3.4 summarises the coverage of each of the regions in Figure 3.3, and provides an example of the type of site represented. Unfortunately, there is insufficient data to quantify either the number of sites, or volume of emissions accounted for by each region. But the table does make a broad assessment of the relative importance of each region, using the categories high, medium and low.

Table 3.4 Distinguishing overlapping target groups for the EU ETS, IPPC, CCL and CCAs

No.	Regulations	Importance	Description
1	CCL only	High	The great majority of sites in the public and commercial sector, and sites in industrial sectors not regulated under IPPC (e.g. mining, mechanical engineering, electrical engineering etc.).
2	CCL and IPPC	Low	Sites in the manufacturing sector which are regulated under IPPC are eligible for inclusion in a CCA. But some sites may have chosen not to join a CCA. No data is available on the size of this group, and such a choice would appear unlikely given the financial benefits of a CCA. But it remains a possibility. Such sites may also be in sectors *not* regulated by the EU ETS.
3	IPPC only	Low	Sites in the upstream energy sector are regulated under IPPC, but are not eligible for the CCL. The majority of these sites are covered by the EU ETS. But there are some important exceptions - for example, coal gasification plants and waste incineration plants.
4	CCA and IPPC	High	Large energy intensive industrial sites in sectors not covered by the EU ETS, including chemicals, non ferrous, asbestos and large food.
5	CCA only	Medium	Sites that lie below the IPPC size threshold in sectors that are eligible for (and have joined) a CCA, but are not eligible for the EU ETS (e.g. small sites in the chemicals and food and drink sectors)
6	CCA and EU ETS	Low	Combustion plant in the size range 20-50MW in a sector that is eligible for a CCA
7	CCL and EU ETS	Low	Combustion plant in the size range 20-50 MW in a sector that is *not* eligible for either IPPC or a CCA
8	CCL, IPPC and EU ETS	Low	Sites in manufacturing which are regulated under IPPC are eligible for inclusion in a CCA. But some sites may have chosen not to join a CCA. Such a choice appears unlikely but remains possible. Such sites may also be in a sector regulated by the EU ETS.
9	IPPC and EU ETS	High	The great majority of sites in the upstream energy industry are included here, including oil refineries, coke ovens and power stations.
10	CCA, IPPC and EU ETS	High	The majority of large sites in energy intensive manufacturing industry are included here, such as paper, minerals and iron and steel.

Figure 3.3 and Table 3.4 illustrate that determining the regulatory coverage of the EU ETS is a difficult task. Moreover, it is even more complicated than this discussion suggests. This is because we also need to consider the differences in regulatory coverage of energy use and CO_2 emissions *within* a single site. For example, CO_2 emissions from fossil fuel combustion may be covered, but CO_2 emissions from industrial processes (e.g. cement) may not be. These issues are explored further in the following two sections.

3.3 Overlaps in site coverage

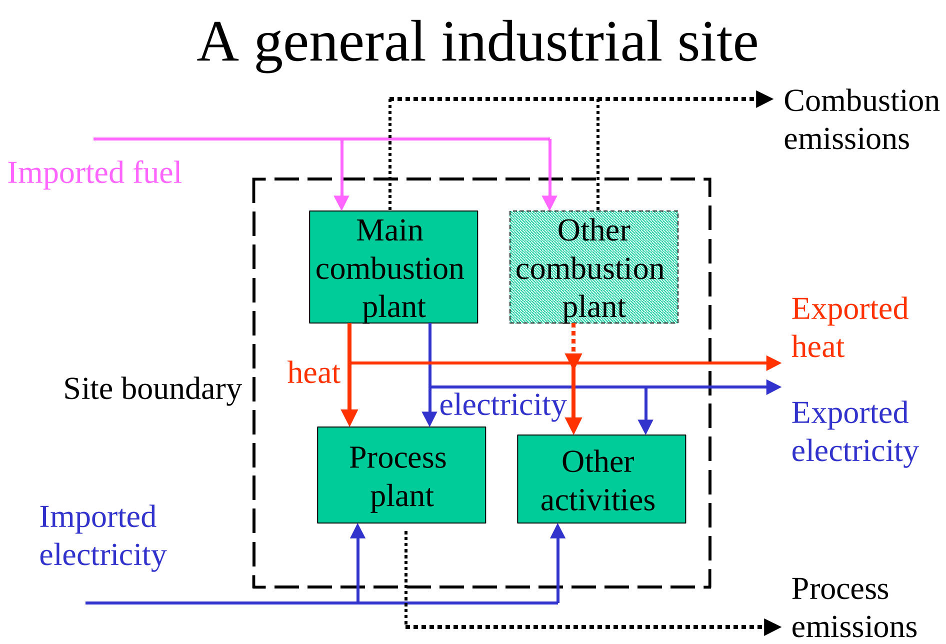
To explore in more detail the potential overlaps in instrument coverage, it is helpful to define a general site in the industrial, public or commercial sector (Figure 3.4). This includes sites in the upstream energy industry, such as oil refineries and power stations. The site can be divided into:

- *combustion plant*: boilers, engines, gas turbines and furnaces producing heat (direct, steam or hot water) and possibly electricity;
- *process plant*: industrial processes, such as chemical production, using heat and electricity (either imported or from the main combustion plant) and including some processes that burn fossil fuels such as kilns; and
- *other activities*: energy using activities unrelated to the core process, such as warehouses and offices.

In addition, it is useful to subdivide combustion plant into:

- *main combustion plant*: the largest combustion plant, supplying process activities and/or generating electricity; and
- *other combustion plant*: smaller combustion plant, supplying other, non-process activities.

Figure 3.4 A general site in the industrial, commercial or public sector



In general terms, sites may contain any combination of combustion plant, process plant and other activities. For example:

- combustion plant only (e.g. power station);
- combustion plant and other activities only (e.g. office block);
- combustion plant, process plant and other activities (e.g. large chemical plant)

In practice, sites may contain more than one type of process plant which may or may not be regulated under IPPC. Similarly, the main combustion plant may need to be subdivided into individual technological categories for regulatory purposes. These complications will be ignored in what follows.

Combustion plant produce heat, in the form of hot water, steam or hot gases (direct heat), some of which may also be used to produce electricity. There may be more than one type of combustion plant: for example, process plant may be supplied by direct heat from a turbine as well as steam from a boiler. As well as supplying process heat and/or electricity, the 'main' combustion plant may supply heat to the entire site, or there may be separate (smaller) combustion plant supplying heat to the other activities.

Combustion plant is regulated under the IPPC Directive, the Large Combustion Plant Directive (LCPD) and supporting domestic legislation. The definition of combustion plant varies between different regulations in terms of:

- *Types of technology covered:* Here, combustion plant is defined as boilers, turbines, engines and furnaces. It does *not* include kilns, coke ovens, blast furnaces and similar equipment, although these may also involve the combustion of fossil fuels. These technologies are included under process plant.
- *Aggregation rules applied to multiple units of plant*: Here, the aggregation rules used in UK legislation for the definition of Large Combustion Plant (LCP) will be used. LCP refers to any combination of boilers, turbines, engines or furnaces that have an *aggregate* net rated thermal input of 50MW or more *if* they are installed so that waste gases may be emitted through a common or multi-flue stack (DoE, 1991).
- *Size of plant*: Here, size will be defined by net[27] thermal input, using the aggregation rules indicated above. Three categories are relevant:
    - *Large combustion plant* (*LCP)*: This is defined by a net thermal input >50MW and is commonly referred to as *Part A* plant, which refers to the classification used in the 1990 Environmental Protection Act (EPA).
    - *Medium combustion plant:* This is defined by a net thermal input >20MW but <50MW, using the same technology definitions and aggregration rules.
    - *Small combustion plant:* This is defined by a net thermal input >20MW. The great majority of combustion installations will fall into this category.

[27] There are two methods of measuring the heat content of fuels, and hence the efficiency of energy conversion plant. The first, gross calorific value (GCV), includes the heat that can be obtained from condensing the steam produced by heating with the fuel. The second, net calorific value (NCV), excludes the heat from condensing. The second is more commonly used when quoting the thermal efficiency of a plant, as the heat from condensing cannot normally be used. However, the Digest of UK Energy Statistics uses GCV when measuring fuel use. The difference between the two is typically 5% for solid and liquid fuels, and 10% for gases. For combustion plant definitions, NCV is used.

In UK legislation, individual boilers, turbines, engines or furnaces that have a net thermal input >20MW but <50MW are defined as *Part B* plant, which refers to the classification used in the 1990 EPA. These plant are regulated by local authorities under Local Authority Air Pollution Control (LAAPC). The Part B definition is based on the thermal input of an *individual* unit, which is in contrast to the Part A definition which uses aggregation rules. Combustion installations usually comprise of several units, which means that there will be many installations with an aggregate net thermal input >20MW but <50MW which are *not* regulated under LAAPC since no individual plant has an input >20MW. Similarly, many of the individual units with thermal input >20MW will form part of a multi-unit LCP installation with an aggregate thermal input >50MW, and hence will be regulated under Part A. In practice, the number of combustion plant installations covered by LAAPC is relatively small.

There is no accurate and up-to-date information on the size distribution of combustion plant in UK industry and commerce. However, we do have some data from 1990 on the size distribution of the UK boiler stock (i.e. excluding turbines, engines and furnaces). This is reproduced in Table 3.5. The data shows the percentage of the total number of sites, boilers, capacity and fuel use accounted for by each size category. As indicated above, the proportion of medium combustion plant regulated under LAAPC will be less than suggested by the table.

Table 3.5 Estimates of the 1990 UK boiler stock by site thermal input capacity (% of total)

Site thermal input (MWth)	**No. of sites**	**No. of boilers**	**Capacity**	**Fuel use**
< 20 MW	99.81	99.42	77.03	52.95
20 - 50MW	0.12	0.34	5.67	7.64
> 50 MW	0.07	0.24	17.29	39.41
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**

Source: Sorrell (1996)

The reason for distinguishing between combustion plant (including size of plant), process plant and other activities is that this distinction is relevant to defining the scope of the CCL, the IPPC Directive, the CCAs and the EU ETS *within* an individual site. The rules are different in each case and are summarised below.

3.3.1 CCL boundaries

The upstream energy sector (power stations etc.) is exempt from the CCL, but the great majority of sites in the public, commercial and industrial sectors are eligible.

In the majority of eligible sites, *all* the imported fuel and electricity that is used for energy (as opposed to non-energy uses such as feedstocks) is eligible. There are two important cases when the source of the energy is exempt:

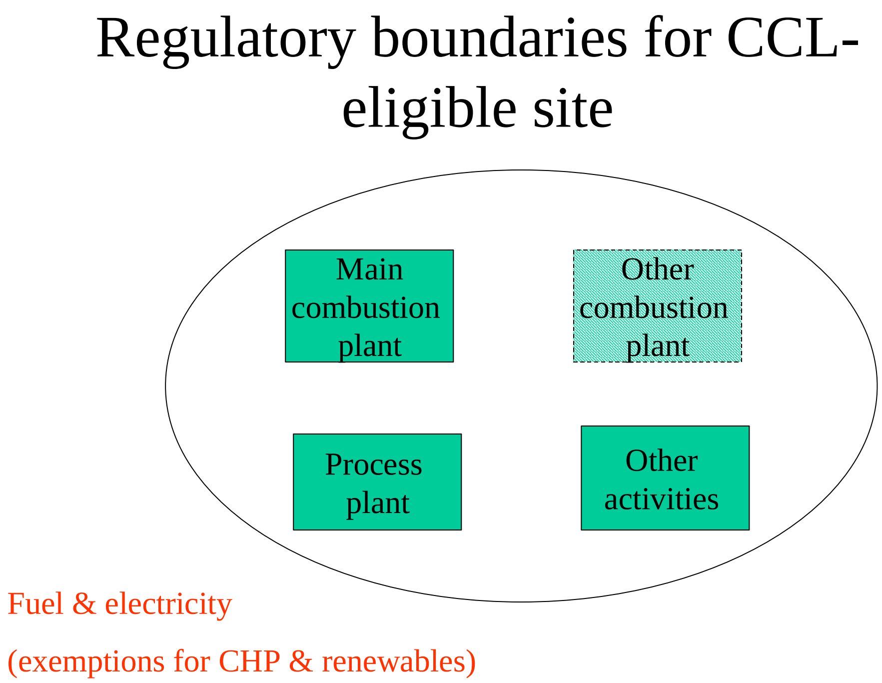
- oil use (gasoil and HFO), because oil is already subject to excise duties; and
- electricity use, where the electricity is generated from *new* renewable energy (as opposed to existing renewables, such as large hydro).

Hence, sites using either oil or renewable electricity will only have a portion of their energy consumption covered by the CCL.

There are also cases when energy use is exempt owing to the *purpose* for which it is used. In these cases, energy used in one part of the site (e.g. process electricity) may be eligible, while energy used elsewhere (e.g. gas turbine fuel) may not. The most important exemptions are:

- electricity used in electrolysis processes, for example, the chlor-alkali process, or primary aluminium smelting; and
- fuel used by 'good quality' combined heat and power (CHP) schemes.[28]

Figure 3.5 Possible regulatory boundaries for a CCL eligible site



3.3.2 IPPC boundaries

IPPC controls a wide range of pollutants in all three media. In many IPPC installations process emissions (e.g. VOCs) may be significant, even when energy use and combustion emissions are small.

IPPC applies to industrial *installations*. The definition of an installation under the IPPC Directive is:

[28] The rules for exempting CHP are complex (DETR, 2000e). To qualify for the full exemption, the plant must meet a 'quality index' of at least 100 and electrical efficiency of at least 20%. Plants of poorer quality (i.e. less efficient) are only eligible for a portion of the exemption. Prior to 2002, the exemption only related to heat and electricity used on site or sold direct to other users. If the electricity was exported to the grid or through bilateral contract, the fuel used to generate this electricity was *not* exempt. This illogical rule created a barrier to CHP and made it necessary to apportion CHP fuel use somewhat artificially between that relating to heat and electricity used on-site, and that relating to exported heat and electricity. The anomaly was removed in the 2002 budget which made *all* fuel used in good quality CHP plant exempt from the CCL.

> '.. a stationary unit where one or more activities listed in Annex I are carried out, and any other directly associated activities which have a technical connection with the activities carried out at that site and which could have an effect on emissions or pollution.'

This definition need *not* include all the activities at a site. The final definition of the installation will be in the hands of the Environment Agency inspector when developing the IPPC permit and will hinge on the interpretation of 'directly associated', 'technical connection' and 'capable of having an effect on emissions'. All three criteria must be satisfied for an activity to qualify. To give two examples (DETR, 2000b):

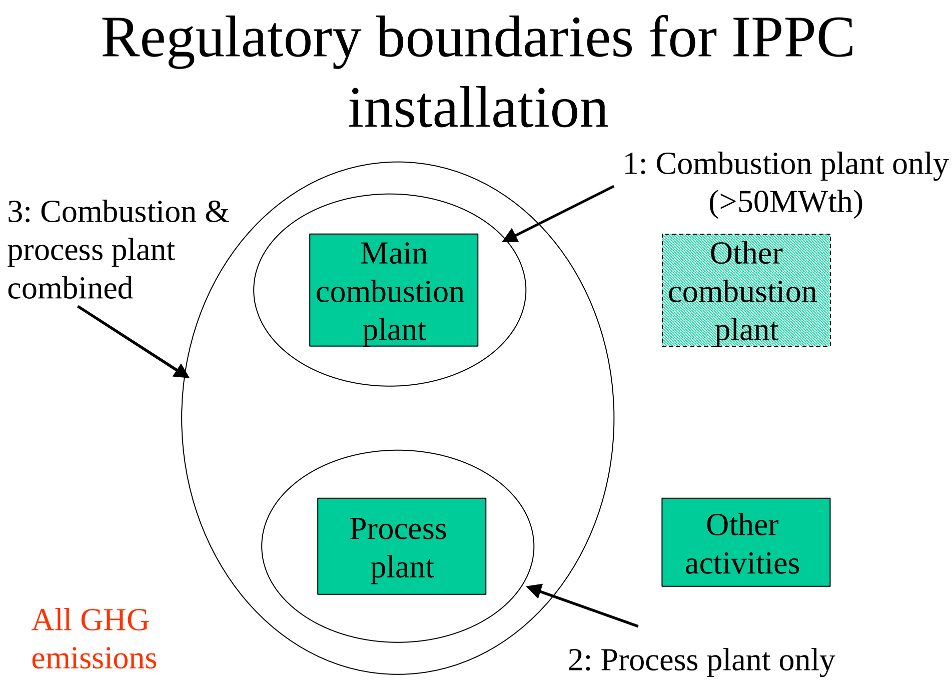
- An on-site warehouse used for the storage of steel billets prior to hot rolling. In this case, the hot rolling plant is the stationary technical unit. Since the warehouse does not have an effect on emissions, it is not part of the installation.
- Extrusion of aluminium. In this case, the stationary technical unit is a furnace used to soften the metal prior to extrusion. The extrusion process itself has no impact on furnace emissions, and has no emissions of its own. It is not, therefore, part of the installation.

In most cases, 'other activities' such as offices will *not* be included in the definition of an installation. However, it is possible that a combustion plant *will* be considered to be directly associated with a process plant. For example, a furnace in a catalytic cracker is an integral part of the process, and therefore forms part of the installation. Furthermore, if the combustion plant has an aggregate thermal input >50MW, it will itself be regulated under IPPC as an LCP. This means that for IPPC there are four relevant possibilities:

- neither the process plant or the combustion plant is regulated under IPPC;
- the process plant is regulated, but the combustion plant is not;
- the combustion plant is regulated, but the process plant is not; and
- both the combustion and the process plant are regulated.

Figure 3.6 illustrates the corresponding boundaries of the IPPC installation(s). In cases where both combustion and process plant are regulated this may be through two separate authorisations, or the two may be combined in a single authorisation (as in oil refineries). In all cases there may be other activities and perhaps other combustion plant that are on the same site but do not form part of the installation.

Figure 3.6 Possible regulatory boundaries for an IPPC installation



In practice (and unlike its predecessor, the Air Framework Directive), IPPC includes obligations on energy efficiency. This means that if the process plant is regulated, the operator will be under some form of obligation to improve the efficiency of heat and electricity use within the process. Since heat is derived from the combustion plant, this will have an *indirect* effect on emissions from the combustion plant whether or not the latter is directly regulated under IPPC. Similarly, the energy efficiency requirements will have an indirect effect on CO_2 emissions from electricity generation plant.

3.3.3 CCA boundaries

As indicated earlier, sites that pay the CCL and contain IPPC regulated processes are eligible for a CCA, together with sites in IPPC sectors that contain processes that fall below the IPPC size threshold and sites in a small number of energy intensive sectors that fall outside IPPC but which are eligible for a CCA. Most eligible sites have become signatories to a CCA, although a few have not.

The regulatory unit in a CCA is termed a *facility*. A facility comprises *one or more* IPPC installations, and may also include other activities. The boundary of a facility is determined by the pattern of energy used at the site. The rules are as follows (DETR, 2000c):

- Where an installation consumes 90% or more of a site's energy use (expressed in primary terms), then all of the site energy use will be eligible to be covered by a CCA. In this case, the facility may be defined as the entire site.
- Where less than 90% of the site energy use is used in the installation, the whole site is not eligible to be covered by a CCA. In this case, the facility must be defined such that at least

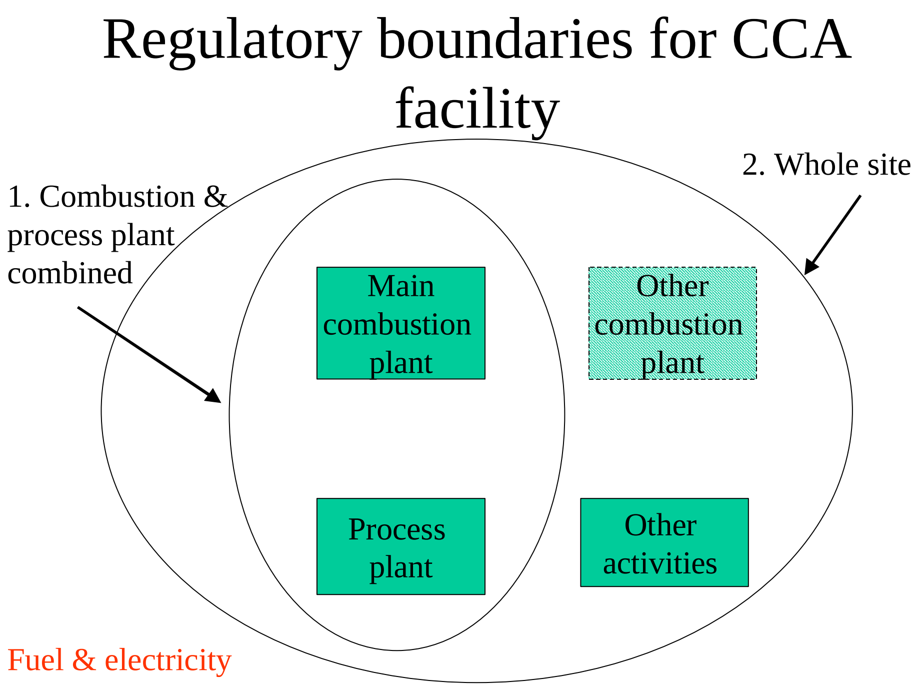
90% of the metered energy is used within the IPPC installation. This energy will need to be metered separately from the rest of the site.

In the general case, the IPPC process is supplied with heat from a combustion plant which may or may not be included in the IPPC authorisation. But for the purposes of the CCA, the two must be grouped together, since the heat used in the process is derived *from* the combustion plant and it is fuel that is eligible for the tax, not the heat. This means that, for the CCA, there are only three relevant possibilities:

- neither the process plant or the combustion plant is eligible for the CCA;
- both the process plant and the combustion plant are eligible for the CCA, but other activities are not; and
- the entire site is eligible for the CCA
-

Note that the CCA targets fuel and electricity use only, not process emissions.

Figure 3.7 Possible regulatory boundaries for a CCA facility



3.3.4 EU ETS boundaries

The scope of the EU ETS is defined through IPPC (Table 3.1), with a subset of IPPC sectors being covered. The EU ETS covers only *direct* emissions from these sites, so an energy user only requires allowances for direct emissions, not for electricity consumption. Since the scope of the EU ETS includes power stations, the ESI must obtain allowances to cover its direct emissions and then pass a portion of the costs on in electricity prices to *all* electricity consumers.

The EU ETS scheme only applies to CO_2 emissions at present, but these may result from either fossil fuel combustion or from certain types of processes such as cement production or the consumption of anodes in the primary aluminium industry. In addition, the fossil fuel combustion may take place either in the combustion plant (boilers, furnaces, turbines and engines) or in the process itself (e.g. kilns or coke ovens). The intention in using IPPC to define the scope of the EU ETS is to capture *all* the CO_2 emissions associated with the energy intensive industrial processes. This means that if an IPPC process installation is eligible, then CO_2 emissions from the associated combustion plant will *also* be included.

The EU ETS also covers combustion plant of >20MW thermal input. The draft Directive does not specify the aggregation rules used, but it is assumed here that the aggregation rules are the same as in the 1990 EPA. Many combustion plant installations of this size will be on industrial sites where there is an associated IPPC process. But others will be on sites where there is *no* IPPC process. Similarly, since the size threshold for combustion plant under the EU ETS (20MWth) is *lower* than that under IPPC (50MWth), the EU ETS will include combustion plant that are not regulated under IPPC.

No information is given in the Directive on how installations are defined (e.g. whether other activities are included). But we assume here that: a) if a participant qualifies because of combustion plant, then only the combustion plant is included; and b) if a participant qualifies because of an IPPC process, then both the IPPC installation and the combustion plant are included.

There are then three possibilities for coverage under the EU ETS:

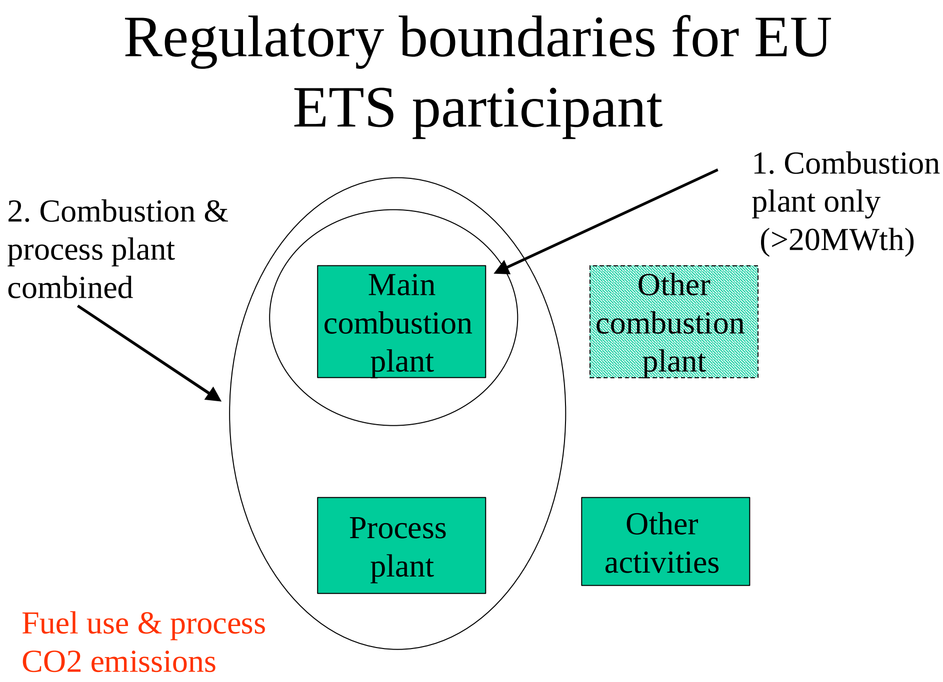
- neither the process plant or the combustion plant is regulated;
- the combustion plant is regulated, but the process plant is not; and
- both the combustion and the process plant are regulated.

The coverage of the EU ETS can be summarised as follows:

- If the combustion plant is regulated directly under IPPC or has an aggregate thermal input >20MW the combustion plant *must* be included in the EU ETS. The associated process plant emissions are *not* included, unless the process itself is eligible for the EU ETS.
- If the process plant is regulated directly under IPPC, the process plant *may* be included in the EU ETS (depending upon the sector). If it *is* included, the combustion plant emissions are covered as well.

Note that if this interpretation is correct, the second rule may allow for combustion plant smaller than 20MW being included, along with the associated IPPC process.

Figure 3.8 Possible regulatory boundaries for EU ETS participant



3.3.5 Overlaps in regulatory boundaries

The following table summarises the potential coverage of each of the four regulations. In each row, only one of the possible coverages is possible at a single site. Possible exemptions to the CCL - such as when the main combustion plant is CHP – are ignored, although in practice these may be important.

Table 3.6 Possible areas of coverage of IPPC, CCL, CCAs and EU ETS within a typical industrial site

	Main combustion plant only	**Process plant only**	**Main combustion and process plant**	**Whole site**
IPPC	✓	✓	✓	
CCL				✓
CCA			✓	✓
EU ETS	✓		✓	

Note: At a single site, only one of the possibilities ticked in each row is allowed.

In the majority of cases, the bulk of emissions derive from the main combustion plant and the process plant. So the distinction between these and the rest of the site is of less importance. Table 3.7 summarises the situation for a *simplified* typical industrial site in which all the energy use and emissions is accounted for by the main combustion plant and process plant.

Table 3.7 Possible areas of coverage of IPPC, CCL, CCAs and EU ETS within a simplified typical industrial site

	Main combustion plant only	Process plant only	Main combustion and process plant
IPPC	✓	✓	✓
CCL			✓
CCA			✓
EU ETS	✓		✓

Note: At a single site, only one of the possibilities ticked in each row is allowed.

3.3.6 Combinations of regulatory influences at a single site

We are interested in defining the overlaps in regulation between the CCL, CCA, IPPC and EU ETS. The question to ask is: what are the *allowed combinations* of regulation by the CCL, CCA, IPPC and EU ETS for the simplified typical industrial site described above? This in turn will depend upon the type of combustion plant at the site. This question is best broken down into three stages:

- What are the allowed combinations of the CCL, CCA and IPPC?
- What are the allowed combinations of the CCL, CCA, IPPC and size of combustion plant installation?
- What are the allowed combinations of the CCL, CCA, IPPC, size of combustion plant installation and the EU ETS?

Tables 3.8 to 3.10 summarises the various possibilities. In these tables, processes may not be regulated by IPPC because: a) the process is not in an eligible sector; b) the process falls below the size threshold; or c) there is no process at the site. Similarly, combustion plant may not be regulated by IPPC because: a) the plant is exempt for some reason; b) the plant falls below the relevant size threshold; or c) there is no combustion plant at the site.

The important result is that **individual sites may have one of 18 possible combinations of the CCL, CCA, IPPC, and EU ETS** (Table 3.10)**.** The picture is clearly getting very complex! The analysis clearly demonstrates that implementation of the EU ETS is likely to open up a host of boundary issues.

The story does not end here however. The instruments also differ in their coverage of: a) individual greenhouse gases; b) different types of fossil fuels; and c) electricity use, including the treatment of renewable electricity. These issues are discussed in the following sections.

Table 3.8 Allowable combinations of IPPC, CCL, and CCA

No	**Process regulated by IPPC?**	**Combustion plant regulated by IPPC?**	**Site CCL eligible?**	**Site CCA member?**	**Example**
1	No	No	Yes	Yes	Large energy intensive site in non-IPPC sector that is eligible for a CCA
2	No	No	Yes	No	Small, non-energy intensive industrial site in IPPC or non-IPPC sector
3	No	No	No	No	Small site that is exempt from the CCL (e.g. charity)
4	Yes	No	Yes	Yes	Site with IPPC process that is eligible for and has joined a CCA
5	Yes	No	Yes	No	Site with IPPC process that is eligible for a CCA, but has chosen *not* to join
6	Yes	No	No	No	Site with IPPC process that is CCL exempt (e.g. gas plant)
7	No	Yes	Yes	Yes	LCP on site in an energy intensive, non-IPPC sector, that is eligible for a CCA
8	No	Yes	Yes	No	LCP on site in a non-IPPC sector
9	No	Yes	No	No	Site with LCP that is CCL exempt (e.g. power station)
10	Yes	Yes	Yes	Yes	Site with IPPC process and LCP that has joined a CCA
11	Yes	Yes	Yes	No	Site with IPPC process and LCP that has chosen not to join a CCA
12	Yes	Yes	No	No	Site with IPPC process and LCP that is CCL exempt (e.g. oil refinery)

Note: Only sites eligible for the CCL can be signatories to a CCA.

Table 3.9 Allowable combinations of IPPC, CCL, CCA, and type of combustion plant

No	**Process regulated by IPPC?**	**Large combustion plant (>50MWth) (IPPC)**	**Medium combustion plant (20-50MWth)**	**Small combustion plant (<20MWth) (unregulated)**	**Site CCL eligible**	**Site CCA member**
1	No	No	No	Yes	Yes	Yes
2	No	No	No	Yes	Yes	No
3	No	No	No	Yes	No	No
4	No	No	Yes	No	Yes	Yes
5	No	No	Yes	No	Yes	No
6	No	No	Yes	No	No	No
7	No	Yes	No	No	Yes	Yes
8	No	Yes	No	No	Yes	No
9	No	Yes	No	No	No	No
10	Yes	No	No	Yes	Yes	Yes
11	Yes	No	No	Yes	Yes	No
12	Yes	No	No	Yes	No	No
13	Yes	No	Yes	No	Yes	Yes
14	Yes	No	Yes	No	Yes	No
15	Yes	No	Yes	No	No	No
16	Yes	Yes	No	No	Yes	Yes
17	Yes	Yes	No	No	Yes	No
18	Yes	Yes	No	No	No	No

Table 3.10 Allowable combinations of IPPC, CCL, CCA, type of combustion plant and EU ETS member

No	Process regulated by IPPC?	Large combustion plant (>50MWth) (IPPC)	Medium combustion plant (20-50MWth)	Small combustion plant (<20MWth) (unregulated)	Site CCL eligible	Site CCA member	EU ETS covers process plant emissions	EU ETS covers combustion plant emissions
1	No	No	No	Yes	Yes	Yes	No	No
2	No	No	No	Yes	Yes	No	No	No
3	No	No	No	Yes	No	No	No	No
4	No	No	Yes	No	Yes	Yes	No	Yes
5	No	No	Yes	No	Yes	No	No	Yes
6	No	No	Yes	No	No	No	No	Yes
7	No	Yes	No	No	Yes	Yes	No	Yes
8	No	Yes	No	No	Yes	No	No	Yes
9	No	Yes	No	No	No	No	No	Yes
10	Yes	No	No	Yes	Yes	Yes	F(sector)	F(sector)
11	Yes	No	No	Yes	Yes	No	F(sector)	F(sector)
12	Yes	No	No	Yes	No	No	F(sector)	F(sector)
13	Yes	No	Yes	No	Yes	Yes	F(sector)	Yes
14	Yes	No	Yes	No	Yes	No	F(sector)	Yes
15	Yes	No	Yes	No	No	No	F(sector)	Yes
16	Yes	Yes	No	No	Yes	Yes	F(sector)	Yes
17	Yes	Yes	No	No	Yes	No	F(sector)	Yes
18	Yes	Yes	No	No	No	No	F(sector)	Yes

3.4 Overlaps in emissions coverage

It is useful to distinguish three categories of *direct* GHG emissions from an industrial site:

- CO_2 emissions from fossil fuel combustion, either in the combustion plant (boilers, furnaces, engines and turbines) or in the process plant (e.g. kilns);
- CO_2 emissions from non-combustion industrial processes (e.g. cement production); and
- other GHG emissions (mostly from non-combustion industrial processes).

Also of interest are the *indirect* CO_2 emissions from electricity consumption. These derive from fossil fuel combustion by thermal power stations. Reducing electricity consumption from an industrial site will lead to a reduction in these indirect emissions. The treatment of electricity is discussed more fully in section 3.5.

The coverage of the three direct sources of emissions differs between our four policy instruments (IPPC, CCL, CCA, EU ETS), as does the manner in which each source is influenced or controlled. The core obligations and incentives are:

- *CCL*: Energy price incentives.
- *CCA*: Relative or absolute targets for energy use or carbon emissions, with participation and compliance incentivised by exemption from 80% of the CCL.
- *IPPC*: Best Available Technology (BAT) requirements for non-CO_2 greenhouse gases, and more ambiguous energy efficiency requirements for fuel and electricity consumption.
- *EU ETS*: Allowance requirements for direct CO_2 emissions, with compliance incentivised by an excess emissions penalty and the requirement to surrender allowances in subsequent periods.

The operation of IPPC is particularly complex as it includes both BAT requirements and energy efficiency requirements. The key points are summarised in Box 3.1, while a fuller discussion is given in Smith and Sorrell (2001).

Box 3.1 IPPC and GHG emission control

IPPC does *not* regulate CO_2 directly. Instead, energy efficiency forms one of the general obligations on operators (Article 3), and represents one of the considerations to be taken into account when determining BAT (Annex IV). CO_2 is *not* listed in Annex III as one of the substances for which emission limit values are particularly applicable (Article 2(6)). However, the other five GHGs *are* listed in Annex III (assuming that methane can be categorised as a volatile organic compound). Hence, while CO_2 emissions would be reduced through improved energy efficiency, IPPC does not appear to have an obvious mechanism to, for example, require a switch to a fuel with a lower carbon content. Nor does it directly allow for the imposition of CO_2 emission limits. However, the wording of the Directive is such that both measures could potentially be justified. For example, Article 2(6) suggests that emission limit values may be assigned for substances not listed in Annex III. Similarly, Article 9(4) requires that 'in all circumstances' provision should be made for the minimisation of long distance or transboundary pollution. So whilst CO_2 is not mentioned explicitly in the Directive, the ambiguity of language permits a range of interpretations.

A further issue is the ambiguity of Article 3. The first paragraph requires authorities to 'ensure that installations are operated in such a way that.... energy is used efficiently'. But the second paragraph weakens this by stating '...it shall be sufficient if Member States ensure that the competent authorities take account of the general principles set out in this Article....'. A strict interpretation could be that the Article requires standards for the amount of energy used, while a loose interpretation could be that it merely requires authorities to ensure that pollution abatement does not lead to excessive energy use.

Table 3.11 summarises the impact of the four instruments on each of the three emission sources, showing the key obligations and incentives. The issues involved are discussed further in section 5.

Table 3.11 Coverage of direct emissions by IPPC, the CCL, the CCA, and the EU ETS

Emission source	**IPPC**	**CCL**	**CCA**	**EU ETS**
CO_2 from fossil fuel combustion[1]	Energy efficiency requirement	Price incentives on gas and coal consumption	Relative or absolute energy or carbon target includes fossil fuel consumption	Carbon allowance allocation includes fossil fuel emissions
Non-combustion CO_2 from process sources	-	-	-	Carbon allowance allocation includes process CO_2 emissions
Other GHGs from process sources	BAT requirements	-	-	-

While each instrument influences CO_2 emissions from fossil fuel combustion, the coverage of individual fossil fuels differs. This is summarised in Table 3.12 *for all sectors other than electricity generation*.

Table 3.12 Coverage of fossil fuel combustion in all sectors other than electricity generation

	IPPC	CCL	CCAs	EU ETS
Coal and lignite	✓	✓	✓	✓
Coke and petroleum coke	✓	✓	✓	✓
Natural gas	✓	✓	✓	✓
LPG	✓	✓	✓	✓
Heavy fuel oil	✓	-	✓	✓
Gasoil	✓	-	✓	✓
Coke oven gas and blast furnace gas	✓	-	✓	✓
Refinery gas and other refinery fuels	✓	-	-	✓
Waste fuels and process gases	✓	-	-	✓
Petrol and road diesel	-	-	-	-

3.5 Indirectly affected target groups

The groups indirectly affected by each policy instrument are diverse. For example, both the EU ETS and the CCL will increase costs for industrial companies, which in turn will either be passed on to customers, passed back to suppliers, or absorbed by lower returns. Similarly, both instruments will create opportunities for energy service companies and for companies engaged in auditing emission reduction opportunities. But the most important indirect impacts are through the electricity industry. These are summarised below for each instrument in turn.

3.5.1 CCL

The CCL targets *consumers* of electricity in the public, commercial and industrial sectors and provides a price incentive to reduce electricity consumption. Reductions in consumption will lead to lower emissions from fossil fuel electricity generating plants. In the case of the CCL, therefore, electricity consumers will be directly affected, and electricity generators indirectly affected.

The CCL provides consumers with the direct incentive to switch to electricity from ‘new renewable’ sources, as this is exempt from the levy. This incentive (0.43p/kWh) helps to overcome the current price disadvantage of electricity from new renewable sources. Qualifying sources include:

- small hydro (<20MW);
- onshore wind
- offshore wind
- geothermal
- wave
- tidal
- photovoltaics
- geothermal

- energy crops
- landfill gas
- coal mine methane
- agriculture and forestry wastes
- municipal and industrial wastes (partial exemption only)

In the case of electricity from new renewable sources, the qualifying generator applies for Levy Exemption Certificate (LEC) which is sold with the electricity to the electricity supplier. The latter uses the certificate to demonstrate to Customs and Excise that the electricity is eligible to be sold free of the CCL. Energy from municipal and industrial waste receives only a partial exemption, related to the energy content of the waste that is derived from fossil fuel. The levy exemptions provide a demand-side boost to renewable electricity, to complement the Renewables Obligation on electricity suppliers.

3.5.2 CCAs

The CCAs also directly target consumers of electricity in the public, commercial and industrial sectors. The CCAs provide incentives to reduce electricity consumption via the adopted targets. Again, reductions in consumption will lead to lower emissions from fossil fuel electricity generating plants.

Since CCA consumers are still paying 20% of the CCL, the incentive to purchase 'new renewable' electricity applies to them as well, although at a reduced level. For both the CCL and CCAs, the increased demand for renewable electricity will provide an indirect incentive to generators to invest in new renewable generation. Generators in this case may be either companies with an existing portfolio of fossil fuel generating plants, and hence directly covered by the EU ETS, or companies with no fossil fuel generating plants, including new entrants to the generation market.

It is important to note, that in the majority of cases, switching to electricity from 'new renewable' sources will *not* help a CCA company meet its energy or carbon target. This is because the carbon content of imported electricity in a CCA facility is calculated assuming a fixed emissions factor, *regardless* of the generating source. The rationale for this is set out in DEFRA (2001a). This notes that electricity from renewable sources will only treated as zero carbon if it has *not* been used by the electricity supplier to count towards the latter's Renewables Obligation (DEFRA, 2001a; Smith, 2002a). Since renewable sources which qualify for LECs will not necessarily be the same as sources which qualify for Renewables Obligation Certificates (ROCs),[29] there is no way of knowing whether electricity which is sold free of the CCL is also used by a supplier to meet its relevant obligation. Given the anticipated difficulty of meeting the renewables targets, the government has assumed that suppliers will wish to claim *all* qualifying renewable supplies towards their obligation (DEFRA, 2001a). Consequently, the assumption is made that any renewable energy supply to end users by a licensed supplier will have been used to meet the latter's renewables obligation. As a consequence, it will count towards the energy use or carbon emissions from the CCA facility. The purchase of renewable electricity will therefore help reduce electricity costs for CCA facilities via exemption from the remaining 20% of the CCL, but will not help them meet their energy or carbon targets.

[29] In particular, the treatment of energy from waste is different.

The logic behind this rule appears confused. Why should renewable electricity which qualifies for a ROC be eligible for a CCL exemption, but not for a CCA target? If ROC qualifying electricity was treated as zero carbon under the CCAs, the net result could be to increase the demand for renewable electricity at CCA facilities and to decrease the incentive to improve electrical efficiency. Whether this would be the case in practice, would depend upon the relative cost of purchasing renewables versus improving end use efficiency. If the primary objective of the CCAs is to improve energy efficiency, then the exclusion of ROC electricity appears justifiable. But the exemption of ROC electricity from the CCL implies that the same priority to end use efficiency does not apply here. In sum, this is a revealing example of the complexities of policy interaction where individual policies have multiple objectives.

3.5.3 EU ETS

The EU ETS covers fossil fuel electricity generators, who will need to obtain allowances to cover their emissions. As a consequence, the cost of electricity supply from fossil fuel plants will rise to reflect marginal abatement costs. A portion of these price rises will be passed on to consumers in *all* sectors - including the domestic sector. In the case of the EU ETS, electricity generators are directly affected and electricity consumers indirectly affected.

The size of the impact on consumers will depend on marginal abatement costs in the EU ETS as a whole, as reflected in the price of allowances (assuming profit maximising behaviour and a liquid allowance market), together with demand and supply elasticities in the wholesale electricity market. Consumer electricity prices must cover generation, transmission, distribution and supply costs, and these will vary with the size of the consumer. Generation costs account for a greater percentage of the total bill for larger consumers, so the proportionate impact of the EU ETS will be greater for these (Table 3.13).

Table 3.13 Illustrative breakdown of electricity costs (percentage of total)

Component	**<100kW ~£400/year**	**100kW – 1MW ~£40k/year**	**>1MW ~£0.4m/year**
Generation	60	71	76
Transmission	6	7	7
Distribution	28	21	16
Supply	7	1	1
Total	100	100	100

An important point is that there is no mechanism at present in the UK for the *carbon labelling* of electricity, or *disclosure* as it is called in the US. Consumers can purchase electricity from 'new renewable' sources, since this is exempt from the CCL and is identified through the system of Levy Exemption Certificates (LECs). But the carbon content of other electricity purchases (including electricity from nuclear and large hydro sources) cannot be identified. This has two implications:

- If a system equivalent to the Levy Exemption Certificates continues, the EU ETS may incentivise consumers to purchase electricity from new renewable sources. This is because the price competitiveness of electricity from new renewable sources will be improved compared to that from fossil sources as the former will not require carbon allowances. The size of this price incentive will depend allowance prices in the EU ETS. The incentive is unlikely to be sufficient in itself to overcome the price disadvantage of renewable sources, but may act in synergy with other measures such as the Renewables Obligation to expand renewable generation.

- Without any system of carbon labelling, the EU ETS will *not* incentivise consumers to switch to other zero carbon electricity sources (such as nuclear and large hydro), or to switch consumption towards lower carbon fossil sources (e.g. away from coal fired generating sources and towards gas fired CCGTs). It would, however, provide a strong incentive for electricity generators to reduce the carbon intensity of their generation mix.

The practicality of introducing carbon labelling is currently being discussed in the context of the proposed Directive on the Liberalisation of the European Electricity Market (CEC, 2001c). Since the proportion of electricity from different generating sources varies with the type of load, time of day and time of year, the concept presents a range of practical difficulties. However, a review conducted by the UK ETG suggested that carbon labelling should be possible in the UK and would be facilitated by the introduction of the New Electricity Trading Arrangements (NETA) (UKETG, 2000). The concept makes more sense for an emissions trading system with indirect allocation of generator emissions to electricity consumers, rather than the direct allocation to electricity generators proposed by the EU ETS. This is because with indirect allocation consumers have a carbon target and switching to lower carbon electricity will help them meet that target. However, even with direct allocation there may be some incentive for consumers to switch, since low carbon electricity should have a price advantage. There may also be public relations benefits in switching to ‘greener’ low carbon electricity, as well as to ‘green’ zero carbon electricity. This suggests that the concept should be explored further.

3.5.4 Incentives for lower carbon emissions from electricity generation

We therefore have a situation in which the CCL, CCAs and the EU ETS are all incentivising lower carbon emissions from electricity generation, but in rather different ways. These incentives operate both directly and indirectly and may be complementary. Table 3.14 provides a summary.

Table 3.14 Incentives for lower carbon emissions from electricity generation

	Measure	IPPC	EU ETS	CCL	CCA
Supply side incentives	Switch to generation from lower carbon fossil fuel	-	Direct via ESI emissions cap	-	-
	Improve thermal efficiency of generation	Direct via energy efficiency provisions	Direct via ESI emissions cap	-	-
	Invest in nuclear or large hydro	-	Direct via ESI emissions cap	-	-
	Invest in new renewable generation sources	-	Direct via ESI emissions cap	Indirect via increased demand from consumers who have switched to gain CCL exemption	-
Demand side incentives	Purchase electricity from new renewable sources	-	Indirect via price advantage of zero carbon electricity	Direct by exemptions for new renewable electricity	-
	Purchase electricity from nuclear, large hydro or lower carbon fossil sources	-	-	-	-
	Improve efficiency of electricity consumption	Direct via energy efficiency provisions	Indirect via electricity price increases from generators	Direct via CCL on electricity purchases	Direct via energy/carbon targets
	Invest in CHP	Direct via energy efficiency provisions and encouragement of CHP	Indirect via electricity price increases (ESI); offset by direct requirement for additional allowances for CHP fuel (consumer)	Direct via exemptions for CHP fuel	Direct via energy/carbon targets and requirements to assess CHP potential

Note: The table shows the *additional* incentives created by the CCA targets. CCA sites still pay 20% of the CCL.

The treatment of electricity from different generating sources is summarised in Table 3.15. This illustrates that:

- IPPC and the CCAs provide incentives to reduce electricity consumption regardless of the source.
- The CCL provides a partial exemption for electricity from municipal and industrial wastes, and full exemption from all other sources classified as 'new renewable'. Note that some of these, such as landfill gas, emit CO_2.
- The treatment of several 'renewable' sources that emit CO_2 by the EU ETS has yet to be clarified. These include agricultural and forestry wastes, energy crops, landfill gas and coal mine methane. The incineration of municipal and industrial waste is excluded from the EU ETS Directive, and it is assumed here that this applies even if the combustion plant has a thermal input >20MWth.

Table 3.15 Coverage of electricity generation technologies by IPPC, the CCL, the CCAs and the EU ETS

Technology	**IPPC**	**CCL**	**CCAs**	**EU ETS**
Fossil fuel	Direct and indirect	Indirect	Indirect	Direct
Large hydro (>20MW)	Indirect	Indirect	Indirect	-
Nuclear	Indirect	Indirect	Indirect	-
Zero carbon renewable[1]	Indirect	*Exempt*	Indirect	-
Municipal and industrial wastes	Indirect	*Partially exempt*	Indirect	-
Agriculture and forestry wastes	Indirect	*Exempt*	Indirect	?
Energy crops	Indirect	*Exempt*	Indirect	?
Landfill gas	Indirect	*Exempt*	Indirect	?
Coal mine methane	Indirect	*Exempt*	Indirect	?

Notes:
1. Includes small hydro (<20MW), onshore wind, onshore wind, geothermal, wave, tidal, photovoltaics, geothermal

3.6 Estimating the size of the target groups

Accurate data is not available on the emissions coverage of IPPC, the CCL, CCAs and the EU ETS. But approximate estimates can be obtained using the information presented in Volterra (2000). *This assigns the CO_2 emissions to electricity generation to the final energy user*. Table 3.16 shows how the estimated 40MtC of ESI emissions in 1998 was approximately split between end users.

Table 3.16 Electricity demand by sector 1998

Sector	**Consumption (TWh)**	**Associated CO_2 Emissions (MtCe)**
Energy Industry	7.6	0.9
Other Industry	107.2	13.2
Domestic	109.6	13.5
Services	99.9	12.3
Total	**324.3**	**40**

Source: Volterra (2000)

The available data can be used to obtain an approximate split between the CCL, CCAs and the EU ETS. This is shown in Table 3.17. Grey areas are where data is unavailable. In this table, regulations are assumed to 'cover' emissions if they either: a) regulate combustion or process emissions directly; or b) regulate electricity consumption, and thereby indirectly affect fossil fuel combustion in the ESI. In the latter case, the regulatory coverage incentivises reduced electricity demand but does not create an incentive for reducing carbon intensity.

The split given in Table 3.17 includes all energy consuming sectors, as well as upstream energy sectors such as oil refineries, but excludes electricity generators as generator emissions are allocated to electricity consumers. To obtain this table, a number of simplifying assumptions have been made, including:

- process CO_2 emissions are ignored, and all direct CO_2 emissions from manufacturing are assumed to come from combustion plant;
- the full CO_2 emissions of all industrial sectors other than upstream energy are covered by either the CCL or the CCAs (i.e. no allowance is made for exempt processes or fuels);
- the full CO_2 emissions of all public, commercial and agricultural sectors are covered by the CCL (i.e. no allowance is made for exempt fuels);
- all IPPC sites in these sectors are included in the CCAs, and no other sites are included (i.e. sites below the IPPC size threshold and sites in non-IPPC sectors are ignored);
- the EU ETS coverage of manufacturing sector emissions is confined to sites with IPPC processes that are eligible for the EU ETS (i.e. sites eligible on the basis of having combustion plant >20MWth are ignored); and
- the EU ETS coverage of service sector emissions is confined to indirect emissions from electricity use (i.e. direct emissions from the small number of combustion plant >20MWth in these sectors are ignored).

These are major simplifying assumptions. For example, they ignore the ~17% of industrial, commercial, public and commercial energy use which is accounted for by oil products and the ~13% of industrial energy use which is accounted for by autogeneration, much of which is exempt from the CCL (DTI, 2002a). While an allowance could be made for these, it is difficult to obtain an accurate breakdown at the sector level. The data should therefore be considered an order of magnitude estimate only, and one which highlights the need for a more detailed analysis.

The data provides a sectoral breakdown of CO_2 emissions covered by IPPC. Given the above assumptions, this provides a proxy for the CO_2 emissions covered by the CCAs (since the latter does not cover non-CO_2 GHGs). IPPC covers both CO_2 and other GHGs, but data is not available on either the sectoral breakdown of other GHG emissions, or the IPPC coverage of this. As a result, the total coverage of GHG emissions by IPPC cannot be estimated.

Table 3.18 aggregates the results by broad sector category, while Tables 3.19 and 3.20 summarise the results as a percentage of the total

Table 3.17 Estimated emissions coverage of the CCL, CCA and EU ETS compared to total UK GHG emissions (MtC equivalent)

Sector	**Total[1] CO_2**	**CO_2 from elec. Gen.[2]**	**Other GHGs**	**Total GHGs**	**Covered by full CCL**	**Covered by CCA**	**Covered by EU ETS[3]**
Iron and Steel	8.6	1.1			1.2	7.4	7.4
Non-ferrous metals	1.7	0.7			0.6	1.1	*0.7*
Non metallic metals	0.7	0.0			0.6	0.1	
Bricks	0.4	0.1			0	0.4	0.4
Cement	1.6	0.5			0	1.6	1.6
Glass	0.6	0.2			0	0.6	0.6
Potteries	0.3	0.1			0.2	0.1	0.1
Chemicals	5.9	1.8			0.9	5.0	*1.8*
Mech. Engineering	1.8	1.0			1.5	0.3	*1*
Elec. Engineering	0.9	0.7			0.9	0	*0.7*
Vehicles	1.8	0.6			1.5	0.3	*0.6*
Food, Drink and Tobacco	3.5	1.4			2.7	0.8	*1.4*
Textiles, leather and clothing	1.2	0.4			0.6	0.6	*0.4*
Paper	3.8	1.2			1.4	2.4	2.4
Plastics and Rubber	1.6	0.5			1.5	0.1	*0.5*
Other Manufacturing	1.8	1.1			1.8	0	*1.1*
Water	0.8	0.5			0.8	0	*0.5*
Construction	1.0	0.2			1	0	*0.2*
Mining	0.6	0.4			0.6	0	*0.4*
Total manufacturing	**38.6**	**12.4**	**11.4**	**50**	**17.8**	**20.8**	**21.8**
Coke	0.7	0.2			0	0	0.7
Oil refining	5.6	0.6			0	0	5.6
Other	2.8	2.7			0	0	2.8
Total Energy	**9.1**	**3.5**	**6.4**	**15.5**	**0**	**0**	**9.1**
Total Industry	**47.7**	**15.9**	**17.8**	**65.5**	**17.8**	**20.8**	**30.9**
Public Sector	8.1	2.6	0.7	8.8	8.1	0	*2.6*
Commerce	13.9	7.6	0	13.9	13.9	0	*7.6*
Total Services	**22**	**10.2**	**0.7**	**22.7**	**22**	**0**	**10.2**
Transport	41.5	1.0	0.4	41.9	0	0	*1*
Domestic	43.5	12.6	3.1	46.6	0	0	*12.6*
Agriculture	3	0.4	10.1	13.1	3	0	*0.4*
Total Other	**88**	**14.0**	**13.6**	**101.6**	**3**	**0**	**14**
TOTAL	**157.7**	**40.0**	**32.1**	**189.8**	**42.8**	**20.8**	**55.1**

Source: Adapted from Volterra (2000), p25; DTI (2002)

Notes:

1. ESI emissions assigned to final user
2. Estimate based on electricity consumption of each sector
3. Italics indicate indirect coverage of electricity emissions only for this sector

Table 3.18 Estimated emissions coverage of the CCL, CCA and EU ETS compared to total UK GHG emissions (MtC equivalent)

Sector	**Total[1] CO_2**	**CO_2 from elec. Gen.[2]**	**Other GHGs**	**Total GHGs**	**Covered by full CCL**	**Covered by CCA**	**Covered by EU ETS[3]**
Manufacturing	38.6	12.4	11.4	50	17.8	20.8	21.8
Energy	9.1	3.5	6.4	15.5	0	0	9.1
Total Industry	**47.7**	**15.9**	**17.8**	**65.5**	**17.8**	**20.8**	**30.9**
Public Sector	8.1	2.6	0.7	8.8	8.1	0	*2.6*
Commerce	13.9	7.6	0	13.9	13.9	0	*7.6*
Total Services	**22**	**10.2**	**0.7**	**22.7**	**22**	**0**	**10.2**
Transport	41.5	1.0	0.4	41.9	0	0	*1*
Domestic	43.5	12.6	3.1	46.6	0	0	*12.6*
Agriculture	3	0.4	10.1	13.1	3	0	*0.4*
Total Other	**88**	**14.0**	**13.6**	**101.6**	**3**	**0**	**14**
TOTAL	**157.7**	**40.0**	**32.1**	**189.8**	**42.8**	**20.8**	**55.1**

Source: Adapted from Volterra (2000), p25; DTI (2002)
Notes:
1. ESI emissions assigned to final user
2. Estimate based on electricity consumption of each sector
3. Italics indicate indirect coverage of electricity emissions only for this sector

Table 3.19 Estimated emissions coverage of the CCL, CCA and EU ETS compared to total UK GHG emissions (% of total in each column)

Sector	**Total[1] CO_2**	**CO_2 from elec. Gen.[2]**	**Other GHGs**	**Total GHGs**	**Covered by full CCL**	**Covered by CCA**	**Covered by EU ETS[3]**
Manufacturing	24.5	31.0	35.5	26.3	41.6	100.0	39.6
Energy	5.8	8.8	19.9	8.2	0.0	0.0	16.5
Total Industry	**30.2**	**39.8**	**55.5**	**34.5**	**41.6**	**100.0**	**56.1**
Public Sector	5.1	6.5	2.2	4.6	18.9	0.0	4.7
Commerce	8.8	19.0	0.0	7.3	32.5	0.0	13.8
Total Services	**14.0**	**25.5**	**2.2**	**12.0**	**51.4**	**0.0**	**18.5**
Transport	26.3	2.5	1.2	22.1	0.0	0.0	1.8
Domestic	27.6	31.5	9.7	24.6	0.0	0.0	22.9
Agriculture	1.9	1.0	31.5	6.9	7.0	0.0	0.7
Total Other	**55.8**	**35.0**	**42.4**	**53.5**	**7.0**	**0.0**	**25.4**
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Adapted from Volterra (2000), p25; DTI (2002)
Notes:
4. ESI emissions assigned to final user
5. Estimate based on electricity consumption of each sector
6. Italics indicate indirect coverage of electricity emissions only for this sector

Table 3.20 Summary of emissions coverage of the CCL, CCA and EU ETS (MtC equivalent)

	Total emissions (MtC)			**Percentage of UK CO_2 emissions**			**Percentage of UK GHG emissions**		
	CCL	**CCA**	**EU ETS**	**CCL**	**CCA**	**EU ETS**	**CCL**	**CCA**	**EU ETS**
Manufacturing	17.8	20.8	21.8	11.3	13.2	13.8	9.4	11.0	11.5
Energy	0.0	0	9.1	0.0	0.0	5.8	0.0	0.0	4.8
Total Industry	**17.8**	**20.8**	**30.9**	**11.3**	**13.2**	**19.6**	**9.4**	**11.0**	**16.3**
Public Sector	8.1	0	2.6	5.1	0.0	1.6	4.3	0.0	1.4
Commerce	13.9	0	7.6	8.8	0.0	4.8	7.3	0.0	4.0
Total Services	**22.0**	**0**	**10.2**	**14.0**	**0.0**	**6.5**	**11.6**	**0.0**	**5.4**
Transport	0.0	0	1	0.0	0.0	0.6	0.0	0.0	0.5
Domestic	0.0	0	12.6	0.0	0.0	8.0	0.0	0.0	6.6
Agriculture	3.0	0	0.4	1.9	0.0	0.3	1.6	0.0	0.2
Total Other	**3**	**3**	**14**	**1.9**	**1.9**	**8.9**	**1.6**	**1.6**	**7.4**
TOTAL	**42.8**	**20.8**	**55.1**	**27.1**	**13.2**	**34.9**	**22.6**	**11.0**	**29.0**

Some notable points from these tables are as follows:

- Total UK GHG emissions in 2000 were 189.7MtC, of which 65.5MtC (34.5%) was from industry, 13.9MtC (7.3%) from commerce and a 8.8MtC (4.6%) from the public sector. Excluding the energy industries, total (manufacturing) industry emissions were 50MtC, or 26.3% of the UK total.
- Total UK CO_2 emissions in 2000 were 157.7MtC. This corresponds to 83% of total UK GHG emissions. The CO_2 emissions were split as follows: industry 30%; public and commercial 13.9%; transport 26.3%; domestic 27.6% and other 2.2%.
- CO_2 dominates GHG emissions in all sectors apart from certain sectors of industry and agriculture. Of the 50 MtC of manufacturing industry emissions, a total of 11.4 MtC (22.8%) derive from GHG gases other than CO_2.
- Direct emissions from the ESI account for 40MtC. This corresponds to 25% of UK CO_2 emissions and 21% of total UK GHG emissions.
- Grouping together both direct and indirect coverage of CO_2 emissions, the CCL covers 27.1% of UK CO2 emissions, the CCAs 13.2%, the CCL/CCA package 40.3% and the EU ETS 34.9%. Taking GHG emissions as a whole, the CCL covers 22.6% of UK GHG emissions, the CCAs 11.0%, the CCL/CCA package 33.6% and the EU ETS 29%.
- Grouping together both direct and indirect coverage of CO_2 emissions, the CCL covers 46.1% of manufacturing sector emissions (ignoring exemptions), the CCAs 53.9%, the CCL/CCA package 100% and the EU ETS 56.5%. The corresponding figures for total GHG emissions are 35.6%, 41.6%, 77.2% and 43.6%.
- Ignoring exemptions, the CCL covers 100% of service sector CO_2 emissions. The EU ETS only covers the indirect emissions from electricity generation, which amounts to 46.4% of the CO_2 total for the service sector. The CCAs do not extend into the service sector.

- The EU ETS covers 27% of the emissions from the domestic sector, through its coverage of indirect emissions from the ESI. In contrast, the CCL/CCAs exempt the domestic sector altogether.

3.7 Summary

This section has explored the overlaps in scope of the CCL, CCAs and EU ETS. Since the coverage of the CCAs is related to coverage of the IPPC Directive, the scope of the latter has also being examined. Most of the discussion has focused on overlaps in the direct target groups, but attention has also been paid to the indirect impacts of the instruments on the electricity market.

The results are formidably complex. They suggest that implementing the EU ETS will create substantial difficulties in terms of differential treatment, double regulation and equivalence of effort. The overlaps were investigated in four stages:

- *Sectoral coverage*: Differences in sectoral coverage of the four instruments suggest that individual sites in the public, commercial, manufacturing and energy sectors may face one of **ten** combinations of the four instruments (Table 3.4).
- *Site coverage*: Differences in the coverage of individual technologies *within* an individual site expands the number of possible combinations of instrument coverage from ten to **eighteen.** For example, comparable sites in the same sector could have different regulatory coverage depending upon the size of their main combustion plant (Table 3.10).
- *Emissions coverage*: Further complications are introduced by the differences in coverage of: a) CO_2 versus other GHGs; b) combustion versus non-combustion CO_2 emissions; and c) combustion emissions from different fossil fuels.
- *Electricity coverage*: A final layer of complexity is provided by the differing incentives each instrument creates for abating emissions from electricity generation. Each instrument gives a different mix of direct and indirect incentives to both the supply and demand side of the electricity market, with the result that each instrument incentivises a different mix of abatement options (Table 3.14). Particular complications are introduced by the inconsistent treatment of electricity from various renewable sources (Table 3.15).

The aggregate coverage of CO_2 emissions from each instrument is also different. The CCL covers approximately 27% of UK CO_2 emissions, the CCAs 13.2%, the CCL/CCA package 40% and the EU ETS 35%. As indicated above, the particular mix of emission sources is different in each case.

Confusion over instrument objectives

This section first explores the quantitative and qualitative objectives of the CCL, CCAs and EU ETS. It then compares these objectives to assess their compatibility and to identify any potential conflicts. The discussion is preceded by a short note on energy prices.

4.1 A note on energy prices

In this section and elsewhere, comments are made on the potential impact of each instrument on energy costs and energy prices. But any such impacts must be set in the context of underlying trends in energy prices. Table 4.1 provides energy price indices for the industrial sector over the period 1990-2001, adjusted by the GDP deflator. These show that:

- In 2001, UK gas prices were 6.8% higher in real terms than in 1990, coal prices were 16.5% lower and electricity prices were 10% lower.
- Gas prices increased by 18% in real terms between 1995 and 2001, while coal prices fell by 3.8% and electricity prices fell by 23%;
- Gas prices increased by 34.6% in real terms between 2000 and 2001, while electricity prices fell by 8.5%.

Table 4.1 Energy price indices for the UK industrial sector

Year	Coal	HFO	Gas	Electricity
1990	100.00	100.00	100.00	100.00
1991	98.50	87.84	100.96	103.31
1992	99.75	84.48	104.46	109.04
1993	93.64	90.05	102.69	114.24
1994	92.52	97.44	103.63	110.10
1995	86.79	113.78	90.36	109.07
1996	82.55	125.65	66.13	105.30
1997	80.62	120.21	69.74	99.30
1998	82.49	100.20	73.59	98.37
1999	81.25	114.69	72.94	98.95
2000	81.37	166.04	79.33	91.74
2001	83.49	165.81	106.79	83.95
% change 1990-2001	*-16.5*	*65.8*	*6.8*	*-16.1*
% change 1995-2001	*-3.8*	*45.7*	*18.2*	*-23.0*
% change 2000-2001	*2.6*	*-0.1*	*34.6*	*-8.5*
Average prices 2001 (p/kWh)	0.482	1.055	0.816	3.135

Notes:

- Figures for 2001 exclude the impact of CCL, which came into force in April 2001.
- Deflated using the GDP implied deflator at market prices with base year of 1995 but rescaled to 1990=100.

Source: DTI (2002)

The decline in industrial electricity prices is continuing. Average industrial electricity prices excluding the CCL decreased in real terms by 6% in the year to the second quarter of 2002, giving an average price of 2.87p/kWh. Over the same period, industrial gas prices excluding the CCL decreased by 12% in real terms, while the price of coal and HFO decreased by 4% and 1% respectively.

The fall in industrial electricity prices is primarily the result of large falls in wholesale electricity prices following the introduction of NETA in March 2001. A combination of overcapacity in electricity generation and (arguably) the absence of incentives within NETA to reward unused capacity has driven wholesale prices as low as 1.4p/kWh. This in turn has halted new investment and precipitated a crisis in electricity generation (ENDS, 2002b). The resulting fall in electricity industrial prices has acted to offset the price increase from the CCL. For example, the difference in average electricity prices (excluding the CCL) between the second quarter of 2000 and the second quarter of 2002 was 0.53p/kWh, which is greater than 0.43p/kWh increase provided by the CCL. In contrast, gas price trends between 2000 and 2002 have added to the price increases from the CCL.

4.2 CCL objectives

4.2.1 Quantitative objectives

The CCL increases coal and gas prices by 0 15p/kWh and delivered electricity prices by 0.43p/kWh. The tax rates can be converted into an equivalent carbon tax for gas and coal by using assumptions about average carbon content. Similarly, the tax rates for electricity can be converted into an equivalent carbon tax for the primary fuel input to electricity generation by using assumptions about fuel mix, carbon intensity, thermal efficiency and losses in transmission and distribution.

The results are shown in Table 4.2. This illustrates that the CCL corresponds approximately to a £8.15/tCO_2 tax for natural gas, a £4.55/tCO_2 tax for coal and a £9.35/tCO_2 tax for the primary fuel input to electricity generation. Together with the exclusion of oil, these figures illustrate the variance of the CCL from a straightforward carbon tax and the disincentive it creates for switching to fuels with a low carbon content. The size of the levy represents a compromise between climate policy and competition objectives, reached in the context of heavy industrial lobbying.

The reason for excluding oil products is that these are already eligible for excise duties. Current duty rates[30] correspond to an equivalent carbon tax of £8.9/tCO_2 for HFO and £11.6/tCO_2 for gasoil. Excise duties are a legacy of policies imposed in the 1970s to reduce dependence upon imported oil, and have been retained despite the UK being a net exporter of oil for nearly two decades. The CCL improves the competitiveness of oil compared to gas and coal. But oil is still taxed at a higher rate on a carbon equivalent basis.

[30] Current excise duties are £27.62/tonne for HFO and £36.53/tonne for gasoil. The combustion of one tonne of HFO leads to emissions of 3.11tCO_2, while the corresponding figure for gasoil is 3.136tCO_2.

Table 4.2 CCL rates and equivalent carbon tax rates

Fuel	**Rate p/kWh**	**Equivalent in £/tCO$_2$**	**Equivalent in £/tC**
Gas	0.15	8.15	29.8
Coal	0.15	4.55	16.7
Delivered electricity	0.43	9.35	34.28

Notes: Assumed emission factors: Gas = 51.3kgCO_2/GJ; Coal = 91.5kgCO_2/GJ. Assumed delivered to primary conversion factor = 2.60. Assumed carbon emissions factor for primary electricity = 0.17 kg CO_2/kWh. These assumptions correspond to those used for the CCAs.

The contribution of the CCL to reduced carbon emissions depends upon assumptions about energy price elasticities in different sectors. Based on DTI econometric modelling, the government estimates the CCL will contribute a reduction of 2MtC/year between 2000 and 2010, 'including the exemption for CHP and renewables' (DETR, 2000c). In addition, CCL revenues fund financial support for R&D and capital allowances for energy efficiency investment, which are expected to contribute an additional 0.5MtC.

The total figure of 2.5MtC/year corresponds to 5.8% of emissions from the fuel and electricity use that is subject to the full CCL, or 3.9% of emissions from the fuel and electricity use that is subject to the CCL/CCA package (CCA facilities still pay 20% of the CCL) (Table 3.17). The uncertainty of this estimate is illustrated by the fact that it is 33% greater than an earlier estimate provided by the DETR, which was for a 30% *higher* CCL rate.

4.2.2 Qualitative objectives

The CCL has its origins in the recommendations of the Marshall report (Marshall, 1998). This concluded that there was a role for a business energy/carbon tax in UK climate policy, in part because a downstream trading scheme could not reach smaller firms. The suggested requirements for such a tax included:

- full revenue recycling, with a portion of the revenues used to promote energy efficiency;
- some form of exemption/rebate for energy intensive industry, while retaining incentives for reduced energy use; and
- incentives for CHP and renewables.

All three of these objectives have been reflected in the design of the CCL. Overall revenue neutrality is achieved through a 0.3% reduction in employers national insurance contributions. Investment in energy efficiency is promoted through a £50m annual R&D fund managed by the newly formed Carbon Trust, together with £100m for a system of first year capital allowances for energy efficiency investments. This represents approximately 15% of the expected £1 billion to be raised from the CCL, with the remainder going to fund the cuts in national insurance contributions. Finally, good quality CHP and renewables are exempt from the levy.

Several other objectives are less explicit but very important, and explain the choice of a downstream energy tax rather than an upstream carbon tax. The first is the *social policy* objective of protecting the domestic consumer from energy price rises. The UK is almost unique in Europe in having up to five million households living in ‘fuel poverty’, defined as spending more than 10% of household income on energy. This results from a combination of income inequality and an inefficient housing stock. Fuel poverty is a sensitive political issue that has prevented previous governments from imposing VAT on domestic energy supplies.[31] The same considerations led to the choice of a downstream tax for electricity, rather than imposing the tax on the fuel consumed by generators. The rationale was that an upstream energy or carbon tax would lead to electricity price rises for *all* consumers, including households.

The second is the *energy policy* objective of protecting the remains of the UK coal industry. The UK coal market shrunk by 49% between 1990 and 1999, largely as a consequence of the ‘dash to gas’ following electricity market privatisation. This decline was (and is) leading to concern about fuel diversity and supply security (PIU, 2002).[32] In 1998, there was concern that the structure and operation of the electricity market was denying a fair opportunity for coal fired generation. This led to a review of energy sources for electricity generation (DTI, 1998), a temporary restriction on consent for new gas fired stations, and ultimately the introduction of NETA. Imposing an upstream carbon tax would have completely undermined these attempts to protect coal.

A second energy policy consideration was the desire to prevent the nuclear industry, and to a lesser extent large hydro, from receiving a large windfall. This would have been the case if the fuel input to generation had been subject to a carbon tax since, prior to 2001, the operation of the UK wholesale electricity market (the Pool) would allow *all* generators to receive a higher electricity price.[33] In contrast to the Pool, NETA is based upon bilateral contracts between generators and suppliers, which makes the impact of an upstream carbon tax more difficult to assess.

The nuclear industry continues to lobby for exemption from the CCL, of the grounds that it emits no CO_2. But the government has refused this by arguing that, despite its name, the CCL is designed to encourage energy efficiency, rather than simply reduce CO_2 emissions (ENDS, 2002b).[34] A rationale for this stance could be that nuclear power has uninternalised environmental costs of its own, which the CCL goes some way to cover. Energy efficiency also has broader benefits in terms of improving supply security and facilitating the long term transition to a low carbon economy and these broader energy policy objectives may also have been a consideration in the design of the CCL.

[31] In contrast, most energy efficiency investments, such as cavity wall insulation, are subject to the full rate of VAT.

[32] The concern is that: first, the UK is becoming increasingly reliant upon gas in all sectors other than transport; second, North Sea gas supplies are declining and by around 2020 as much as 90% of gas may need to be imported; and third, fuel diversity in electricity generation will be reduced further by the closure of nuclear power stations. At present, the UK has 12.5GW of nuclear capacity, representing 15% of installed capacity and around 25% of supply. By 2020, only around 2GW (Sizewell B) is anticipated to remain in operation.

[33] This assumes that generators receive the system marginal price (SMP), which would normally be set by coal fired generation plant and would be increased through the imposition of a carbon tax.

[34] In October 2002, Trade and Industry Secretary Patricia Hewitt stated that the government had no plans to exempt nuclear from the CCL (ENDS, 2002b). The levy had been designed as an energy tax rather than a carbon tax to: ‘…encourage all sectors of business and the public sector to improve energy efficiency. Excluding electricity generated from nuclear would take a fifth of the UK's electricity out of the levy, reducing the incentive upon business to use electricity efficiently and reducing the levy’s beneficial effect on carbon emissions.’

The net result is that the UK CCL does not have the sole objective of reducing carbon emissions - something which would have best been achieved through an upstream carbon tax. Instead, its complex design reflects a range of other objectives, including the desire to protect domestic consumers, energy intensive industry, and UK coal producers, together with avoiding a windfall to nuclear generators and encouraging energy efficiency. Instead of meeting these objectives explicitly through subsidiary policies and measures – for example, tax exemptions for low income households – the government chose to achieve these multiple objectives through the CCL itself. The result is that the transparency of policy objectives has been clouded and the cost effectiveness of the tax (in terms of £/tCO_2 abated) has been reduced.

4.3 CCA objectives

The primary objective of the CCAs is to cushion energy intensive industries from the full impact of the CCL, while at the same time securing quantified improvements in energy efficiency and thereby contributing to the UK carbon targets. Each CCA has a specific, precise and quantified target for reducing energy intensity, carbon intensity or energy use (no sectors have chosen absolute targets for carbon emissions). The agreements are complex and vary from sector to sector in a number of respects, including:

- *baseline year:* this can be any year from 1990 to 2000[35];
- *absolute or relative targets*: nearly all sectors have opted for relative targets (e.g. % reduction in energy use per unit of output), with only the steel and aerospace sectors agreeing to targets for absolute energy consumption.
- *value of the targets*: the percentage improvement over the baseline year varies widely between sectors;
- *risk management procedures*: some sectors are allowed to adjust their targets if there are changes in product mix or output level, while others have adopted a 'tolerance band'.

The negotiation of the targets was based on a bottom up database of industrial energy efficiency opportunities held by ETSU (ETSU, 2001). This distinguishes between 'technically possible' opportunities and 'cost effective' opportunities, where the latter include assumptions about investment criteria in different sectors. A selection of these assumptions are summarised in Table 4.3

[35] The baseline is normally a single year, rather than the average of several years.

Table 4.3 ETSU assumptions on typical payback criteria by sector

Sector	Retrofit measures	New plant
Iron and Steel	2	4
Non Ferrous Metals	2	2
Non Metallic Minerals	2	4
Bricks	2	4 (15*)
Cement	2	4 (15*)
Glass	2	2 (10*)
Pottery	2	4 (10*)
Chemicals	2	2 (5-10*)
Mechanical Engineering	1-2	2
Electrical Engineering	2	5
Vehicles	2	5
Food and Drink	2	2-4
Textiles	1-2	1 (2*)
Other Industries	1-2	2
Paper	2	2
Plastics and Rubber	2	2

Source: ETSU (1999)

The starting point for negotiations was the adoption of 'all cost effective' (ACE) opportunities identified by the database by 2010. But the final agreements generally require less than ACE. Overall, the CCAs will lead to around 60% of ACE measures being taken, although there is wide variation between sectors. Factors influencing the targets for each sector include: the negotiating skills of the trade association; availability of capital; growth rates; market structure and international competitiveness; historic progress on energy efficiency; differing baseline years; varying potential for CHP; regulatory constraints; and the cost of management time (ETSU, 2001).

The stringency of the targets may be questioned (Sorrell and Smith, 1999). First, the ETSU database is limited in its level of sectoral and technology disaggregation and hence only identifies a subset of the available energy efficiency opportunities. Second, improvements in energy efficiency may result from either specific energy efficiency investments, or as a by-product of technological investments undertaken for other reasons. This second type of improvement may not have an easily identifiable payback rate, but historically has been very important in improving industrial energy efficiency (Bell, 1990). Again, the ETSU database may only include a subset of such opportunities. Third, the ETSU database is confined to currently available technologies, but over the ten year period of the agreements technical innovation could substantially change both the availability and cost of efficiency opportunities (although this risk is partly mitigated by the review of the CCA targets which are scheduled for 2004 and 2008). Finally, the investment criteria illustrated in Table 4.3 can be challenged in terms of the rationale for the variation between sectors, the choice of simple paybacks rather than discounted cash flow,[36] the very short paybacks used, and the neglect of

[36] This reflects normal industry practice, but simple paybacks neglect cost savings beyond the end of the payback period.

wider social costs. In practice, if the investment are cost effective then industry should be making them anyway, without the incentive of the agreement.[37]

Based on ETSU's analysis, the government estimates that the CCAs will deliver 2.5MtC annual reductions by 2010 compared to a business as usual scenario. This compares to 4MtC if 'all cost effective measures' were adopted. Interestingly, ETSU also estimate that the price effect of the levy on its own in the sectors (i.e. with no agreements and no associated discounts) would give a saving of only 0.25MtC per annum (ETSU 2001). A 2.5MtC reduction corresponds to 12% of the baseline emission coverage of the CCAs, while 4MtC corresponds to 19.2%.

Although this figure is based upon quantified and legally binding targets, there is some uncertainty over whether it will be achieved in practice. First, most of the agreements are on a relative basis. If industrial output increases faster than was anticipated during the negotiations then there will be a concomitant increase in carbon emissions. Second, most of the agreements are on an energy basis. If the balance between different types of fuel, or between fuel and electricity, departs from that assumed there will be a corresponding change in carbon emissions. Third, the risk management procedures have complicated the agreements, and may lead to changes in the targets if there are changes in the product mix. Fourth, the targets are not fixed for the ten year period but are open to renegotiation in 2004 and 2008, at which point they may either be relaxed or tightened. Finally, and most importantly, the estimates of carbon emissions from electricity consumption are based upon a *fixed* conversion factor for the period 2000-2010, which in turn is based upon assumptions about the average fuel mix for electricity supply over this period (Table 4.4). In practice, actual carbon emissions are likely to depart from estimated carbon emissions due to changes in generation efficiency and fuel switching by generators. The most likely scenario is for carbon intensity to fall, leading to the emission factor overestimating actual carbon reductions. To take an extreme case, if nuclear generation remained unchanged in 2010 and all coal plants were replaced with gas fired CCGTs, the carbon intensity of electricity production would fall by some 28%. The carbon savings from improved electricity efficiency at CCAs facilities would then be overestimated by some 28%. Total energy consumption would still be reduced, but the calculated reduction in carbon emissions would be incorrect. This *discrepancy* is of particular importance when considering the potential interface between the CCAs and the EU ETS.

[37] The issue here is the definition of 'cost effective'. Hidden costs, notably management time, may make many apparently cost effective investments uneconomic. This is a complex question, with a voluminous literature (Sorrell et al, 2000).

Table 4.4 Conversion factors for grid purchased electricity used in the CCAs

Year	Delivered to primary conversion factor	Carbon emission factor kgCO2/GJ (primary)	Carbon emission factor kgCO2/kWh (primary)	Carbon emission factor kgCO2/kWh (delivered)
1990	3.20	69.65	0.25	0.80
1991	3.20	66.72	0.24	0.77
1992	3.10	61.96	0.22	0.69
1993	3.00	57.19	0.21	0.62
1994	2.95	54.99	0.20	0.58
1995	2.90	55.36	0.20	0.58
1996	2.88	55.36	0.20	0.57
1997	2.84	49.49	0.18	0.51
1998	2.76	46.19	0.17	0.46
1999	2.68	46.19	0.17	0.45
2000	2.60	46.19	0.17	0.43
2005	2.60	46.19	0.17	0.43
2010	2.60	46.19	0.17	0.43

Source: DETR, 1999a
Notes:

- Delivered to primary conversion factor allows for efficiency losses in generation, transmission and distribution, while carbon emission factor allows for carbon intensity of fuel mix.
- 1GJ = 277.8kWh; 1tC = 3.66tCO_2;

4.4 EU ETS objectives

4.4.1 Quantitative objectives

The Directive does not include any quantitative targets for GHG emissions reduction. Decisions on the *total quantity* of allowances to be issued are left to individual Member States, but must be ‘consistent with’:

- Member State obligations under the Kyoto Protocol and the EU burden sharing agreement, taking into account the proportion of national emissions represented by covered sources;
- the technological potential of installations to reduce emissions;
- assessments of actual and projected progress towards fulfilling Community commitments; and
- other EU legislative and policy instruments (CEC, 2001a).

The last includes a requirement that no allowances should be allocated to cover emissions which would be reduced or eliminated as a consequence of EU legislation on renewables. Account should also be taken of unavoidable increases in emissions resulting from new legislative requirements.

The *total quantity* of allowances should ensure that the overall emissions of all the participating installations collectively would be no higher than if the emissions were to be regulated under IPPC (Article 13). In practice, this is likely to be very difficult to demonstrate. CO_2 emissions are not regulated by BAT under the IPPC Directive, but by more ambiguous energy efficiency requirements (Smith and Sorrell, 2001). This means that it is first necessary to decide how these will be interpreted, and then to demonstrate that the requirements have been adhered to in practice. Other GHGs are currently subject to strict BAT requirements under IPPC, which are incompatible with emissions trading (Smith and Sorrell, 2001). The Directive therefore proposes that the IPPC Directive be amended to accommodate the subsequent inclusion of such gases in the scheme (CEC, 2001a).

In Phase 1 of the scheme (2005-2008), allowances will be allocated free. The criteria for distributing allowances *between installations* include (CEC, 2001a):

- compliance with State Aid provisions (each situation examined on its merits);
- consistency with the technological potential of installations to reduce emissions;
- taking account of unavoidable increases in emissions resulting from new legislative requirements;
- not discriminating between companies or sectors in such a way as to unduly favour certain undertakings or activities;
- not allocating an installation more allowances than it is likely to need;

Taken together, the suggested allocation criteria are at best ambiguous and at worst contradictory. On the one hand, the reference to the EU burden sharing agreement implies a top-down form of allocation, while on the other hand the references to technological potential, equivalence to IPPC, and 'need' for allowances imply a bottom-up form of allocation. It is not clear which should take priority or how a compromise between these could be achieved.

From the perspective of UK industry, an approach to allocation which is strongly shaped by the burden sharing targets would be preferred. This is because the UK is well on course to meet its burden sharing target. Following this logic, UK installations could obtain relatively soft targets under the EU scheme. Conversely, installations in Member States (such as Spain) which look likely to exceed their burden sharing target would receive more stringent targets. But this raises equity issues. A Member State (e.g. the UK) may be on course to meet its burden sharing target for reasons that are entirely independent of the performance of many of the installations regulated under the EU scheme.[38] This may mean that the EU ETS installations get off lightly, giving them a competitive advantage over installations in other countries. Alternatively, individual companies may feel penalised for the failure of their Member State (e.g. Spain) to meet its burden sharing target. Hence, differentiating installation targets on the basis of national progress towards the burden sharing targets is bound to raise competitiveness concerns. Conversely, allocating targets on the basis of bottom-up considerations is administratively burdensome. Trying to do both is arguably worse still, although this is what is implied by the text of the Directive.

[38] In the aggregate, this is unlikely. The EU ETS covers approximately 46% of EU CO_2 emissions and includes electricity generation which has been the primary source of reduced emissions in the last decade. But the contribution of individual installations to a Member State's progress towards its burden sharing target may vary widely.

A similarly contentious issue is giving ‘credit for early action’ within the allocation. This will be strongly argued for by many participants (including those with CCAs), but may violate the recommendation that installations should receive no more allowances than they ‘need’. Negotiating acceptable allocations within and between Member States is likely to be time consuming and difficult.

4.4.2 Qualitative objectives

The Directive also mentions a variety of qualitative objectives, including:

- cost-effective reduction of GHG emissions to help meet Kyoto obligations;
- striking a balance between simplicity, effectiveness, subsidiarity and transparency;
- compatibility with liberalised energy markets ;
- synergy with existing legislation, notably IPPC;
- transparency and public access to information;
- preserving integrity of the single market and avoiding distortion of competition;

Within this, the desire for compatibility with liberalised energy markets is particularly important as this led to electricity generators being given direct responsibility for emissions to facilitate cross-border trade in electricity (section 2.3). Similarly, the requirements on competitiveness and the single market are central issues in determining allowance allocation and equivalence of effort.

The implicit social and energy policy objectives that shaped the design of the CCL - protecting domestic consumers and the coal industry, encouraging energy efficiency and avoiding windfalls to nuclear - are entirely absent from the proposal.

4.5 Stringency of objectives

The core objective of each of the three instruments is the same: the reduction of carbon emissions from the target groups. But two aspects of the objectives warrant closer examination: first, the relative *stringency* of each instrument (in terms of marginal abatement cost); and second, the potential conflicts between *subsidiary* objectives - in particular those associated with the CCL. These are discussed in the following two sections.

4.5.1 Stringency of the EU ETS

Assuming free allocation of allowances, there are three elements to the stringency of the EU ETS. First, the stringency of the overall cap as reflected in the allowance price; second, the stringency of individual targets as reflected in the individual allowance allocations; and third, the extent to which allowance prices and abatement costs are modified by the interface between the EU ETS, other trading schemes and the international carbon market.

Overall stringency is determined by the size of the cap (i.e. the total number of allowances), relative to the abatement cost curve of the total population of participating installations. In a well functioning allowance market, the allowance price will equal the marginal abatement costs for the source population while total costs will equal the integral over the marginal cost curve between initial emissions and target emissions. As indicated above, the total number of allowances is intended to be determined through a mix of top-down and bottom-up criteria.

The stringency of individual targets will be determined by the size of the individual allowance allocation, relative to both the abatement cost curve of the individual installation and the market price for allowances. Individual installations may find themselves to be either buyers or sellers of allowances. While an individual installation will always minimise costs by setting marginal abatement cost equal to the allowance price, the total costs incurred will depend upon the size of its initial allowance allocation.

The above assumes that the EU ETS is a closed system. But Article 24 of the draft Directive states that the Community may conclude agreements with other Annex B Parties to provide for the mutual recognition of allowances, and Article 26 creates the possibility of future links to JI projects and the CDM (CEC, 2001a). This means that after 2008, both allowances and project credits from outside the EU could enter the EU ETS.

This provision is very important, as it means that after 2008 the allowance price in the EU ETS could converge with the international price for carbon. Given: a) the availability of cheap hot air from Russia and the EITs; b) the large reduction in demand created by the withdrawal of the US from the Kyoto Protocol; and c) the generous sink provisions negotiated at Marrakech; it is highly likely that the international price will be very low. For example, den Elzen and Moor (2002) estimated an allowance price during the commitment period of $\$2.4/tCO_2$ ($\sim£1.6/tCO_2$), while other commentators have put allowance prices at or close to zero (Blanchard et al, 2002). Whether this occurs in practice will depend upon developments in the international carbon market, including the extent to which Russia and the Ukraine raise prices by operating as a cartel.[39] If this proved to be the case and if the EU ETS was fully open, the stringency of the scheme could fall significantly after 2008. Conversely, the Community may seek to restrict the import of allowances in order to maintain the EU ETS allowance price and thereby maintain the incentive to reduce EU emissions. A wide range of scenarios is possible, but the general point is that after 2008 the stringency of the EU ETS will depend in part upon the extent to which it is opened up to other trading schemes.

4.5.2 Consistency with technological potential and IPPC

The text of the draft EU ETS Directive requires that both total allowance allocation and individual allowance allocation be 'consistent with' the technological potential to reduce emissions. The criteria make no reference to the economic potential to reduce emissions. This is in contrast to the targets in the CCAs, which are based upon an (arguably weak) interpretation of cost effective potential, which is distinct from (and less than) technological potential. One interpretation of 'consistent with technological potential' is strict BAT, as in IPPC. But this interpretation of the EU ETS guidelines seems unlikely as BAT does not apply to CO_2, and even BAT (as defined in IPPC) requires consideration of sectoral affordability (Sorrell, 2002).

The requirement that allowance allocation be consistent with a counterfactual implementation of IPPC also create difficulties. Leaving aside for the moment the fact that not all participants are regulated under IPPC, there are important differences between how EU ETS targets and

[39] Also, individual countries are unlikely to minimise abatement costs in the manner assumed in economic models, with the result that such models are likely to underestimate both abatement costs and allowance prices.

IPPC targets would be negotiated. The former would be done at an aggregate level, in a similar manner to the CCAs, while the latter would be negotiated individually for each installation. In each case, the motivation of the regulator is to determine abatement costs and to set a target according to some agreed criteria of costs and benefits, while the motivation of the regulated party is to reduce the stringency of the agreed target by exaggerating estimates of abatement costs. Industry has private information on abatement costs which are difficult for the regulator to gain access to.

The relevant issue here is the difference in the level of information asymmetry between:

1. government negotiating an aggregate target for industry overall, or for individual sectors (EU ETS); and
2. the environmental regulator negotiating installation-specific targets with individual firms (IPPC).

The former suffers from problems of aggregation. Estimates of what is cost effective for a sector may differ significantly from what is cost effective for individual sites. Some sites may have greater opportunities, while others may have fewer. The aggregate target for a sector should ideally be based on the sum of cost effective opportunities for individual sites, but without individual site audits the regulator has only limited information on what these are. The advantage of negotiating with individual firms under IPPC is that this aggregation problem is significantly reduced. In principle, the regulator can employ detailed knowledge of the circumstances of the individual site; can require a site energy audit to identify opportunities; and can, in principle, reflect the full range of energy efficiency opportunities within the permit requirements. Set against this, however, the regulator may lack resources and relevant expertise in energy efficiency, and may also lack the political authority to require challenging targets.

The relative stringency of the EU ETS is therefore an empirical question and will depend upon implementation by individual Member States. Information asymmetry is unavoidable and there is always the risk that the agreed targets will be significantly less than is achievable. The importance of this will depend very much upon the time frame for the targets. The CCAs pose particular risks in that the targets are fixed, in principle, for ten years (2001-2010) although there are provisions for revisions. This should be less of a problem for Phase 1 of the EU ETS, as this is only intended to run for three years (2005-2007).

4.5.3 Differential treatment and equivalence of effort

The comparative stringency of the different instruments is relevant for two reasons. First, there may be questions of differential treatment and equivalence of effort if one sector/site is targeted by one instrument, and a second by another. This is relevant both within a sector, and between sectors in different countries. Differential treatment dominated the politics of the CCAs (with sectors clamouring to be included so as to avoid the full rate of the CCL), and may similarly be a dominant issue for the EU ETS. Section 3 illustrated the complexity of the overlaps and boundaries in the coverage of the different instruments, suggesting that differential treatment could be a significant issue if the two instruments were implemented side by side.

Differential treatment could also be relevant if *opt-in/out* clauses were included in the EU ETS, allowing sectors/companies/installations to opt-in to or out of the scheme provided they were covered by an equivalent 'regulation' such as a CCA. This would require demonstration of equivalence of effort between the included and excluded groups - both within Member States and between Member States. Equivalence of effort will be very difficult to demonstrate for CCA facilities, not only because they have relative rather than absolute targets (section 2.4), but also because of the associated risk management provisions (Sorrell, 2001a). Differences in stringency would incentivise companies to move in or out of the EU ETS – representing one form of carbon leakage. Movements out of the cap (by high cost participants) should lower allowance demand, lower allowance prices and bring marginal abatement costs down. Movements in to the cap (to avoid more stringent regulations outside) should raise allowance demand, increase allowance prices and raise marginal abatement costs. Both sets of movements should bring marginal abatement costs within the cap closer to those outside. But the incentives to move are complex. They depend upon the relative scope, form and stringency of targets inside and outside the cap (e.g. absolute versus relative); the prevailing allowance price; the perceived benefits of allowance trading; and the associated administrative costs of moving, including monitoring, verification and enforcement costs and the transaction costs of using the allowance market. This complexity makes the benefits of opt-in/opt-out provisions difficult to assess.

The stringency of the CCAs would also become relevant if they were used as the basis for calculating allowance allocation for CCA companies, thereby facilitating their entry into the EU ETS. This form of *sequencing* from existing negotiated agreements to the EU ETS is specifically endorsed in the Directive, which recommends using output forecasts to convert existing relative targets into an allowance cap. The issue would then be whether the (arguably weak) CCA targets meet the criteria for allowance allocation in the EU ETS.

4.6 Conflicts between objectives

As indicated above, the CCL was designed to protect domestic consumers and the coal industry and to avoid a windfall to nuclear power. The EU ETS does not have these objectives, and there is a risk that the operation of the EU ETS will undermine these objectives. The scale of the conflict may be illustrated by some simple calculations.

4.6.1 Coal

Take the impact on the coal industry first. The EU ETS will increase generation costs for carbon intensive generation plant. The size of the increase will depend on a variety of factors, including abatement cost curves, the stringency of the cap, the liquidity of the allowance market and the method of allowance allocation. Abatement costs will in turn depend upon fuel prices and the plant mix.

An order of magnitude estimate of the short term price increases from the EU ETS can be made assuming: a) the trading scheme is introduced overnight without companies having the opportunity to change their behaviour (i.e. invest in energy efficiency or fuel switch); b) the full costs of meeting the emission target are passed on to consumers through electricity price rises, with none being be passed on to suppliers or absorbed through lower returns; and c) the recycling of revenue from any allowance auctioning can be ignored.

The impact on generation costs will depend very much upon whether the allowances are freely allocated or auctioned. But in theory the impact on electricity prices should be independent of the method of allowance allocation (section 2.1.3). As an illustration, it is assumed here that 100**%** of the allowances are auctioned and that the clearing price in the auction is **£10/tCO_2** (£36.6/tC). This is above the current CCL rate for coal (£4.55/tCO_2) and gas (£8.15/tCO_2) but close to the equivalent upstream carbon tax that would be required to produce the current CCL rate for electricity (£9.35/tCO_2).[40] It is higher than the market price for allowances in the early stages of UK and international trading (£3-5/tCO_2) and significantly higher than estimates of carbon prices during the commitment period, which assume maximum use of hot air trading and sink flexibilities (£1.6t/CO_2) (Natsource, 2002; den Elzen and Moor, 2002).[41]

For simplicity we calculate the average short term increase in generation costs and wholesale electricity prices created by the EU ETS. This may be estimated by calculating the revenue raised from an allowance auction with a clearing price of £10/tCO_2, divided by unchanged electricity output. The impact on generation costs is summarised in Table 4.5. This static analysis gives a very broad brush illustration of the short term economic impact of a scheme with 100% allowance auctioning on electricity generators and consumers.

Table 4.5 Illustrative impact of full allowance auctioning to the UK generators, with a £10/tonneCO_2 clearing price and no revenue recycling

	Electricity Generation (TWh)	**Emission factor MtCO_2/TWh**	**Carbon emissions MtCO_2**	**Revenue from allowance auction with £10/tCO_2 clearing price (£m/yr)**	**Increase in generation costs (p/kWh)**
Renewables	10.2	0.00	0.0	0	0.00
Nuclear	96.3	0.00	0.0	0	0.00
Gas	141.4	0.40	57.1	571	0.40
Coal	106.1	0.99	105.0	1050	0.99
Oil	5.6	0.78	4.4	44	0.79
Total/av	**359.5**	**0.46**	**166.5**	**1665**	**0.46**

Source: Based on DTI (2002).

Using current average generation efficiencies, such a scheme would increase generation costs for coal-fired plant by ~1.0p/kWh, and those for a gas-fired CCGT by ~0.4p/kWh (Table 4.5). The generation cost for a new CCGT was estimated by the DTI in 1999 to be around 2.0p/kWh, and that for an existing coal-fired plant 1.6p/kWh (2.0p/kWh if FGD is fitted) (DTI, 2000). Future generation costs depend upon gas and coal price trends. If fuel prices remained at 1999 levels,[42] a trading scheme with 100% auctioning with a clearing price of £10/tCO_2 would increase generation costs from existing coal-fired plant by 63% to 2.6p/kWh, or to 3.0p/kWh if FGD is required, while costs for new CCGTs would increase by only 20% to 2.4p/Wh (Table 4.5). This would mean that new CCGT investment would be 8% cheaper than existing coal-fired generation, and 20% cheaper than existing coal-fired generation if

[40] For comparison, the 1992 EU proposals for a carbon tax was set at $10/bbl which, if updated, would equate to around £16.3/tCO_2 (£60/tC).

[41] den Elzen and Moor's (2002) projection of carbon prices prior to the withdrawal of the US and the additional sink provisions was around $7.0/t$CO_2$.

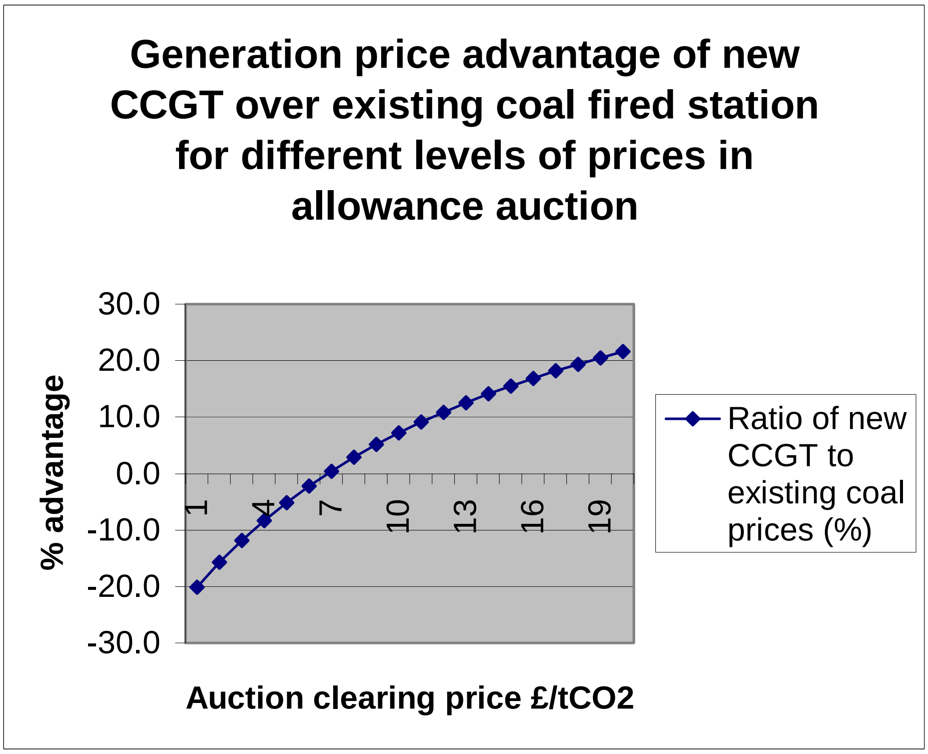
[42] DTI (2000) uses 1999 fuel prices to calculate generation costs. But gas prices have since increased and coal prices reduced (Table 4.1).

FGD were required. In practice, coal plant without FGD is likely to be restricted in the number of operating hours after 2008 in order to meet the requirements of the revised LCPD (DEFRA, 2002a).[43]

In the 2000 DTI energy projections using 'central' economic growth and 'low' fuel price assumptions (CL scenario), coal-fired generation declines by 63% between 1999 and 2010, with capacity falling from 26GW to 9GW (all with FGD) (DTI, 2000). An EU ETS with 100% allows auctioning would disadvantage coal still further and would be likely to accelerate its replacement with gas unless compensating measures were taken. In turn, explicit (as opposed to implicit) compensating measures may fall foul of EU state aid rules.

Figure 4.1 uses the above data and assumptions to show the price advantage of new CCGT investment against existing coal fired stations for a range of allowance prices. This suggests that, with 100% allowance auctioning, an allowance price of around £7/tCO_2 should make new CCGT competitive against existing coal. Again, this ignores revenue recycling and the scope for efficiency improvements. In practice, a host of market and regulatory factors complicate these simple calculations and until the recent falls in electricity prices, new CCGT investment was going ahead with no price on CO_2.

Figure 4.1 Generation price advantage of new CCGT over existing coal fired station for different levels of prices in allowance auction



With free allocation of allowances and/or a lower allowance price, the price changes and the corresponding threat to the coal industry would be much less than indicated above. This is all the more the case if new plant has to purchase allowances while existing plant receives a free allocation. However, these illustrative figures do help explain the choice of energy tax over a

[43] The choice for coal plant is either to fit FGD, or to generate for no more than 20,000 hours/year after 2008 and to close in 2016.

carbon tax for the CCL as well as the threat posed to the remaining coal industry by the inclusion of UK electricity generators in a European trading scheme. While the UK coal industry is in steep decline, with little prospect of new coal fired generation capacity, the government has expressed its concern about the threat to supply security from the increasing reliance on gas throughout the economy. This is one of a number of issues explored in the recent Cabinet Office Energy Review (PIU, 2002), which is due to be followed by a White Paper on energy policy in early 2003 (DTI, 2002b). The EU ETS therefore has some important implications for UK energy policy.

4.6.2 Nuclear

Very similar comments apply to the position of nuclear power. Again, using the above assumptions a trading scheme would lead to an increase in average electricity prices of 0.46p/kWh. But generation costs for nuclear power would remained unchanged. Since nuclear power runs on baseload, its share of total generation is likely to remain unchanged in the short term (although the retiral of nuclear plants will reduce its share in the longer term). If nuclear generation continued at its 1999 level of 96TWh, and if nuclear benefits fully from the net increase in average electricity prices resulting from the EU ETS, this implies a 'windfall' to the nuclear industry of £442 million/year.

The Cabinet Office Energy Review has recommended that nuclear power should benefit from any methods that will be used to value carbon and internalise the externalities of fossil fuel use (PIU, 2002, p125), although this is not yet official government policy. During 1992, the UK nuclear generator, British Energy, faced increasing difficulties as a consequence of falling wholesale electricity prices - which were in turn due to a combination of the new electricity trading arrangements (NETA) and overcapacity in electricity generation. The company's financial situation became so bad that in September 2002 the government agreed to a loan of £410m (later increase to £650m) to cover its working capital requirements and save it from insolvency. Further support may be necessary in the future unless overcapacity is reduced and electricity prices increase. Hence, the economic and political context has changed and a 'windfall' to nuclear may now be consistent with government objectives. The EU ETS may provide an alternative mechanism for supporting nuclear power in the longer term without requiring government expenditure or an explicit subsidy. But the issues of waste and decommissioning have yet to be resolved and nuclear power remains highly controversial (Evans, 2002).

4.6.3 Domestic consumers

The third area of concern is the position of domestic consumers. Again, using the above illustrative figures, an trading scheme with a allowance price of £10/tCO_2 would lead to a price increase to domestic consumers of around 0.46p/kWh. Using the average annual electricity consumption of 3300kWh/year, this corresponds to an increase of £15.34, or 6% of the average 'standard credit' domestic electricity bill for England and Wales in 1999 (£261/year). The percentage increase for overall energy bills (fuel plus electricity) would be smaller still.[44] This relatively small increase reflects the fact that a large component of domestic electricity prices are made up of transmission, distribution and supply costs (Table 3.13). In comparison, average annual domestic electricity prices in 2001 (including VAT) were 25.9% lower in real terms than in 1995, and 24.2% lower than in 1990.

[44] . It is overall energy bills, rather than fuel used for heating, that is used in the UK definition of fuel poverty (DETR, 2000d).

It would be useful to conduct a more detailed analysis of impact of such price increases on households in fuel poverty. Since these are likely to both spend a greater proportion of their total energy bill on space heating and to use inefficient electric storage heating, the proportional impact is likely to be greater. Furthermore, any increase in domestic energy prices is likely to increase the number of households in fuel poverty. Government data suggests that falling energy prices between 1996 and 1999 reduced the number of fuel poor households from 5.5 to 4.5 million (DETR, 2000d), a trend which politicians would be unwilling to reverse.

Three factors may make the estimate of a 0.46p/kWh increase in consumer prices (for a £10t/CO_2 allowance price) rather pessimistic:

- The estimate is for short-term price impacts, which do not allow for behavioural change, including efficiency improvements by generators and consumers and changes in the carbon intensity of generation.
- The estimate assumes 100% pass through of costs to electricity consumers. In practice, some of the costs will be absorbed by shareholders or fuel suppliers.
- The estimate assumes that the impact of electricity prices will be the same, regardless of the method of allowance allocation. This is the theoretical prediction, but it is questionable whether this will hold in practice (section 2.1.3).

In addition, allowance prices greater or less than £10/tCO_2, will lead to corresponding changes in the price impact on the domestic consumer. Smaller price impacts will reduce the political difficulties of introducing the EU ETS, as will the expected progress in eliminating fuel poverty by 2010 (DETR, 2000d). But the calculations do illustrate that the EU ETS has some important implications for UK social policy.

4.5 Summary

The core objective of the three instruments is the same: the reduction of carbon emissions from the target groups. Whether the instruments can be considered complementary or redundant can only be decided through a more detailed examination of their mode of operation, and the incentives they create for individual target groups (section 5). But two points can be made:

- The stringency of the EU ETS is at present unclear and the proposed allocation criteria are contradictory. But there is a strong possibility that targets required under the EU ETS will be more stringent (in terms of marginal abatement costs) than those currently applicable under the CCAs - quite apart from the fact that these will be absolute, rather than relative targets. This has important implications for either the use of CCAs targets as a basis for allocation in the EU ETS, or the use of opt-in or opt-out options within the EU ETS at the national, sector, company or installation level. An important complication, however, is the possibility of importing allowances from other trading schemes into the EU ETS after 2008. This would reduce EU ETS allowance prices and consequently make it much easier for participants to comply with their obligations.

- The design of the CCL reflects multiple objectives, including the desire to protect domestic consumers, energy intensive industry, and UK coal producers, together with the desire to promote energy efficiency and avoid a ‘windfall’ to nuclear generators. Such objectives would be threatened by the introduction of the EU ETS, although in each case the political importance of these objectives has changed since 1999 and is likely to have changed further by 2005 or 2008. In particular, a nuclear ‘windfall’ may now be positively helpful to government objectives. Nevertheless, it is clear that the proposed Directive raises major issues of UK energy policy (particularly supply security) and social policy (fuel poverty).

5. Confusion over instrument operation

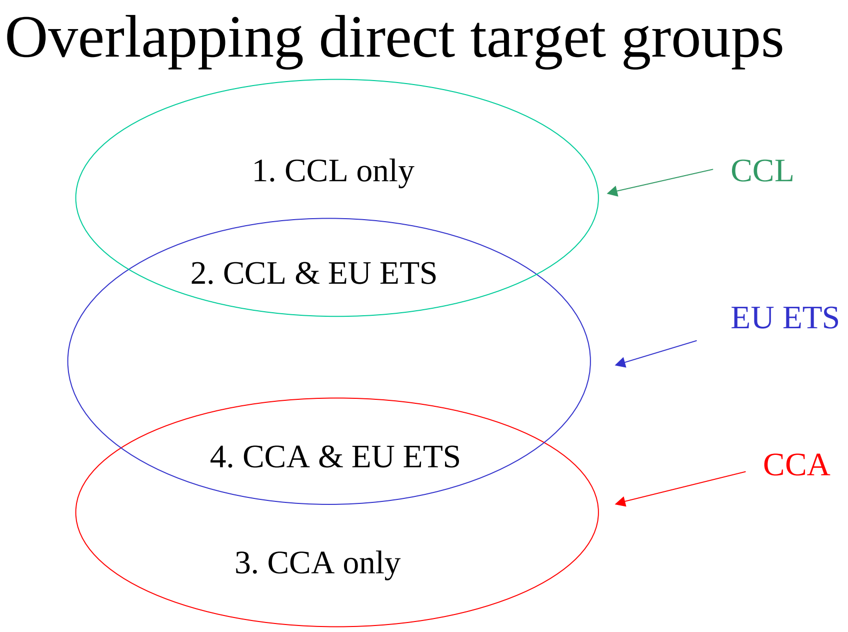
This section explores the interaction between the operation of the EU ETS and the CCL/CCA package, assuming that the EUETS is implemented while the CCL/CCA package remains unchanged. In practice, it is very unlikely that the EU ETS could coexist alongside an unchanged CCL/CCA package, but by examining interaction under the assumption that they do coexist we can highlight some relevant issues and conflicts. This in turn can guide the subsequent development of policy options.

Each instrument can be understood as imposing *obligations* on its target groups, although these obligations may leave considerable scope for discretion. Similarly, each instrument provides *incentives* for the target group to act in accordance with these obligations and in support of policy objectives. If a single target group is directly affected by more than one policy, it must respond to the obligations and incentives of both. The compatibility of these obligations and incentives may be considered as lying somewhere on a spectrum from mutually reinforcing to direct conflict (Sorrell, 2001b).

The obligations and incentives change the behaviour of the target group, which in turn may have consequences for other (indirectly affected) target groups. In particular, there may be changes in the costs faced by these target groups. These indirect effects will also be examined here, focusing primarily on the consequences for the electricity market.

Section 3 explored the complex overlaps in direct and indirect target groups for the EU ETS and CCL/CCA package. Figure 5.1, which is a simplified version of Figure 3.3 with IPPC removed, shows the overlaps in *direct* target groups between the CCL, CCA and EU ETS. A useful way of exploring the interaction of obligations and incentives is to examine the groups marked 1,2,3 and 4 in turn.

Figure 5.1 Overlapping direct target groups for the EU ETS and CCL/CCA package



5.1 Group 1: CCL only

This group includes sites in the manufacturing, commercial and public sectors that are eligible for the CCL but are not participants in either the CCAs or the EU ETS. This group includes the bulk of sites in these sectors.

While not directly affected by the EU ETS, this group is indirectly affected by the increase in electricity prices that result from the generators taking on an emissions cap. As indicated in section 2.1, the size of this price increase will depend upon a range of factors including allowance prices and the relative elasticity of electricity supply and demand. In turn, allowance prices will be a function of the stringency of the overall cap.

Sites in this group will effectively have *double regulation* of electricity. They will be paying the CCL at 0.43p/kWh and they will be paying whatever electricity price increase results from the cap on the generators. Whether this is considered acceptable or not will depend upon political priorities and the likely scale of the electricity price increase from the EU ETS relative to current and anticipated wholesale electricity prices. These are all uncertain, but some general comments can be made. These are grouped here under five headings: double regulation; multiple objectives; market distortions; backup regulation; and implications for revenue raising.

5.1.1 Double Regulation

Under some circumstances, the scale of the price increase could be substantial. The illustrative calculations in section 4 assumed:

- the market price for an allowance in the EU ETS is £10/tCO_2;
- the full costs of meeting the emission target are passed on to consumers through electricity price rises, with none being passed on to suppliers or absorbed through lower returns;
- there is no recycling of the revenues raised from any allowance auctioning; and
- the impact on electricity prices is the same, whether allowances are freely allocated or auctioned.

These assumptions lead to an electricity price increase of around 0.46p/kWh, which is essentially the same as the current CCL rate for electricity (0.43p/kWh). This means that consumers would face an additional increase in electricity prices comparable to that imposed by the CCL. This would almost certainly lead to complaints about 'double regulation'.

The main difference between carbon/energy taxation and emissions trading concerns price/quantity adjustment. With a tax, it is the tax level that is fixed and the quantity of CO_2 that adjusts. With emissions trading, it is a quantity of CO_2 emissions that is fixed, and the price of the allowances that adjusts.[45] In the absence of an agreed allocation, it is not possible to estimate the allowance prices under the EU ETS, or the consequent impact on electricity

[45] In theory, the choice between taxation and trading should be based upon the relative slopes of the marginal damage and marginal cost curves (Weitzman, 1974).

prices. Even with an agreed allocation, ex ante estimates of allowance prices are likely to vary widely. So the EU ETS creates the risk of high allowance prices and the consequent risk of electricity price increases that would hit groups currently regulated by the CCL. This may create pressure for modifying or removing the CCL prior to introducing the EU ETS.

A related issue is the probable lack of compensation for these price increases. With the CCL, electricity price increases were balanced by reductions in employers' national insurance to give overall revenue neutrality. This created winners and losers, but overall the affected groups were paying no more tax than before. With the EU ETS, the allowances are most likely to be freely allocated to participants, including the electricity industry. If the theoretical predictions of section 2.1.3 prove correct, the impact on electricity prices will be the same as if the allowances were auctioned. But in the absence of auction revenues, there will be no mechanism for compensating electricity consumers for the resulting price increases. Hence, using the above assumptions on allowance prices, the EU ETS could lead to a similar level of electricity price increase as the CCL, but without any compensation. If the EU ETS *replaced* the current CCL on electricity, Group 1 would be worse off. If the EU ETS *coexisted* with the CCL on electricity, Group 1 would be substantially worse off. Even if the allowances were auctioned, the most likely recipients of recycled revenues would be the participants of the scheme (including electricity generators), rather than those indirectly affected by electricity price increases. So sites paying the CCL would still suffer uncompensated price increases.

This line of reasoning suggests that Group 1 should lobby for auctioning within the EU ETS, with a portion of the revenues being used to compensate them for electricity price increases. But in practice, both the use of auctioning and the use of revenues in this way look an unlikely outcome, even for Phase 2. As an alternative, Group 1 could monitor and lobby against 'unwarranted' electricity price increases by the generators. As argued in section 2.1.3, increases in electricity prices that result from an EU ETS with free allocation may be considered unwarranted as they represent a form of 'double charging'. Consumers pay once as taxpayers, in creating an effective subsidy with the free allowances, and a second time as consumers in purchasing the sector's products. But the 'inequity' of this arrangement is less obvious than with an explicit subsidy since there is no direct use of taxpayers money. Also, in the context of asymmetric information the extent to which a price increase is 'warranted' could be very difficult to detect, and the institutional mechanisms for challenging such behaviour may be ineffective. This suggests that the most obvious strategy for Group 1 would be to lobby for modification to the CCL.

The above discussion needs to be set in the context of the relatively small contribution of energy to total costs for Group 1 sites. By definition, the great majority of Group 1 sites are not energy intensive, otherwise they would be eligible for a CCA. For example, in mechanical engineering sector, energy accounts for around 1.5% of total production costs, and the figure is lower still in the commercial sector. This is even more the case when we consider recent trends in wholesale electricity prices (section 4.1). Hence, the potential impact of double regulation on Group 1 sites should not be overstated.

5.1.2 Multiple objectives

The coexistence of the CCL and EU ETS would improve incentives for the efficient use of electricity, since the price signal for this would be greater than either instrument acting alone. Whether this is considered desirable will depend upon the weight given to energy efficiency as a policy objective, as opposed to the least cost abatement of carbon emissions.

It may well be the case that fuel switching in electricity generation offers lower cost abatement than improving end-use efficiency.[46] But the choice of a downstream rather than upstream tax in UK climate policy suggests that the objective of least cost abatement is balanced by other objectives and concerns. Section 4.2 argued that the primary objective in the design of the CCL was the protection of the domestic consumer, but security of supply considerations also played a role. Unrestricted fuel switching in electricity generation may pose a risk to supply security by increasing dependence upon imported gas. In contrast, improving end-use efficiency can only be beneficial for energy security. Indeed, a recent assessment of UK climate policy by the Sustainable Development Commission (SDC) found that energy efficiency scored higher than any other abatement option against a set of sustainable development criteria that included energy security (SDC, 2001).[47] Hence, from a multi-criteria perspective, the promotion of end-use efficiency may be a highly valued policy goal.

But establishing that energy efficiency is a highly valued objective is not the same as establishing that higher energy prices are the most desirable way to achieve that objective. Higher prices remove one impediment to optimal investment in energy efficiency, that of the divergence between the private and social cost of energy consumption, and increase the profitability of individual energy efficiency investments. However, they may do little to remove the range of other barriers to energy efficiency (Box 3.1) and may have undesirable consequences for equity or competitiveness unless compensating measures are introduced. These wider barriers may be best addressed through a policy mix, in which higher energy prices form a necessary but not sufficient element.

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[46] Historical experience would appear to bear this out, although the opportunities are diminishing as gas takes a large proportion of the generation fuel mix. However, this is an empirical question and close attention would need to be paid to the distortions and market failures in both the generation market and in the market for end-use efficiency.

[47] The criteria were: a) integrating the economic, social and environmental dimensions of quality of life; b) respecting biophysical limits; c) making the polluter pay; d) protecting and enhancing UK competitiveness; e) promoting social justice and inclusion; and f) achieving energy security (SDC, 2001).

Box 5.1 Barriers to energy efficiency

- *Market failures*: Several features of the energy service market can be understood as neo-classical market failures. In particular, the market produces insufficient information about the energy performance of different technologies. When the costs of acquiring information on energy efficiency greatly exceed those for energy supply, consumers will under-invest in energy efficiency. The split incentives between landlord and tenant also represent a form of market failure.
- *Organisational failures*: Organisations commonly use high discount rates to evaluate efficiency investments, neglect life cycle costs and provide inadequate incentives for staff to use energy efficiently. While these are normal features of organisational behaviour, there may be instances where governments can intervene to the mutual benefit of both the organisation and society.
- *Transaction costs*: Energy supply and energy efficiency provide alternative means of supplying energy services, but their market characteristics are very different. Energy efficiency is not a stand-alone product but a subsidiary feature of a wide range of products and services. This means that the transaction costs of purchasing energy efficiency greatly exceed those for energy supply, creating a systematic bias against the former.
- *Limitations on decision-making*: Individuals do not make decisions in the manner assumed by economic models, but are instead subject to severe constraints on attention, resources and their ability to process information. Energy is easily overlooked when its contribution to total costs is small. Such limitations can create an additional barrier to energy efficiency, reinforce the operation of other barriers, or set a limit to what can be achieved by policy initiatives such as information programmes.

Source: Sorrell et al (2000)

5.1.3 Market distortions

If we assume that the primary purpose of climate policy is to internalise the external costs of CO_2 emissions, then the economic incentives for substituting between fuel and electricity (or vice versa) will be distorted by double regulation. Electricity prices will internalise CO_2 costs in addition to the CCL, while fuel prices will not. The notion of 'internalising' CO_2 costs assumes that the CO_2 prices in the EU ETS provide an accurate reflection of the external costs of climate change. In practice this is unlikely, and the CO_2 price will almost certainly be too low.[48] The key point, however, is that the relative costs of fuel and electricity use will be distorted.

In practice, the technical opportunities for substituting between fuel and electricity may be limited. Furthermore, the CCL itself distorts economic incentives by using different implicit CO_2 costs for coal, gas and electricity while exempting oil products. From the perspective of industrial consumers, the CCL provides an implicit carbon tax on the fuel for electricity generation of £9.35/tCO_2,[49] compared to £8.15/tCO_2 for downstream gas consumption and £4.15/tCO_2 for coal (Table 4.2). Hence for Group 1 sites, the increase in electricity prices from the EU ETS merely compounds the existing distortion between fuel and electricity prices that is provided by the CCL.

[48] Climate change is a clear case of environmental problem where notions of monetising environmental impacts appear untenable. It is far preferable to work with physically based sustainability targets, such as those recommended by the IPCC. But the current Kyoto targets represent only the first step towards this goal.
[49] Using the assumptions on generation fuel mix etc. adopted for the CCAs.

The double regulation of electricity may be expected to improve the economics of cogeneration by increasing electricity import prices relative to on-site fuel use (although here there is already a strong incentive through the CCL exemptions on CHP fuel). But if energy prices are distorted, the environmental benefits of encouraging cogeneration are undermined. A counter argument could be that the price differential between electricity and fuel helps to overcome the range of barriers that CHP currently faces. This may be one rationale behind the existing CCL exemptions for CHP. But as with energy efficiency, a more effective approach could be to address these barriers directly, rather than indirectly through changes in relative energy prices.[50]

5.1.4 'Backup' regulation

There is one scenario in which the coexistence of the EU ETS and CCL could be positively beneficial for UK policy objectives. This is where the anticipated allowance price in the EU ETS is very low. There are two circumstances in which this could occur:

- Before or after 2008, if the aggregate targets under the EU ETS are very weak. In theory, this scenario should be unlikely as it appears inconsistent with the allocation criteria listed in the draft Directive, including the requirements that allowance allocation should be consistent with technological potential to reduce emissions, and that no site should be allocated more allowances than it 'needs' (CEC, 2001a). But in practice, these allocation criteria may be difficult to apply.
- After 2008 if cheap allowances are imported into the EU ETS, either through bilateral interfaces with other trading schemes or through interfaces with the international carbon market (AAUs, ERUs or CERs). As discussed in section 4.5.1, the combination of surplus hot air, generous sink flexibilities and the US withdrawal make it very likely that the international carbon price will be low during the commitment period. This means that external interfaces could drive down allowance prices in the EU ETS. As a result, both developments in the international carbon market and the interface rules for the EU ETS are of critical importance to the future development of UK climate policy.

If the allowance price is low, the impact of the EU ETS on electricity prices will be limited. The double regulation described above would have relatively little economic impact on Group 1 sites and political opposition to the retention of the CCL would be reduced. Conversely, if the EU ETS *replaced* the CCL on electricity, the net result would be a reduction in electricity prices and a consequent loss of the downstream incentive to improve electricity efficiency. Hence, if a scenario of low allowance prices is considered likely and if electricity efficiency is a valued policy objective, there may be an argument for retaining the CCL in its current form in order to retain this downstream price incentive. Here, the CCL could be seen as a 'backup' to the EU ETS to ensure that Group 1 sites took *some* action to improve electricity efficiency.

European governments have long been concerned about hot air trading and during the Protocol negotiations they attempted to impose 'supplementary' conditions that would ensure that a portion of abatement was achieved through domestic action. This attempt failed, but the

[50] The trend of rising industrial gas prices and falling electricity prices has damaged the economic potential of CHP. But an equally important factor has been the operation of the balancing mechanism in NETA, since this penalises intermittent and unpredictable generators (Bathurst and Strbac, 2001). Other barriers include the high charges that are imposed for connection to distribution networks.

concern remains. It stems from a tension between cost minimisation in the first commitment period and the creation of incentives for deep cuts in carbon emissions over the longer term (Grubb et al, 1999, p193).

The EU ETS allowance price could be maintained by preventing or restricting the import of trading commodities from outside the EU ETS. At present, the Commission has indicated its intention to allow the import of ERUs and CERs into the EU ETS in the longer term (provided that they do not derive from nuclear or sink projects) and to enter into bilateral agreements with third party trading schemes for the transfer of allowances. But the Commission is opposed to EU ETS participants using AAUs to fulfil their commitments. While this stance may reduce the risk of a low allowance price post 2008, it neglects the fact that the trading commodities are partly fungible. For example, a low price for AAUs is likely to be reflected in a low price for ERUs and CERs. Similarly, if AAUs are imported into a third party trading scheme which is interfaced to the EU ETS they will affect the EU ETS allowance price. In this context, retention of the CCL as a backup regulation for Group 1 sites could be seen as imposing ‘supplementarity by the back door’.

5.1.5 Implications for revenue raising

Some 85% of the £1 billion/year by the CCL is returned to industry in the form of reductions in employers national insurance contributions. The remaining £150 million is allocated as follows (Carbon Trust, 2002):

- £100 million to support a programme of Enhanced Capital Allowances (ECAs) for investment in energy efficiency equipment;
- £13 million to the DTI for R&D into renewable electricity;
- £4 million to DEFRA for an energy crops programme;
- £1.4 million for renewables programmes in Scotland and Northern Ireland; and
- £30.9 million to fund the newly formed Carbon Trust, which is administering a revised Energy Efficiency Best Practice Program (EEBPP)[51] and funding a Low Carbon Innovation Programme.

These are central elements of the UKCP. For example, the financial support for R&D and the ECA programme are together expected to contribute emission reductions of 0.5MtC by 2010. Effectively, all the above programmes return revenue to industry but in a less direct manner than reductions in employers national insurance, and with a beneficial impact on carbon emissions.

The point here is that both the overall revenue neutrality of the CCL proposal and these individual climate policy initiatives would be threatened by any scenario which involved either replacing the CCL with the EU ETS, or modifying the level of the CCL. Any reduction in the level of the CCL would lead to a reduction in overall government revenue, with a corresponding requirement to either raise the revenue by other means or to reduce government spending – possibly by removing the above schemes. Compensating revenues could be obtained through auctioning allowances in the EU ETS, but this looks unlikely. Hence, revenue issues are a central concern for the future implementation of the EU ETS.

[51] Now termed ‘Action Energy’.

5.1.5 Summary

In summary, the coexistence of the EU ETS and CCL leads to double regulation of electricity for all CCL sites, with associated distortions of the energy market. Group 1 is unlikely to be compensated for these costs, even with the recycling of auction revenues. The increased costs may be justified by the objective of promoting electricity efficiency, but this argument seems weak and is likely to attract opposition.

Double regulation may, however, be justified if allowance prices in the EU ETS were expected to be low during the commitment period. In this case, the retention of the CCL would ensure that a downstream price signal for electricity efficiency was retained (the 'backup' option). It would also ensure that the policy initiatives and institutions currently funded by the CCL, including the Carbon Trust, could continue unchanged. The difficulty is that allowance prices during the commitment period are uncertain and dependent upon decisions by the European Commission and developments in international carbon markets.

5.2 Group 2: EU ETS and CCL

This group should be relatively small. The most obvious candidates are sites with combustion plant with an aggregate thermal input >20MW but <50MW in sectors which are not eligible for a CCA (section 3.3). For these sites, eligibility for the EU ETS is given by the size of combustion plant, rather than the sector in which the plant is located, so this group could include sites in the public and commercial sectors and in the non-CCA sectors of manufacturing industry.[52] Despite its small size, this group does illustrate some relevant issues.

5.2.1 Double regulation

Sites in this group would require allowances for CO_2 emissions from fossil fuel combustion in the main combustion plant (section 3.3).[53] At the same time, the site would pay the CCL on coal and gas (but not oil) consumption by the main combustion plant. Process CO_2 emissions, whether from combustion or non combustion processes, would not be covered by the EU ETS (since only the combustion plant is eligible to join), but oil and gas combustion in the process plant would incur the CCL. In addition, the site would pay the CCL on electricity consumption, and would incur the additional costs for electricity resulting from the participation of the generators in the EU ETS, described above.

For sites in this group, there is double regulation of both fuel and electricity. With combustion plant fuel, the site is directly affected by the CCL and the EU ETS. For electricity, the site is directly affected by the CCL and indirectly affected by the EU ETS. The relative impacts on fuel and electricity consumption may differ. The biggest impacts on fuel will occur if allowances are auctioned, while the impacts on electricity prices should be independent of the method of allowance allocation. Table 5.1 provides a summary of the possible short term impact on energy costs for a site in this group, assuming:

[52] Or sites in sectors eligible for CCAs, but which have chosen not to join.
[53] It is possible that allowances would also be required for CO_2 emissions from non-commercial fuels such as biomass.

- 100% of allowances are auctioned with a clearing price of £10/tCO_2;
- the trading scheme is introduced overnight without companies having the opportunity to change their behaviour;
- the full costs of meeting the emission target are passed on to consumers through electricity price rises; and
- the recycling of revenue from any allowance auctioning can be ignored.

Table 5.1 Illustrative impacts on unit energy costs under a combination of the CCL and EU ETS with 100% auctioning (p/kWh)

	Coal	**HFO**	**Gasoil**	**Gas**	**Electricity**
Average industrial energy price 2000	0.47	1.07	1.59	0.61	3.47
Increase from CCL	0.15	-	-	0.15	0.43
Increase from EU ETS @ allowance price of £10/tCO_2 with 100% auctioning	0.33	0.25	0.25	0.18	0.46
Cost including CCL only	0.62	1.07	1.59	0.76	3.90
Cost including EU ETS only	0.80	1.32	1.84	0.79	3.93
Cost with CCL and EU ETS combined.	0.95	1.32	1.84	0.94	4.36
% cost increase from the CCL	**31.9**	**0.0**	**0.0**	**24.8**	**12.4**
% cost increase from the EU ETS	**70.2**	**23.4**	**15.7**	**29.7**	**13.3**
% cost increase from the CCL and EU ETS combined	**102.1**	**23.4**	**15.7**	**54.5**	**25.7**

Notes:

- Using average industrial energy prices for 2000 (pre CCL)
- Fuel costs (p/kWh) = fuel price + CCL + allowance costs (assuming unchanged consumption)
- Electricity costs (p/kWh) = electricity price + CCL + portion of generator's marginal abatement costs passed on in electricity prices (assumed equal to allowance price)
- Conversion factors include: Coal=28.0GJ/tonne; HFO=43.2GJ/tonne; Gasoil=45.5GJ/tonne; 1kWh=$3.6*10^{-3}$GJ; coal=2.41 tCO_2/tonne; HFO=3.11tCO_2/tonne; gasoil=3.14tCO_2/tonne; natural gas=0.187kgCO_2/kWh. Assumed delivered to primary conversion factor = 2.60. Assumed carbon emissions factor for primary electricity = 0.17 kg CO_2/kWh.

Source: Derived from (DTI, 2002) and Goodwin et al (1999).

The impact of the EU ETS is in direct proportion to the carbon content of each fuel and to the carbon intensity of imported electricity. In contrast, the equivalent carbon tax corresponding to the CCL varies between fuels, with HFO and gasoil being exempt altogether. This means that the EU ETS has a proportionally greater impact on carbon intensive fuels and also impacts on oil. An EU ETS allowance price of £10/tCO_2 is approximately equivalent to the upstream carbon tax that would be required to give the current CCL rates for electricity. If the same rate applied for downstream fuel use, coal prices would increase by 70% rather than by 32% under the current CCL.

Using these assumptions, the combined impact of the CCL and the EU ETS would be substantial. The cost of using coal would double compared to 2000 (pre CCL) and the cost of using gas would increase by 55%. This compares to an increase of 32% and 25% respectively for the CCL alone. In contrast, the cost of using electricity would increase by only 26% (compared to 12% for the CCL alone). These cost impacts may be ameliorated by the recycling of auction revenues to EU ETS participants. The net impact would then depend upon the rules for revenue distribution.[54]

The combination of the CCL with 100% allowance auctioning under the EU ETS may be opposed as double regulation, as fuel users will effectively be paying twice for fuel emissions. But full auctioning is still a distant prospect. With the free allocation proposed for Phase 1, participants would only incur abatement costs for fuel combustion, rather than having to purchase allowances for all direct emissions. The cost burden (for fuel) should correspondingly be much less than indicated above.

Note that when making decisions on the marginal cost of fuel use, the Group 2 site will still value the marginal cost of each tonne of associated emissions at the full allowance price. In theory, the firm will take the same decisions on output and abatement regardless of whether the allowances are auctioned or freely allocated (section 2.1.3). The difference lies in the overall cost burden from the firm and hence its capital value (i.e. the difference lies in the wealth effects, not the effect on product prices). With auctions, the firm pays for *all* emissions, while with free allocation the firm only incurs abatement costs - including the net cost of any allowance acquisition.

5.2.2 Double regulation as a substitute for allowance auctioning

As discussed in section 2.1.2, there are strong economic arguments for allowance auctioning. Free allocation allows participants to capture all of the scarcity rent and is equivalent to a lump sum subsidy for participating firms. With free allocation, polluters do not pay for the damage caused by residual emissions and the government denies itself the opportunity to raise revenue. In contrast, the CCL raises revenue and requires polluters to pay for residual emissions - albeit not at equivalent £/tCO_2 rates for all fuels. This means that there could be an argument for combining the CCL with the EU ETS *if the latter uses free allocation*, since the CCL can provide some of the benefits of auctioned allowances. This is a second-best alternative to 100% auctioning, but may be politically more feasible since the CCL is already in place and no agreement would be required at the EU level. There are, however, three objections to this approach.

First, this form of double regulation would undermine the efficiency advantages of the trading scheme. Marginal abatement costs at the affected sources (Group 2) would be distorted by the CCL, leading to higher costs than those faced by other EU ETS participants which are not eligible for the CCL. This would raise overall abatement costs under the EU ETS.[55]

Second, the rationale given above for allowing double regulation only applies to fuel use. Here, allowances will have been freely allocated to Group 2 participants. But for electricity, the allowances will have been freely allocated to the generators. Group 2 participants will not capture the economic rent from the these allowances but, if the theoretical predictions of section 2.1.3 prove correct, they will still face electricity price increases equivalent to those

[54] For example, a flat rate reduction in employment taxes (as with the CCL) would reward the less energy intensive companies; distributing revenues on the basis of historic emissions would compensate the most heavily affected sites; and basing compensation on sector benchmarks for energy intensity would reward the best performing sites.

[55] This problem is not unique to the UK. Pre-existing taxes exist in all Member States and vary from one fuel to another. As in the UK, carbon intensive fuels are commonly taxed at a lower rate or even subsidised.

under 100% auctioning. In these circumstances, a better approach may be to exempt EU ETS participants from the CCL on electricity.

Third, there is a risk that the competitiveness of Group 2 firms will be undermined since competing firms in the same sector will not face the same type of double regulation. In the UK, some may be subject to the CCL alone; some may be subject to a CCA; and some may be subject to joint regulation under the EU ETS and the CCAs. In other Member States, an entirely different mix of regulations may apply.

This differential treatment is particularly problematic if competitors are also participants in the EU ETS. Group 2 participants face higher fuel prices and are therefore likely to reduce emissions further than they would under the EU ETS alone. This means that they are likely to either sell more allowances, or purchase fewer allowances. If Group 2 is sufficiently large (i.e. possess some degree of market power) there will be a consequent reduction in allowance prices. Lower allowance prices will make it easier for their competitors to comply with their obligations. In effect, the sites subject to double regulation will be subsidising those which are not. Against this, the small number of Group 2 firms are likely to form only a small proportion of the total number of firms regulated under the EU ETS and hence are likely to be price takers in the allowance market. Their costs will be increased, with consequent impacts on shareholders, suppliers or (possibly) consumers, but there will be no direct subsidy of other firms.[56] Since many direct competitors of Group 2 firms will not be subject to the double regulation of the CCL and EU ETS, it is unlikely that Group 2 firms will be able to pass on these additional costs in product prices. Instead, it is their shareholders that are likely to bear the burden.

Group 2 participants may contest these competitive distortions - notably between companies in a sector which are subject to the EU ETS (e.g. with combustion plant >20MW) and those in the same sector which are not (e.g. with combustion plant <20MW). Such competitive distortions are inherent in any regulatory system in which some sites in a sector are targeted by a policy and others are not. The most obvious route by which this occurs is through the use of size thresholds for eligibility, such as in IPPC. While the competitive distortions created by IPPC have *not* been a major political issue, the competitive distortions potentially created by the CCAs *have* been, despite the fact that the CCAs use the same size thresholds as IPPC. This may be because the perceived cost impacts of the CCL were greater than those for IPPC. In the case of the CCAs, the government removed the size thresholds as eligibility criteria, allowing even very small sites to join.

In the present case, Group 2 EU ETS participants may object to the double regulation of fuel, but the strength of this objection will depend upon whether the allowances are auctioned or freely allocated. If auctioned, the strength of this objection will also depend upon the process by which revenues are distributed. Group 2 sites also have double regulation of electricity, but in this case they face the same costs as Group 1 sites that are not eligible for the EU ETS. The extent of competitive distortions will therefore depend upon the allowance allocation rules and the relative fuel and electrical intensity of Group 2 sites. For most sites, electricity

[56] Cross subsidy would also be avoided if *all* the sites subject to the trading scheme were subject to the full CCL. In practice this is not the case in the UK, and it clearly does not apply to sites in other Member States. However, several Member States have their own energy or carbon taxes.

costs make up the bulk of total energy costs, which should reduce the competitiveness impacts of the double regulation of fuel.[57]

5.2.3 Summary

In summary, the coexistence of the EU ETS and the CCL leads to double regulation of fuel and electricity for all Group 2 sites. The implications for electricity costs are identical to those for Group 1 sites, while the implications for fuel costs depend very much upon the method of allowance allocation. Cost impacts would be very much greater with 100% auctioning than with free allocation, although this could be ameliorated by revenue recycling.

In practice, free allocation is planned for Phase 1 of the EU ETS and it is likely that only a small fraction of allowances will be auctioned in Phase 2. While the coexistence of the CCL could be seen as a second-best alternative to 100% auctioning (as it raises revenue), it would undermine some of the efficiency benefits of the EU ETS. Also, the differential treatment of Group 2 firms compare to competitors may be challenged as distortion to competition.

5.3 Group 3: CCA only

This group is far more important than Group 2. It includes sites in the non ferrous, chemicals and food and drink sectors, together with sites in other energy intensive sectors which are eligible for a CCA but not eligible for the EU ETS. These account for a large proportion of total industrial energy use.

Group 3 sites have CCA targets covering fuel and electricity consumption in both the main combustion plant and the process plant - termed the 'facility' under the CCA (section 3.3). This energy consumption is still subject to the residual 20% of the CCL, while the remainder of site energy consumption (outside the facility) is eligible for the full rate of the CCL. If the CCA facility accounts for >90% of total site energy consumption, then the total energy consumption at the site will be subject to the CCA target. These sites are not directly affected by the EU ETS since they are not eligible for participation. However, they are indirectly affected through the participation of the electricity generators in the EU ETS.

The CCA targets may take one of four forms:

- absolute CO_2 emissions (E) (tCO_2);
- absolute energy consumption (EN) (GJ);
- energy use per unit of output (EN/Q) (GJ/unit);
- CO_2 emissions per unit of output (E/Q) (tCO_2/unit).

We have:

$$F = \sum F_i$$

$$EN = F + EL$$

[57] For example, for a heat to power ratio of 3:1 and average industrial energy prices, electricity costs would be 2.2 times fuel (gas) costs.

$$E_{fuel} = \sum(F_i * C_i)$$

$$E_{elec} = C_{elec} * EL$$

$$E = E_{fuel} + E_{elec}$$

Where:
F_i = Fuel use of fuel type i (GJ)
F = total fuel use (GJ)
EN = total energy use (GJ)
EL = electricity use (GJ)
E_{fuel} = direct carbon emissions from fuel use (tCO_2)
E_{elec} = indirect carbon emissions from electricity use (tCO_2)
E = total carbon emissions from energy use (tCO_2)
C_i = carbon intensity of fuel type i (tCO_2/GJ)
C_{elec} = assumed average carbon intensity of imported electricity (tCO_2/GJ)

Of the four denominations of CCA target, it is energy use per unit of output which is most commonly used. No sector has chosen a target denominated in absolute CO_2 emissions and only a couple (e.g. steel) have chosen a target denominated in absolute energy consumption.

CO_2 emissions at the site may be decomposed as follows:

$$E_{fuel} = Q * (F/Q) * (E_{fuel}/F)$$

$$E_{elec} = Q * (EL/Q) * (E_{elec}/EL)$$

Where:

Q = production output (units)
F/Q = fuel intensity (GJ/unit)
E_{fuel}/F = average carbon intensity of fuel use (tCO_2/GJ)
EL/Q = electrical intensity (GJ/unit)
E_{elec}/EL = average carbon intensity of electricity use (tCO_2/GJ) – this is *fixed* for the CCAs.

The following table shows how changes in the production output, fuel intensity and carbon intensity affect the attainment of different types of CCA target.

Table 5.2 How changes in output, energy intensity and carbon intensity affect the attainment of different types of CCA target

Variable	**Denomination of CCA target**			
	CO_2 emissions (E)	**Energy consumption (EN)**	**Energy intensity (EN/Q)**	**Carbon intensity (E/Q)**
Output (Q)	✓	✓	-	-
Fuel intensity (F/Q)	✓	✓	✓	✓
Average carbon intensity of fuel (E_{fuel}/F)	✓	-	-	✓
Electrical intensity (EL/Q)	✓	✓	✓	✓
Carbon intensity of electricity (E_{elec}/EL)	✓	-	-	✓

Notes: The average carbon intensity of fuel will be changed by switching between fossil fuels. However, for the purpose of the CCAs the carbon intensity of electricity is assumed to be *fixed* regardless of the source of the electricity. Electricity from renewable sources is treated the same as electricity from fossil sources (section 3.5).

The relevant interactions for Group 3 sites relate to the treatment of electricity, and this is the focus of the following discussion. But it is important to note that these electricity related interactions are identical for *all* CCA sites. This includes Group 4 sites which are also participating in the EU ETS. There are additional issues for Group 4 sites related to the treatment of fuel emissions, and these are discussed in detail in section 5.4.

To analyse these electricity-related interactions, it is useful to distinguish a situation in which the CCAs take their basic form *without* the associated baseline and credit trading arrangements, from one in which the existing trading arrangements are allowed to continue alongside the EU ETS. This gives two cases to consider.

- implications for electricity, no CCA trading;
- implications for electricity, with CCA trading.

These are discussed in turn.

5.3.1 Implications for electricity, no CCA trading

With the CCAs and EU ETS coexisting, electricity use at Group 3 sites is:

- subject to the relevant CCA target;
- eligible for the residual 20% of the CCL; and
- subject to electricity price increases resulting from the participation of the electricity generators in the EU ETS.

This creates a double regulation problem.

Magnitude of cost impacts

Previous sections explored a scenario in which a £10/tCO_2 allowance price was passed on in full in electricity prices. This translates to an increase electricity prices which is approximately equivalent to the current level of the CCL (0.43p/kWh).

The purpose of the CCAs is to shield energy intensive companies from the increase in energy costs created by the CCL. If the EU ETS leads to an electricity price increase of the same magnitude as the CCL, the rationale for negotiating the agreements is partially undermined. Group 3 firms would have a target for their electricity consumption at the same time as they faced an increase in electricity prices. Considering electricity alone, firms would be worse off than under the full rate of the CCL. Not only would they face the double regulation of CCA targets and EU ETS electricity price increases, they would also receive no compensation for those price increases. Unlike with the CCL, there would be no revenue to distribute if the allowances were freely allocated, and if the allowances were auctioned the electricity generators themselves would be the more likely recipients.

As with Group 2, the importance of this double regulation will depend on the relative price of electricity and fuel and the electricity intensity of Group 3 sites. An order of magnitude illustration is given by Table 5.3. This estimates the relative contribution of fuel and electricity to total CCL costs for the two main Group 3 sectors (chemicals and food and drink), using 1999 energy prices and assuming that each pays the *full* rate of the CCL.[58]

[58] Non-ferrous metals is a highly electricity intensive sector that also falls within group 3. But data on fuel use for the sector is not reported separately in DTI (2002a).

Table 5.3 Estimated contribution of imported electricity to total CCL costs for the chemical and food and drink sectors

	Chemicals	**Food and Drink**
Energy consumption (GWh)		
Coal	6455	2093
Petroleum	4489	4129
Gas	51184	29005
Imported electricity	13712	9804
Total	**75839**	**45031**
CHP fuel use (GWh)		
Coal	4826	1844
Petroleum	4021	611
Gas	22181	7973
Total	**31028**	**10428**
Pre CCL energy costs (£m)		
Coal	30.3	9.8
Petroleum	33.2	30.6
Gas	279.5	158.4
Imported electricity	496.8	355.2
Total	**839.7**	**553.9**
Estimated CCL levy costs (£m)		
Coal	2.4	0.4
Petroleum	0.0	0.0
Gas	43.5	31.5
Imported electricity	59.0	42.2
Total	**104.9**	**74.1**
Total costs (£m)	**944.6**	**628.0**
CCL as % of total	**12.5**	**13.4**
Contribution of individual fuels to CCL costs (%)		
Coal	2.3	0.5
Petroleum	0.0	0.0
Gas	41.5	42.6
Imported electricity	***56.2***	***56.9***

Notes:

- Consumption and price data from 1999. Energy costs calculated using *average* industrial prices: coal=0.47p/kWh; petroleum=0.74p/kWh (assuming HFO); gas=0.55p/kWh; electricity=3.62p/kWh. As large consumers, the unit price for CCA companies could be lower.
- Assumes each sector pays the *full* rate of the CCL.
- Uses aggregate energy consumption data for each sector. In practice, only a portion of sites may be covered by the CCAs and only a portion of energy consumption at these sites may be eligible. Furthermore, the energy intensity and heat to power ratio of eligible sites may differ from the sector average.
- Estimates electricity imports from the difference between total electricity consumption and self generated electricity. The latter includes both CHP and non-CHP plants. Coal fired stream turbines dominate in the chemicals sector.
- Assumes all CHP fuel use is *exempt* from the CCL.

Source: DTI (2002)

These calculations estimate that electricity accounts for ~56% of total CCL costs for the chemicals sector and 57% for the food and drink sector (although see the notes to Table 5.3).

An increase in electricity prices equivalent to that provided by the CCL would increase total energy costs by 6.5% for chemicals and 6.7% for food and drink. If imported electricity accounts for a lower proportion of energy costs in CCA firms compared to the sector as a whole (possible if the contribution of self generation is higher), these figures would be reduced.

Compared to Group 1 sites, the site are relatively energy intensive. But despite this, these estimates suggest that the impact of the EU ETS on overall energy costs for Group 3 sites could be relatively small. This is all the more case when the estimates are set in the context of long-term changes in industrial electricity prices. As indicated in section 4.1, between 1996 and 2001, average industrial electricity prices fell by 20% (30% in real terms), while there was a fall of 10% (13% in real terms) in 2001 alone (DTI, 2002). Hence, under the above assumptions, the cost impacts of the EU ETS on these sectors would be insufficient to reverse the reduction in electricity costs that was experienced in 2001 alone.

As before, the calculations assume that the full cost increase to electricity generators is passed on to electricity consumers, rather than borne by suppliers or shareholders, and that the size of the cost increase is independent of the method of allowance allocation. In practice, the first assumption is almost certainly incorrect and the second is questionable (see section 2.1.3). Hence, the actual rise in electricity prices assuming an allowance price of £10/tCO_2 could be less than indicated here.

'Backup' regulation

The calculations are also based on an assumed allowance price of £10/tCO_2. As indicated in section 4.5, this could be an overestimate for the post-2008 period if: a) excessive hot air pushes the international carbon price to a low level; and b) linkages between the EU ETS and JI, CDM, IET or other trading schemes means that the EU ETS allowance price follows the international price.

This situation is similar to that described in section 5.1.4. If the allowance price is low, the impact of the EU ETS on electricity prices will be very small. The double regulation described above would then have relatively little economic impact on Group 2 sites and political opposition to the retention of the CCAs would be reduced. Conversely, if the EU ETS *replaced* the CCAs on electricity, the net result would be a reduction in electricity prices, a loss of the CCA electricity targets and a consequent loss of the downstream incentive to improve electricity efficiency. Hence, if a scenario of low allowance prices is considered likely and if electricity efficiency is a valued policy objective, there may be an argument for retaining the CCAs in their current form in order to retain this downstream incentive. Here, the CCAs could be seen as a 'backup' to the EU ETS to ensure that Group 1 sites took *some* action to improve electricity efficiency. An analogous approach has been adopted by the UK Environment Agency in their interpretation of the energy efficiency provisions under IPPC (Smith, 2002a).

A central issue here is the relative effectiveness of energy price increases versus downstream targets in encouraging energy efficiency. The UK government's view is that price signals alone are relatively ineffective, given the range of other barriers that inhibit energy efficiency (Box 3.1).[59] This is considered to be even more the case when the price signal is indirect, as with the EU ETS, rather than explicitly labelled and publicised, as with the CCL. This leads

[59] Interview with DEFRA official, June 2002.

to a preference for negotiated downstream targets for energy intensive uses - a view which accords with the preferences of energy intensive industry since it allows them to avoid paying for residual emissions. In support of this, the bottom-up modelling conducted by ETSU suggested that the CCAs would deliver 9.2MtCO_2 annual reductions by 2010, compared to a saving of only 10% of this (0.92MtCO_2) if companies paid the full rate of the CCL (i.e. with no CCA targets) (ETSU, 2001). A 9.2MtCO_2 reduction corresponds to 12% of the baseline emission coverage of the CCAs and 14% of the total quantified emission reductions in the UKCP – as compared to only 1.4% with the CCL alone. As with any modelling work, there are caveats regarding the methodology and the tenfold difference seems very surprising. But if it is correct, it illustrates the centrality of the CCA targets to the overall UKCP and the risks to the program if the CCA targets were removed.

5.3.2 Implications for electricity, with CCA trading

The existing CCAs also have arrangements for emissions trading as part of the UK ETS. These are of the baseline and credit form and are described fully in Sorrell (2001a). The correct term for the trading commodity used by the CCAs should be 'credit', but since these are fungible with the allowances used in the cap and trade portion of the UK ETS, the commodity is known by the general term 'UK ETS allowances' and is denominated in tonnes of CO_2 (Sorrell, 2001a). Three points to note are:

- There has to be conversion between the currency of the allowances and the currency of the CCA targets. This conversion uses the output of the previous year and the average values of energy intensity (EN/Q) and carbon intensity of fuel (E_{fuel}/F) over the previous year.
- CCA companies can purchase allowances at any time from anywhere in the UK ETS. But CCA companies can only sell surplus allowances at two-year intervals, after their performance has been verified against their targets.
- There are no restrictions on the purchase of allowances by CCA companies or on the sale of allowances to other CCA companies. But the sale of allowances to direct participants in the UK ETS is subject to the provisions of the Gateway (Sorrell, 2001a).

Since the CCA targets cover electricity use, this implies that the carbon emissions associated with that electricity use can be traded in the UK ETS. At the same time, the carbon emissions from electricity generation can be traded by the electricity generators in the EU ETS. While the UK ETS allowances *indirectly* cover the emissions from the associated electricity generation, the EU ETS allowances *directly* cover emissions from electricity generation. This means that both the electricity generator and the CCA participant have ownership of a property right (an EU ETS or UK ETS allowance) which: a) corresponds to the same physical emissions; b) relates to the use of the atmospheric commons; and c) can be traded. As discussed in section 2.3.2, the nature and extent of control that each party has over these emissions is quite different.

In practice, there may be fungibility between the EU ETS and the UK ETS trading commodities. But since this raises a range of practical issues, full fungibility cannot be guaranteed. Another possibility is that there will be *no* fungibility of trading commodities. In this case, the trading arrangements for the UK ETS and EU ETS will remain entirely separate.

Double coverage and double crediting

The different treatment of electricity in the EU ETS and CCAs creates a *double coverage* problem. The electricity generator requires EU ETS allowances to cover *all* the emissions associated with generating electricity for CCA sites. Meanwhile, the CCA firm will require UK ETS allowances to cover *exceedances* of its CCA target. Some or all of this exceedance may result from excess electricity consumption, and this will be converted into equivalent emissions (and corresponding allowance requirements) by means of the relevant conversion factors. In principle, this means that when CCA companies exceed their targets, *two* allowances may be required to cover each tonne of additional emissions that result – i.e. one UK ETS allowance required by the CCA firm, and one EU ETS allowance required by the electricity generator.

This situation also creates a *double crediting* problem. Reducing electricity consumption below the CCA target could 'free up' or 'create' allowances in both the UK ETS and EU ETS. In the EU ETS, the corresponding reduction in electricity generation will mean that allowances held by electricity generators will no longer be required to cover emissions. Hence they are 'freed up' and available for sale to other EU ETS participants. In the UK ETS, reducing electricity consumption below the CCA target will 'create' UK ETS allowances which had no existence prior to the abatement action. These are then available for sale to other UK ETS participants.

To clarify the implications of this double coverage/crediting it is useful to revise the distinction between allowance and credit based emissions trading schemes, as summarised in Table 5.4.

Table 5.4 Allowances versus credits

Emission Reduction Credit	**Emission Allowance**
Scheme: 'Baseline and credit'	Scheme: 'Cap and Trade'
Applies to emission reductions below defined baseline	Applies to all emissions.
Only emission reductions can be traded	All emissions can be traded
Credits are generated when a source reduces its emissions below an agreed baseline	Allowances are allocated by the regulatory authority
May develop incrementally as a means of introducing flexibility into existing regulatory structure	Trading must be built into the regulatory structure from the beginning
Participation in the credit market is voluntary - sources can just meet existing standards	Participation in the program is mandatory - the overall emission cap still applies even if sources do not trade

Source: Sorrell and Skea (1999)

The distinction between allowance and credit based schemes is separate from the distinction between absolute and relative targets. Absolute targets place an absolute limit on the quantity of emissions from a trading participant, while relative targets restrict the quantity of emissions per unit of output. The EU ETS is an allowance based scheme (cap and trade) with absolute targets and allowance based schemes can *only* be used with absolute targets. But the trading arrangements for the CCAs are a credit based scheme (baseline and credit) with *both* absolute and relative targets. The choice between absolute and relative targets varies between CCA sectors - although most have chosen relative targets denominated in energy use per unit of output.

Figure 5.2 is a stylised representation of situation. The left-hand side shows allowance holdings in the EU ETS. Here, allowances are required to cover all emissions and the sum of allowances equals the emissions cap. The right hand side shows the equivalent emissions in the CCAs (the other participants in the UK ETS are ignored here). Here, emissions are calculated using the relevant conversion factors and include both the direct emissions from fossil fuel combustion and the indirect emissions from electricity consumption. Group 3 firms form a subset of CCA participants and electricity generators form a subset of EU ETS participants.

In practice, all CCA firms have a portion of their emissions resulting from electricity consumption. But to simplify this exposition, let us assume that the indirect emissions from non-Group 3 CCA firms are zero (i.e. assume their electricity consumption is zero and that all their emissions result from direct fossil fuel combustion). This confines attention to the indirect emissions from Group 3. For these, assume that, initially, 50% of emissions result from direct fossil fuel combustion and 50% from electricity consumption. A portion of electricity generator emissions results from generating electricity for these Group 3 firms, and these emissions are represented on both sides of the diagram. To simplify things further, assume that:

- all CCA participants have targets denominated in absolute emissions;[60]
- all UK ETS and EU ETS allowances are used to cover emissions;
- emissions from CCA participants are equal to their individual targets.

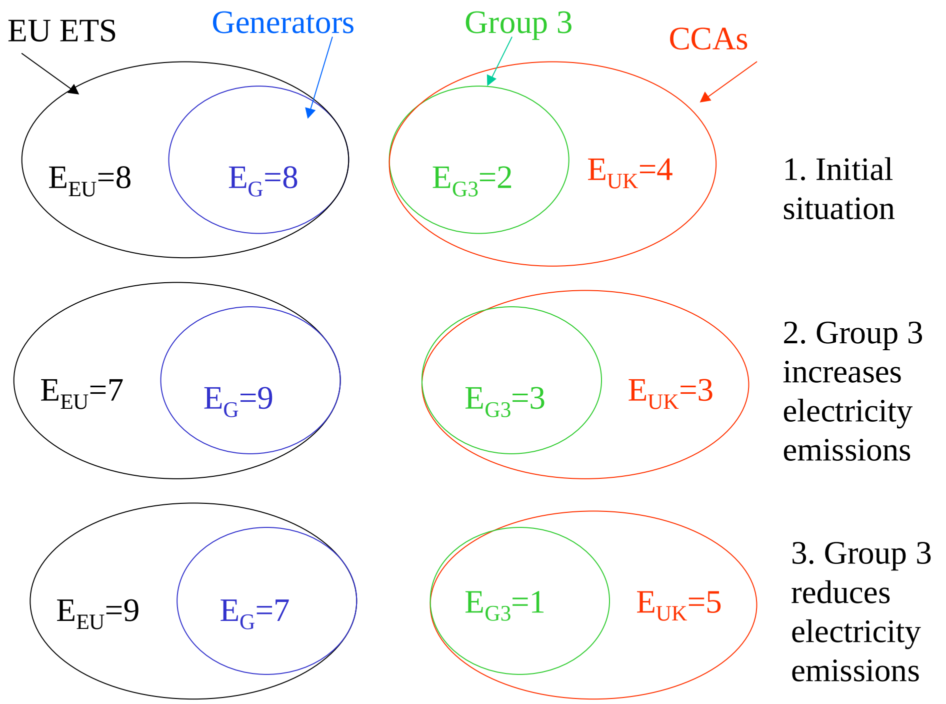
Panel 1 of Figure 5.2 shows this initial situation, in which:

- the emissions from Group 3 firms are 2 tonnes, of which 1 tonne (50%) results from electricity consumption;
- the emissions from electricity generators are 8 tonnes of which 1 tonne results from electricity generated for Group 3 firms;
- the emissions from non-Group 3 CCAs are 4 tonnes;
- the emissions from participants other than electricity generators in the EU ETS are 8 tonnes;
- the emissions covered by the EU ETS are 16 tonnes;
- the emissions covered by the CCAs are 6 tonnes.

The total emissions covered by the EU ETS and CCAs combined is not equal to 16+ 6 = 22 tonnes. This is because the 1 tonne of Group 3 emissions that result from electricity consumption is counted twice – once on each side of the diagram (i.e. there is ‘double coverage’ of these emissions). Hence, the 22 tonnes of emissions that is covered by the combination of the EU ETS cap and the CCA targets corresponds to only **21** tonnes of real, physical emissions.

[60] In practice, no CCA firms have targets in this form, but adopting this as an initial assumption simplifies the explanation.

Figure 5.2 Double counting of electricity emissions with coexistence of EU ETS and CCAs, when the CCAs have absolute targets



Now, consider a situation where electricity-related emissions from the Group 3 firms increase by 1 tonne as a consequence of increasing electricity consumption. Group 3 emissions now exceed the aggregate Group 3 CCA target. To cover these emissions, Group 3 firms must purchase 1 tonne of UK ETS allowances from other participants in the CCAs. At the same time, emissions from the electricity generators will have increased by 1 tonne as a consequence of the increased electricity generation required to meet the Group 3 demand. To cover these emissions, electricity generators must purchase 1 tonne of EU ETS allowances from other participants in the EU ETS. Assuming all allowances are used to cover emissions, the situation is then as shown in Panel 2 of Figure 5.2. The sum of the regulatory targets in the two sectors is the same as before: 16+ 6 = 22 tonnes. But the real physical emissions covered by the two regulations has *reduced* by 1 tonne to **20** tonnes (16 + 3 + 1). The increase in emissions by the Group 3 firms has been offset by a reduction in emissions of twice the size - one tonne from EU ETS participants, and one tonne from the CCA participants. In other words, the emission increase from the Group 3 firms has been 'double covered'.

For comparison, consider a situation where electricity-related emissions from the Group 3 firms reduce by 1 tonne to zero tonnes. Group 3 emissions are now below the aggregate Group 3 CCA target. This will give Group 3 firms a surplus of 1 tonne of UK ETS allowances which may be sold to other CCA participants. At the same time, it will give electricity generators a surplus of 1 tonne of EU ETS allowances which may be sold to other EU ETS participants. Assuming all allowances are used to cover emissions, the situation is then as shown in Panel 3 of Figure 5.2. The sum of the regulatory targets in the two sectors is unchanged at 22 tonnes. But the real physical emissions have *increased* by 1 tonne to **22** tonnes (16 + 5 + 1). The reduction in emissions by the Group 3 firms has been offset by an increase in emissions of twice the size - one tonne from EU ETS participants, and one tonne from the CCA participants. In other words, the emission increase from the Group 3 firms has been 'double credited'.

In summary, an increase/decrease in emissions from Group 3 firms lead to an equal and opposite decrease/increase in emissions from participants in each of the two trading schemes. The net result is that an emissions increase/decrease from Group 3 firms leads to a decrease/increase of twice the size in the total emissions covered by the CCAs and EU ETS. The final total of emissions covered by the CCAs and EU ETS may be greater or less than the initial total of emissions (21 tonnes in Figure 5.2). However, this final total will always be less than or equal to the sum of the allowance cap in the EU ETS and the target emissions for the CCAs. This sum provides an overall cap on the total emissions from the combined schemes. The situation is complicated by the fact that the CCA targets reduce every two years while the EU ETS cap is fixed for the duration of each phase, but this will be ignored here.

Since the CCAs use credit based trading, the double coverage problems described above only apply to emission increases above the relevant CCA target. If the Group 3 emissions are initially below the aggregate Group 3 CCA target, and if they remain below the target after an emissions increase, there will be no double coverage since they will be no requirement for UK ETS allowances. Similarly, the double crediting problems only apply to emission reductions below the relevant CCA target. If the Group 3 emissions are initially above the aggregate Group 3 CCA target, and if they remain above the target after an emissions reduction, there will be no double crediting since they will be no generation of UK ETS allowances. In contrast, if the CCAs used allowance based (rather than credit based) trading, the double coverage/crediting would apply to all emissions increases/decreases.

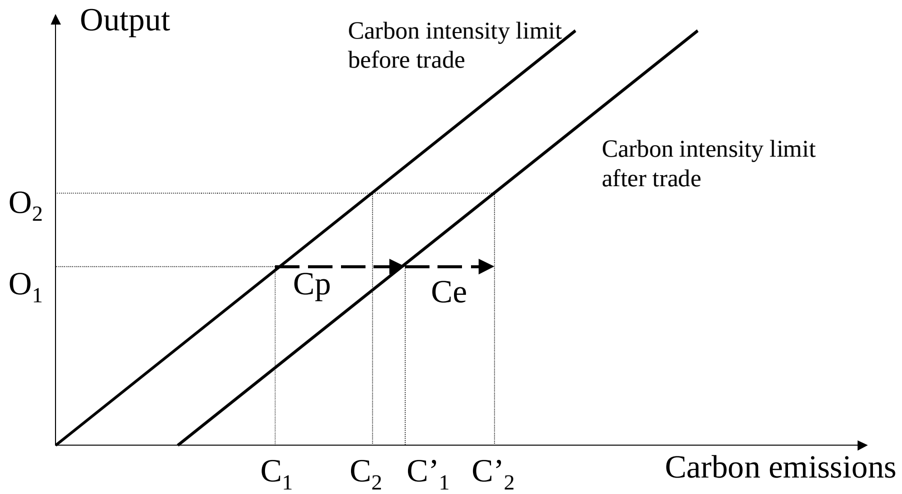
In practice, Group 3 firms have relative rather than absolute targets. In this case, the manner by which emissions increase becomes important. If the CCA target is denominated in emissions intensity (E/Q), increasing equivalent emissions through increasing output (Q) while holding emissions intensity constant will not create a requirement for UK ETS allowances. Conversely, increasing emissions through increasing E/Q while holding Q constant *will* create a requirement for UK ETS allowances. As before, double coverage will only take place for emissions that exceed the aggregate Group 3 CCA target, but in this case the target is relative, rather than absolute. Similarly, double coverage will only take place for increases in the emissions intensity of electricity use (E_{elec}/Q) – not for fuel use (E_{fuel}/Q). Since the carbon intensity of imported electricity (C_{elec}) is assumed to be constant, the only way in which a requirement for allowances is generated is through an increase in electricity intensity (EL/Q). Similar comments apply to double crediting.

Implications for environmental integrity

The cap in the EU ETS will not breached by this double crediting - total emissions from participating firms in the EU ETS will remain equal to or below the cap and the total number of EU ETS allowances will remain unchanged. Similarly, the operation of the CCAs will not be affected by the double crediting. If all the CCAs had absolute targets, total emissions from the CCA sector would remain below the target emissions. Since, in practice, most CCAs have relative targets, aggregate emissions in the CCA sector (and hence the UK ETS overall) could increase. But this is an inherent feature of a scheme with relative targets and is not due to the double crediting.

The reason aggregate emissions in the CCA sector may increase is that increases in output can lead to increases in emissions. To see how this may apply, refer to Figure 5.3.[61] This shows the carbon intensity limit for a facility in the CCA relative sector which has purchased a total Cp of UK ETS allowances from a Group 3 firm. This has the effect of shifting the emission constraint for the purchasing firm (a sloping line) to the right. Before the trade, allowable emissions for this firm at output O_1 are equal to C_1, while allowable emissions at output O_2 are equal to C_2. After the trade, allowable emissions for output O_1 are equal to C'_1, and allowable emissions for output O_2 are equal to C'_2. For an increase in output from O_1 to O_2, total allowable emissions have increased by $(C'_2 – C_1) = (Cp + Ce)$. At the same time, total allowable emissions from the Group 3 firm will have decreased by only Cp. This means that the total allowable emissions from overall CCA sector (for output level O_2 from the purchasing firm) will have increased by Ce, while emissions from the Group 3 firm will only have reduced by Cp. This is not, however a consequence of the double crediting, but is an inherent feature of a scheme with relative targets. The same situation would result if Cp of allowances were purchased from a non-Group 3 CCA firm.

Figure 5.3 How trading with relative targets can lead to an increase in total emissions



Given the above, we can ask whether the potential double coverage/crediting is a problem. At first sight, environmental integrity appears to be breached: in some circumstances two allowances are created from a one tonne reduction in emissions at a Group 3 site and these allowances are used to cover two tonnes of emissions increase at other sites. However, the double crediting is balanced by the double coverage. One tonne of emissions increase from the Group 3 sites is covered by two allowances, which must be obtained from two tonnes of emission reduction at other sites. In all cases, this only applies to emissions increases above or reductions below the Group 3 CCA targets.

[61] This discussion is based on Salmons (2000).

The net result does not present a threat to environmental integrity. In the case of absolute CCA targets, the combined emissions from the EU ETS and CCAs will be less than the sum of the emissions cap for the EU ETS and the target emissions for the CCAs (i.e. there will be an assurance of an overall cap). In the case of relative CCA targets, there is no assurance of an overall cap and emissions from the CCA sector may increase if output (Q) increases. But this is an inherent feature of relative targets and is not a consequence of the double coverage/crediting.

But while environmental integrity may be protected, the double coverage/crediting does inject a considerable amount of confusion into the regulatory situation. In particular, the ownership of emissions from Group 3 sites becomes disputed. This would apply if both trading schemes were allowance based, but is all the more the case when the CCAs use credit based trading since this means that *some* emissions increases/decreases from Group 3 sites will be double covered/credited and some will not.

The double coverage/crediting also creates problems for carbon accounting within the UKCP. Total emissions from the EU ETS and CCA sectors are not equal to the sum of emissions from the EU ETS participants and the CCA participants, since the electricity-related Group 3 emissions are double counted. Instead, the electricity-related emissions from Group 3 participants must only be counted once. However, if the CCAs have absolute targets, the emissions ceiling for the EU ETS and CCA sectors *is* equal to the sum of the EU ETS and CCA targets. This ceiling would only be reached if the electricity-related Group 3 emissions were zero. With relative targets, there is no emissions ceiling.

Overall, the double coverage/crediting of electricity-related emissions for Group 3 sites appears complex, confusing and unwieldy, both for the participants themselves and for the UKCP overall.

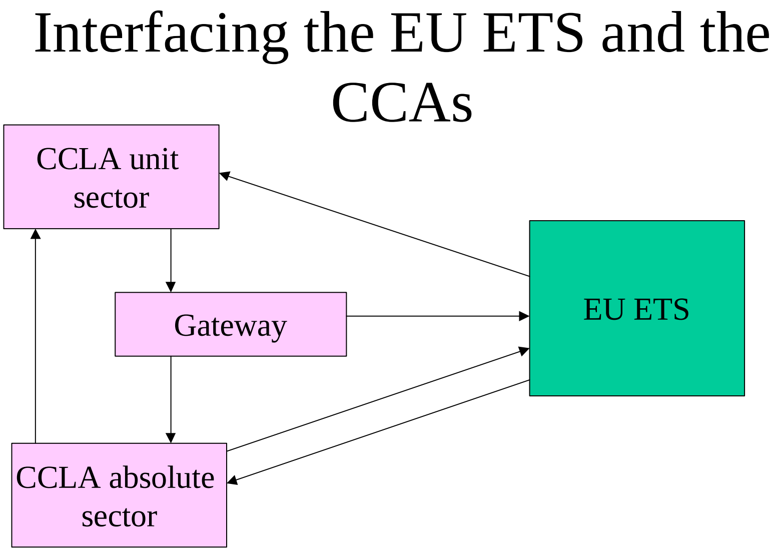
Fungibility between the EU ETS and the UK ETS

One final issue is the potential fungibility between UK ETS and EU ETS allowances. Unrestricted fungibility means that an EU ETS participant could purchase UK ETS allowances and use them for compliance with its obligations, and similarly a UK ETS participant could purchase EU ETS allowances and use them for compliance with its obligations.

If all CCAs had absolute targets, the overall environmental integrity of the EU ETS would not be threatened. However, if (as is the case) the CCAs had relative targets, the environmental integrity of the EU ETS could be threatened. This is because output growth in the CCA sector could increase the total number of allowances in the two schemes, thereby inflating the size of the EU ETS cap. In practice, since the CCAs use credit based rather than allowance trading, this need not automatically be the case since UK ETS allowances (credits) are only created when emissions are reduced below a CCA target. Nevertheless, it remains a possibility.

Whether this is a problem is a matter of political judgement. Since the inflation threatens the entire EU ETS, the judgement needs to be made by the Commission. The concern here is analogous to that which led to the inclusion of the Gateway in the design of the UK ETS. The Gateway prevents a net flow of allowances from the CCA sector to the direct participant sector, thereby preventing inflation of the direct participant cap (Sorrell, 2001a). To prevent inflation in the EU ETS, a similar arrangement would be required to govern trade (fungibility) between those CCAs that had relative targets and the EU ETS. The Gateway would *not* be needed to govern trade between those CCAs that had absolute targets and the EU ETS. The required arrangement is illustrated in Figure 5.4.

Figure 5.4 Interfacing the EU ETS and the CCAs



5.3.3 Summary

In summary, the coexistence of the EU ETS and CCAs leads to double regulation of electricity for all Group 3 sites. The electricity generators incur abatement costs to meet their EU ETS targets and a portion of these costs are passed on in electricity prices to Group 3 firms. This cost increase is identical to that faced by Group 1 and Group 2 firms. For the latter, the cost increase is in addition to the CCL on electricity, while for Group 3 sites, the cost increase is in addition to the existing CCA target (which includes electricity consumption). This means that Group 3 sites face an electricity price increase at the same time as being required to meet a CCA target. Under certain assumptions, an EU ETS allowance prices of around £10/tCO_2 could lead to an electricity price increases of a similar magnitude to the full rate of the CCL.

The impact on overall energy costs at Group 3 sites will depend upon the market price for allowances and the electricity intensity of Group 3 sites. Simple calculations suggest that with allowance prices of around £10/tCO_2, the overall increase in energy costs will be less than 10% for a typical Group 3 site. This appears relatively small compared to the reductions in industrial electricity prices over the last five years. Furthermore, these calculations assume that the full cost increase to electricity generators is passed on to electricity consumers and that the size of the cost increase is independent of the method of allowance allocation. In practice these assumptions may well be incorrect, and the actual electricity price increase with free allocation of allowances could be less than indicated here.

The calculations also assume an allowance price of £10/tCO_2. This could be an overestimate for the post 2008 period if excessive hot air on the international carbon market leads to a corresponding reduction in EU ETS allowance prices. In these circumstances, there may be an argument for retaining the CCA electricity targets as 'backup' regulation, to ensure *some* improvement in downstream electricity efficiency. This points to a broader debate regarding the relative effectiveness of energy price increases versus downstream targets in encouraging energy efficiency.

In practice, the CCAs have credit based trading arrangements as part of the UK ETS. Coexistence of these arrangements with generator participation in the EU ETS leads to: a) *double coverage*, where two allowances may be required to cover each tonne of additional emissions; and b) *double crediting*, where two allowances are 'freed up' or 'generated' from a each tonne of emission reductions. Since the CCAs use credit based trading, these problems only result from increases above or reductions below the CCA target . Similarly, since most of the CCAs use relative targets, these problems only result from changes in the emissions intensity of electricity use - not from changes in output. In practice, this means that some emissions increases/reductions are double covered/credited and some are not. Overall, this double coverage/crediting does not threaten the environmental integrity of either the EU ETS or the CCAs. It does, however introduce complexity and confusion into the regulatory situation, resulting from a conflict over the ownership of emissions from electricity generation.

Finally, the use of relative targets in the CCAs means that output growth in the sector could increase the total number of allowances in circulation. If there were full fungibility between UK ETS and EU ETS allowances, this would create a danger of inflation in the number of EU ETS allowances with a corresponding risk of violating the EU ETS emissions cap. Whether or not this is a problem is a matter for political judgement. The most likely result in practice is for the Commission to require the use of a Gateway arrangement, similar to that used in the UK ETS, to interface the CCAs to the EU scheme.

5.4 Group 4: EU ETS and CCA

In terms of overall energy use and emissions, this group is more important than Group 3. It includes energy intensive sites in the paper, glass, steel, minerals and other energy intensive sectors which account for a very large proportion of total industrial energy use.[62] Again, it is very unlikely that the EU ETS and CCAs could coexist at these sites, but it is useful to work through the implications if they did.

These sites would require EU ETS allowances to cover CO_2 emissions from fossil fuel combustion in both the main combustion plant and process plant, together with CO_2 emissions from non-combustion processes. At the same time, their CCA target would cover fuel and electricity consumption in both the main combustion plant and process plant. If the latter accounted for more than 90% of the energy consumption at the site, then the total site energy use would be included in the CCA. Electricity prices would also be indirectly affected by the participation of electricity generators in the EU ETS. Table 5.5 summarises this overlapping coverage.

[62] Iron and steel, paper and minerals together account for around 28% of manufacturing energy consumption. The bulk of this is concentrated in the larger sites, which are eligible for the EU ETS.

Table 5.5 Coverage of EU ETS and CCA at a single site

Emission source	**CCA**	**EU ETS**
Fuel use in main combustion plant	✓	✓
Fuel use in process plant	✓	✓
Fuel use elsewhere on the site	f(90% rule)	-
Electricity use in main combustion plant	✓	✓
Electricity use in process plant	✓	(indirect)
Electricity use elsewhere on the site	f(90% rule)	(indirect)
Non combustion processes	-	✓

Notes: The average carbon intensity of fuel will be changed by switching between fossil fuels. However, for the purpose of the CCAs the carbon intensity of electricity is assumed to be *fixed* regardless of the source of the electricity. Electricity from renewable sources is treated the same as electricity from fossil sources (section 3.5).

The consequences for electricity consumption of this interaction are identical to those for Group 3 sites in the previous section. Hence, this section will confine attention to the direct emissions from fuel use.

As in section 5.3, it is useful to distinguish a situation in which the CCAs take their basic form without the associated baseline and credit trading arrangements, from one in which the existing trading arrangements are allowed to continue alongside the EU ETS. This gives two cases to consider.

- implications for fuel, no CCA trading;
- implications for fuel, with CCA trading;

These are discussed in turn.

5.4.1 Implications for fuel, no CCA trading

CO_2 emissions from fuel combustion are constrained by the allowance allocation under the EU ETS, but with the flexibility to trade. This is an absolute target. At the same time, fuel use is constrained by the parallel CCA target, but without the flexibility to trade. In most cases, the CCA will have a relative target.

When a CCA is combined with the EU ETS, there are two targets for the site to meet. For the EU ETS target, denominated in CO_2 emissions, changes in Q, F/Q and E_{fuel}/F will all affect attainment of the target. In contrast, only a subset of these variables will affect attainment of the CCA target (Table 5.2). On the one hand there are more degrees of freedom to meet the EU ETS target (including allowance purchases), but on the other hand the EU ETS exposes the operator to greater risk, since increases in output may threaten attainment of the EU ETS target.

Implications for marginal abatement costs

The effect of having two targets will depend upon whether the constraint imposed by the CCA target is binding. If so, the net effect will be to increase marginal abatement costs for the site in question. This may be demonstrated algebraically. Assume that the firm is a price taker in both the product market and the allowance market. Its problem is then to choose output (q) and abated emissions A such that profits (revenues minus costs) are maximised.

First consider the situation with the EU ETS target alone. Assuming free allocation of EU ETS allowances, the site must maximise the following objective function:

$$Profit = P*q - TC(q,A) - PP[(E(q) – A) - GF]$$

Where:
q = production output (units),
P = exogeneous product price (assume the firm is a price taker in the product market)
A = abated emissions
TC(q,a) = total costs (production + abatement) for output q and abated emissions A
E(q) = unconstrained emissions for output q
PP = exogenous allowance price (assume the firm is a price taker in the allowance market)
GF = allowance allocation (assuming free allocation)

Assume that total costs are increasing in output (dTC(q,A)/dq>0) and in abated emissions (dTC(q,A)/dA >0) and that emissions are increasing in output (dE(q)/dq>0). Also assume that marginal production costs are increasing in output (d(dTC(q,A)/dq)dq>0) and marginal abatement costs are increasing in abated emissions (d(dTC(q,A)/dA)da >0). [63]

The first order condition for minimising abatement costs is then given by:

$$dTC(q,A)/dA = PP$$

This is the standard cost efficiency result: total abatement costs are minimised when marginal abatement costs are set equal to the allowance price.

Now consider the situation with a parallel CCA target. As indicated above, this target is most likely to be denominated in energy intensity. This, together with the differing coverage of the EU ETS and CCAs complicates the derivation of simple equations for profit maximisation. But the general principle may be illustrated by assuming that the CCA target is denominated in *emissions* intensity (E/Q) and that the scope of the CCA is identical to that of the EU ETS. Using these simplifying assumptions, the site must then also meet the following constraint:

$$(E(q) – A)/q <= N$$

Or:

$$(E(q) – A) <=q*N$$

where: N = emissions intensity target (tCO_2/unit)

Forming the Lagrangian:

$$Z = P*q - TC(q,A) - PP[(E(q) – A) - GF] + \lambda[q*N – (E(q) – A)]$$

[63] The first derivative measures whether the *value* of the function is increasing (+ve), decreasing (-ve) or stationary (=0). The second derivative measures whether the *slope* of the function is increasing (+ve), decreasing (-ve) or stationary (=0). For a maximum, the first derivative = 0 and the second derivative < 0. For a minimum, the first derivative = 0 and the second derivative > 0. Here, the function = profits; and the slope of the function means the change in profits for changes in either q or A.

The full solution requires the Kuhn Tucker conditions. But if we assume q>0 and A>0, then the first order condition for minimum cost abatement is given by dZ/dA=0, or:

$$-dTC(q,A)/dA + PP + \lambda = 0$$

or:

$$dTC(q,A)/dA = PP + \lambda \qquad (1)$$

The Lagrange multiplier λ indicates the change in the objective function (profits) for a marginal change in the CCA-constraint. If the CCA-constraint is binding, λ is positive. If the CCA-constraint is not binding, λ is zero. In the latter case, profits are not affected by the additional CCA-constraint.

If the CCA-constraint is binding, equation (1) shows that the firm chooses abatement such that the marginal abatement costs are equal to the allowance price plus λ. This means that the firm faces higher marginal abatement costs and higher total abatement costs from the additional CCA-constraint. The net effect of the CCA target is to increase the marginal abatement costs of the Group 4 firm relative to those firms which are participating in the EU ETS without such a constraint. The double regulation of Group 4 firms distorts the operation of the EU ETS in that it can no longer achieve a minimum cost distribution of CO_2 abatement. In this, the effect of the CCA target is similar to that of the CCL for Group 2 firms (section 5.1.3). The additional costs faced by Group 4 firms will be passed on to shareholders or to suppliers. It will only be possible to pass costs on to consumers if the Group 4 firms in a particular sector have market power in the relevant product market.

If the CCA-constraint is binding, the firm will abate more than it would with the EU ETS alone. This situation is similar to that described in section 5.1 for double regulation with the CCL. If, in the absence of the CCA target, the firm was likely to be a net buyer of allowances, the number of allowances bought is likely to be reduced by the coexistence of the CCA. In some circumstances, the firm could even become a net seller of allowances. Similarly, if in the absence of CCA target the firm was likely to be a net seller of allowances, the number of allowances sold is likely to be increased. Thus, compared to the case with the EU ETS alone, the coexistence of the CCA will lead to more allowances on the market and, potentially, a reduction in the allowance price.[64] In this case, the double regulation of Group 4 firms would not only increase the costs of these firms, but also subsidise abatement at other, non-Group 4 firms since the latter will be able to purchase cheaper allowances. These may be UK or foreign competitors of the Group 4 firms. Whether this is actually the case will depend upon the collective market power of Group 4 firms (i.e. their ability to affect the allowance price). Since the EU ETS market is EU-wide, this could be limited.

The first order condition for optimum output (q) is given by dZ/dq = 0, or:

$$P - dTC(q,A)/dq - PP^*dE(q)/dq + \lambda(N - dE(q)/dq) = 0$$

Then:

$$P = dTC(q,A)/dq + PP^*dE(q)/dq + \lambda(dE(q)/dq - N)$$

Or:

[64] Assuming the CCA target is binding for at least some firms.

$$dTC(q,A)/dq = P - PP*dE(q)/dq - \lambda(dE(q)/dq- N) \quad (2)$$

Equation (2) shows that Group 4 firms should chose output (q) such that the marginal production costs are equal to product price *minus* both:

- the marginal costs for covering emissions associated with the additional output (which equals the EU ETS allowance price); and
- a term that reflects the impact of an increase in output on the CCA-constraint.

If the additional emissions from a one unit output increase exceed that allowed by the CCA (N), this additional term is negative and output will be lower compared to a regime with the EU ETS alone. By contrast, if the additional emissions from a one unit output increase are lower than the CCA target, the CCA-constraint becomes less binding, and output will be higher compared to a regime with the EU ETS alone.

Magnitude of cost impacts

The relative importance of the CCA target to the firm will depend upon the magnitude of λ relative to the allowance price PP. Here:

λ = f (the individual CCA target (N) and the cost characteristics of the individual firm)

PP = f (the aggregate emission target in the EU ETS and the cost characteristics of the population of participating firms).

One possibility is that PP>>λ (this include situations where the constraint is non-binding and hence λ=0). In this case, the CCA target for the firm will have relatively little effect compared to the EU ETS (zero effect if λ=0). In this scenario, the CCA becomes largely redundant and the EU ETS dominates overall abatement costs. Another possibility is that PP<<λ. Here, it is the CCA target which dominates and the scope for compliance with the EU ETS is severely constrained. A third possibility is that λ≅PP. In this case, the marginal abatement costs for Group 4 will be doubled compared to a scenario with the EU ETS alone. The effect upon total abatement costs and average abatement costs will depend upon the shape of the marginal cost curve. But in all cases, total abatement costs will be increased.

The stringency of the CCA-constraint λ relative to PP will vary from firm to firm and the constraint may only be binding for a subset of firms. But in principle, the λ's for each firm should be based upon broadly similar criteria. It is reasonable, therefore, to discuss the average value of the constraint for Group 4 firms - λ_{av} - and compare this with PP. The above scenarios then become λ_{av}<<PP, λ_{av}>>PP and λ_{av}≅PP.

If λ_{av}>>PP there is a possible rationale for retaining the CCA targets. This is identical to the rationale given in section 5.1.4 for retaining the CCL, and in section 5.3.1 for retaining the electricity targets in the CCAs. This stems from the fact that cost minimisation is not the only objective of UK climate policy. The promotion of energy efficiency is also a highly valued policy goal and this requires the retention of downstream incentives. If there were serious concerns that allowance prices in the EU ETS would be low post 2008, this could motivate the retention of CCA targets for fuel consumption at Group 4 sites as a 'backup'. The CCAs would ensure that individual firms took *some* action to improve the efficiency of fuel use (in most cases through improving F/Q), rather than relying solely on the purchase of cheap allowances. Note that this argument holds regardless of the stringency of the EU ETS targets for the Group 4 firms – what matters is the market price for EU ETS allowances.

If $PP \gg \lambda_{av}$, the justification for retaining the CCAs is less obvious. Here it is the EU ETS which dominates, and the CCAs have relatively little impact on overall abatement costs or regulatory flexibility. In practice, however, the relative stringency of the CCA targets and the EU ETS will not be known prior to the introduction of the latter and may differ between Phase 1 and Phase 2.

Practical considerations

Double regulation by the EU ETS and CCAs does not merely increase abatement costs, but also administrative costs. These derive from having two sets of reporting requirements (every two years under the CCAs and annually under the EU ETS), two sets of verification requirements, two sets of compliance provisions and so on. There may be some scope for rationalisation, but the sum of administrative costs will inevitably be greater than under either instrument acting alone. Given that the administrative requirements of the CCAs are already considered onerous (ENDS, 2002c), such a level of administrative complexity would be strongly opposed by Group 4 firms.

In practice, the biggest obstacle to this type of double regulation would be political. The EU ETS would remove the flexibilities that the CCAs give - relative targets would be replaced by absolute targets and the broader provisions for risk management would be lost. Objections may be anticipated from Group 4 sites. This is an inevitable consequence of joining the EU ETS, but the difficulties and costs this creates for CCA sites would be compounded if the existing CCAs were retained alongside the new EU ETS. The double regulation would be viewed as unnecessary, costly and redundant and is unlikely to be seriously contemplated.

5.4.2 Implications for fuel, with CCA trading

As described in section 5.3, the existing CCAs also have arrangements for credit-based emissions trading. Hence, if Group 4 CCA firms join the EU ETS, they will become participants in two trading schemes simultaneously: the UK ETS and EU ETS. In practice, there may be fungibility between the two trading schemes, but we first consider a situation where there is no fungibility of trading commodities – i.e. the trading arrangements for the UK ETS and EU ETS are entirely separate.

Implications for marginal abatement costs

As before the implications for marginal abatement costs of this form of double regulation can be determined algebraically. In this case, using the same terminology as above and assuming an emissions intensity target for the CCA, the problem for the Group 4 firms is to choose abatement and output levels which maximise the following function:

$$\text{Profit} = P*q - TC(q,A) - PP_{EU}[(E(q) - A) - GF] - PP_{UK}[(E(q) - A) - N*q]$$

Where:

PP_{EU} = allowance price in the EU ETS

PP_{UK} = allowance price in the UK ETS

and other symbols as above

We again assume that the firm is a price taker in the product market and both allowance markets. The first order condition for minimising abatement costs is then:

$$-dTC(q,a)/dA + PP_{EU} + PP_{UK} = 0$$

Or:

$$dTC(q,a)/dA = PP_{EU} + PP_{UK} \quad (3)$$

Equation (3) states that firms choose abatement such that marginal abatement costs for that firms are equal to the sum of allowance prices in the two separate markets. Note that equation (1) would be the same as equation (3), if λ was replaced by PP_{UK}. Allowing firms to trade allowances to meet the CCA targets improves efficiency, since all firms face the same marginal abatement costs in that market (PP_{UK}). For any individual firm, PP_{UK} may be greater or less than the λ parameter derived in the previous section, which means that marginal abatement costs may be higher or lower than without CCA trading. But *total* abatement costs for the firm will always be equal to or less than in the non-CCA trading scenario. If $\lambda > PP_{UK,}$ the firm will comply by purchasing UK ETS allowances at a lower cost than reducing direct emissions, while if $\lambda < PP_{UK}$, the firm will reduce emissions by more than in the previous case and sell the surplus UK ETS allowances for a profit. In both cases, the firm benefits. The same result applies to Group 4 firms as a whole: the sum of abatement costs across all firms will be lower in a regime with CCA trading than in a comparable regime without trading.

If the *overall* target implied by the CCA is binding, PP_{UK} will be positive. If not, PP_{UK} will be zero. For positive PP_{UK}, *all* firms will reduce more emissions than under an EU ETS alone. This compares to only *some* firms in the case with no CCA trading. In the latter case, only those firms where the CCA constraint was binding ($\lambda > 0$) would abate more than with the EU ETS alone. Whether individual firms under a CCA-trading regime abate more or less than without trading depends on whether PP_{UK} is greater or less than their individual λ.

The first order condition for optimising production output (q), is:

$$P - dTC(q,A)/dq - PP_{EU} * dE(q)/dq - PP_{UK} *(dE(q)/dq - N) = 0$$

Then:

$$P = dTC(q,A)/dq + dE(q)/dq*(PP_{EU} + PP_{UK}) + PP_{UK} *N$$

Or:

$$dTC(q,A)/dq = P - (PP_{EU})*dE(q)/dq - PP_{UK} *(dE(q)/dq- N) \quad (4)$$

Equation 4 states that firms chose output such that the marginal production costs are equal to product price minus:

- the marginal costs for covering emissions associated with the additional output under the EU ETS; and
- a term that reflects the impact of an increase in output on the CCA-constraint.

If dE(q)/dq < N an increase in output enables the firm to sell additional allowances under the CCA trading scheme at a price of PP_{UK} per unit. Thus, output will be higher compared to the EU ETS alone. By contrast, if dE(q)/dq > N the increase in output forces the firm to buy additional allowances under the CCA trading scheme at a price of PP_{UK} per unit and output will be lower compared to the EU ETS alone.

Although individual firms should be better off with CCA trading than without, participation in two separate allowance markets may create severe practical difficulties. In particular, it is possible that a firm could be a seller in one market and a buyer in the second at the same time. This confusing situation implies additional administrative costs which could undermine the cost savings from trading. Once again, there seems little prospect of this scenario being acceptable in practice.

Double coverage and double crediting

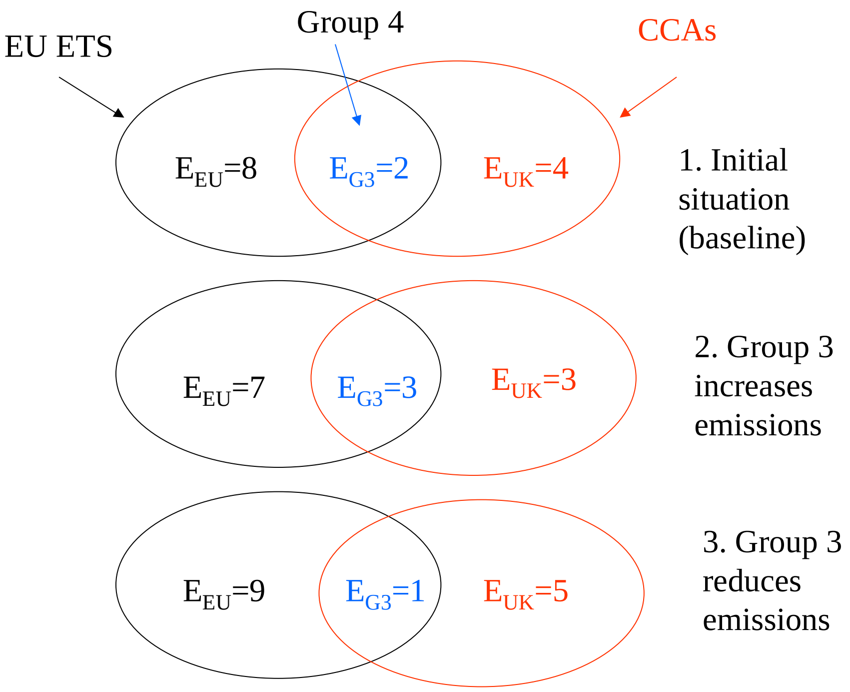
Simultaneous participation in two trading schemes also creates a *double coverage* problem. The firm requires EU ETS allowances to cover *all* the direct emissions from fuel combustion. It also requires UK ETS allowances to cover emissions in *excess* of its CCA target. In principle, this means that two allowances are required for each tonne of direct fossil fuel emissions in excess of the CCA target. While the ownership of the emissions clearly resides with the Group 4 firm, it needs to acquire two separate property rights to cover these emissions: one from the UK ETS and one from the EU ETS.

Similarly, the simultaneous participation in two trading schemes also creates a *double crediting* problem. This primarily relates to the situation where a firm is a seller in both markets. Here, a single abatement action that reduces CO_2 emissions could ‘free up’ allowances in the EU ETS or ‘create’ UK ETS allowances.

The difference between this and the double coverage/crediting of electricity emissions needs to be emphasised. For the indirect emissions from electricity generation, Group 4 sites are participating in only one trading scheme (the UK ETS). However, at the same time the electricity generators are participating in the EU ETS. Allowances in the UK ETS indirectly cover the emissions from electricity generation, while allowances in the EU ETS directly cover emissions from electricity generation. For the direct emissions from fuel combustion, Group 4 sites are simultaneously participating in two trading schemes. Allowances in both the UK ETS and the EU ETS are being used to cover direct emissions from the Group 4 site. For both fuel and electricity consumption at the Group 4 site, there is double coverage of the associated (direct and indirect) emissions.

The implications of this double coverage/crediting can be analysed in a similar manner as for the Group 3 sites in section 5.3.2. Figure 5.5 is a stylised representation of the Group 4 firms participating in both trading schemes. As before, assume that all CCA participants have targets denominated in absolute emissions and that all UK ETS and EU ETS allowances are used to cover emissions. Similarly, assume that, initially, emissions from CCA participants are equal to their individual targets. Panel 1 of Figure 5.5 shows this initial situation, Panel 2 shows the consequences of increasing emissions at the Group 4 sites, and Panel 3 shows the consequences of reducing emissions.

Figure 5.5 Double counting with simultaneous participation in an allowance based and credit based trading scheme, when both schemes have absolute targets



The net result is very similar to the double counting of electricity emissions described in section 5.3.2. An increase/decrease in emissions from Group 4 firms leads to an equal and opposite decrease/increase in emissions from participants in each of the two trading schemes. Hence, an emissions increase/decrease from Group 4 firms leads to an equal and opposite decrease/increase in the total emissions covered by the CCAs and EU ETS. The final total of emissions covered by the CCAs and EU ETS may be greater or less than the initial total of emissions (14 tonnes in Figure 5.5). But this final total will always be less than or equal to the sum of the allowance cap in the EU ETS and the target emissions for the CCAs. This sum provides an overall cap on the total emissions from the combined schemes.

Since the CCAs use credit based trading the double coverage problems only apply to emission increases above the relevant CCA target and the double crediting problems only apply to emission reductions below the relevant CCA target. Similarly, since in practice Group 4 firms have relative rather than absolute targets, the manner by which emissions increase/decrease is relevant (i.e. changing output, or changing energy/carbon intensity).

As before, the cap in the EU ETS will not breached by the double crediting and the operation of the UK ETS will not be affected by the double crediting. If all the CCAs had absolute targets, total emissions from the CCA sector would remain below the target emissions. Since, in practice, most CCAs have relative targets, aggregate emissions in the CCA sector (and hence the UK ETS overall) could increase, but this is an inherent feature of a scheme with relative targets and is not due to the double crediting.

As before, while environmental integrity may be protected the double coverage/crediting injects a considerable amount of confusion. In this case, the ownership of fuel emissions from Group 4 sites becomes unclear. This is all the more the case when the CCAs use credit based trading since this means that *some* emissions increases/decreases from Group 4 sites will be double covered/credited and some will not.

Double coverage/crediting also creates problems for carbon accounting within the UKCP since total emissions from the EU ETS and CCA sectors are *not* equal to the sum of emissions from the EU ETS participants and the CCA participants.

As with the double coverage of electricity emissions, the simultaneous participation of Group 4 sites in two trading schemes appears complex, confusing and unwieldy, both for the participants themselves and for the UKCP overall.

Fungibility between the EU ETS and the UK ETS
The situation becomes even more confusing when we consider the potential fungibility between UK ETS and EU ETS allowances. Consider the implications of unrestricted fungibility for the situation shown in Panel 2 of the Figure 5.5, where the Group 4 firm has increased emissions by one tonne in excess of its CCA target. In this case, the Group 4 firm could cover its EU ETS obligations by buying allowances from either trading scheme. Similarly, the firm could cover its CCA obligations by buying allowances from either scheme. The final result in terms of emissions would be the same as shown in Panel 2. But the firm would be in the odd position of using two allowances of the same type to cover the same tonne of emissions.

If all CCAs had absolute targets, overall environmental integrity would not be threatened. The situation would merely be complicated and confused. However, if (as is the case) the CCAs had relative targets, the environmental integrity of the EU ETS could be threatened. This is because output growth in the CCA sector could increase the total number of allowances in the two schemes, thereby inflating the size of the EU ETS cap.

Section 5.3.2 discussed the use of a Gateway to govern trade between the CCAs and the EU ETS. This would prevent a net flow of allowances from the CCA sector to the EU ETS. But the dual participation of Group 4 firms in both trading schemes means that any Gateway arrangement could easily be circumvented. This means that the dual participation of Group 4 firms in both trading schemes is likely to prevent the fungibility of UK ETS and EU ETS allowances.

Sector versus firm incentives
A final issue to consider is the conflict between sector-level and firm-level incentives. The analysis has so far assumed that each Group 4 firm was acting to minimise its own abatement costs. But the structure of the CCAs complicates this assumption.

The great majority of the CCAs consist of a two tier agreement: an *umbrella* agreement between the government and the trade association combined with *underlying* agreements between government and individual firms (Sorrell, 2001a). The umbrella agreement contains an overall target for the sector, while the underlying agreements contain targets for the individual firms which are based on the overall sector target but take into account factors such as product mix. If the sector as a whole meets the target in the umbrella agreement, *all* firms within the underlying agreement receive the CCL discount. If the sector target is not met, individual firms are assessed against their individual targets in the underlying agreement and are eligible for the discount if they have complied. With this structure, the incentive to free ride is mitigated by the risk of losing the discount if the sector as a whole fails to meet its target.

The CCA trading rules create problems for this arrangement. In principle, an individual firm could sell its surplus emissions outside the sector, rather than having them count towards meeting the sector's target. The latter course of action would amount to a subsidy of competitor firms which were failing to meet their targets. To address this, the trade associations for the CCA sectors have developed three models for regulating trading, summarised in Box 5.2.

Box 5.2 Models for organising CCA trading in the UK ETS

Model 1: Independent emissions trading

- Each CCA facility participates independently in the UK ETS. There is no mutually supportive action at the sector level.
- Any facility 'over-achieving' its target would be free to sell or bank UK ETS allowances and would not automatically contribute its over-achievement to the sector association.
- Any facility 'under-achieving' its target would need to buy additional allowances. There will be no surplus held at the sector level.
- Individual underlying agreement targets would only be tested if the sector failed.
- Any risk of cross-subsidy between firms would be avoided

Model 2: sector emissions trading

- The sector association participates in the UK ETS, while individual target holders voluntarily surrender their right to participate in the UK ETS.
- The sector association will purchase allowances to achieve overall sector compliance and will be responsible for organising the verification required for any sale of allowances by the sector.
- The sector association and the individual target holders would need to agree the allocation of costs and proceeds. Some element of cross subsidy is involved.
- Individual target holders would be free to stay outside Model 2 if they wished, and trade independently. In these circumstances, their emissions would be removed from the aggregate target for the sector and they would be assessed individually for compliance with their target.

Model 3: first refusal trading

- Target holders would agree to offer first refusal to the sector association, at market price, of any generated allowances. If the allowances were refused, the target holders would be free to sell or bank.
- The sector association would co-ordinate all intra-sector transactions needed to meet the sector target.
- Constraining the freedom to trade allowances implies a potential economic loss to participating firms. Difficulties could also arise if a firm lost its CCL discount as a result of a mistake by the sector association.
- Individual target holders would be free to stay outside Model 3 if they wished, and trade independently. In these circumstances, their emissions would be removed from the aggregate target for the sector and they would be assessed individually for compliance with their target.

Source: DEFRA, 2002b

Model 1 appears to be the rational course of action for a cost minimising firm, since both Model 2 and Model 3 imply potential cross subsidy of competitor firms. However, Models 2 and 3 may reduce transaction costs for individual firms by allowing them to avoid many of the complications of the UK ETS. In practice, all three models are represented in actual agreements.

The point here is that the introduction of the EU ETS could completely undermine Model 2 and Model 3 agreements. The sector association could attempt to play the same role in the EU ETS as in the UK ETS, but this will be complicated by the fact there is no equivalent to the umbrella agreement in the EU ETS. Overall compliance by the sector will not 'cover' for lack of compliance by an individual site. Instead, the sector association would need to buy and sell EU ETS allowances and distribute them appropriately. Further complications are introduced by the fact that only a subset of facilities within a sector may be eligible for the EU ETS – the others will be subject to the CCAs alone. The most obvious course of action for individual facilities is to leave the Model 2 or Model 3 agreements and to trade independently.

These complications are a subsidiary issue to the double regulation and double crediting problems discussed above. But they are a further indication of the potential of the EU ETS to unravel existing arrangements within UK climate policy.

5.4.3 Summary

In summary, the dual participation of Group 4 sites in both the EU ETS and CCAs leads to complex problems of double regulation, double coverage and double crediting. These apply both to fuel and electricity consumption in both the combustion and process plant. The implications for electricity are identical to those for Group 3 sites. The implications for fuel result from the sites having two separate targets for direct emissions: one absolute target under the EU ETS, with associated allowance-based trading; and one (normally) relative target under the CCAs, with associated credit-based trading.

The implications of this unlikely arrangement can be illustrated in a stylised form, using simple optimisation equations. If the CCA targets are fixed (with no associated trading arrangements), the behaviour of the firm is only affected if the CCA target is binding relative to the EU ETS target. If so, both marginal and total abatement costs are increased relative to a situation with no CCA target. This double regulation distorts the operation of the EU ETS and may either reduce shareholder dividends or reduce the market value of Group 4 firms. If Group 4 firms have market power in the allowance market, this could also lead to an effective subsidy of (non-Group 4) competitors by reducing the EU ETS allowance price.

The size of the cost increase will depend on a wide range of factors. One possibility is that the abatement costs created by the CCA will be much larger than those resulting from the EU ETS, as a consequence of low EU ETS allowance prices. These in turn may be a consequence of the interface between the EU ETS and the international carbon market after 2008, with the associated problems of hot air trading. Under these circumstances, there may be a case for retaining the CCA targets for fuel consumption as a form of 'backup' regulation. But in all circumstances, the coexistence of the CCAs and the EU ETS is likely to entail substantial administrative costs for Group 4 firms and be extremely unpopular.

If the CCA trading arrangements are retained, marginal abatement costs should be equal to the sum of the allowance prices in the two separate markets. For individual firms, marginal abatement costs may be higher or lower than with fixed CCA targets, but in all cases total abatement costs will be equal to or less than in the non-trading scenario. Again, considerable complexity is implied, such as when a Group 4 firm is a buyer in one market and a seller in the second.

Dual participation in the two trading markets also leads to double coverage of emissions increases above the CCA target, and double crediting of emission reductions below the CCA target. Since most of the CCAs use relative targets, these problems only result from changes in the emissions intensity of fuel use - not from changes in output. In practice, this means that some emissions increases/reductions are double covered/credited and some are not. This double coverage/crediting does not threaten the environmental integrity of the EU ETS or the CCAs, but introduces further complexity and confusion into an already confused regulatory situation.

In summary, while the analysis of the coexistence of the two instruments has highlighted some important issues, it appears an unlikely outcome in practice. The desire for 'backup' regulation is unlikely to be sufficient to outweigh the numerous disadvantages that such an arrangement would bring.

5.5 Multi criteria Evaluation

From the narrow perspective of static economic efficiency, the coexistence of the EU ETS with the CCL/CCA package is clearly undesirable as it fails to achieve least cost abatement. But in practice, policy decisions are made using a broader set of criteria, with particular attention to political acceptability. The overall desirability of the policy package may therefore be explored using a multi-criteria assessment (MCA) (Weimar and Vining, 1999). Box 5.3 lists some appropriate criteria.

Box 5.3 Generic objectives for policy instruments

- *environmental effectiveness*: defined as the likelihood of the policy achieving a specific environmental objective.
- *static economic efficiency*: defined as the potential to minimise the direct costs of meeting an environmental objective;
- *administrative simplicity*: defined as the administrative burden on both the target group(s) and the implementing organisations;
- *competitiveness*: defined as avoiding damage to the competitiveness of national industry.
- *political acceptability*: defined as the acceptability of the proposal by key groups in the economy.

In a case such as this, any MCA must necessarily be highly qualitative and subjective. Furthermore, the evaluation under each criteria will be sensitive to unknown factors, such as the anticipated price of EU ETS allowances. Hence, the MCA framework will be used here in a very simple way to classify and highlight some of the more important conclusions from the preceding analysis. This provides a useful starting point for the assessment of alternative policy options in section 7.

Tables 5.6 to 5.9 provide a MCA of each Group in turn. These include a 'score' from 1 to 5 indicating the desirability of the identified outcomes.

Table 5.6 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 1 (CCL only)

Criteria	**Relevant issues for Group 1**	**Score**
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for electricity efficiency; • retains positive environmental impact of policy measures funded by CCL revenues (e.g. ECAs); • retains price incentive for electricity efficiency in the case of low allowance prices (backup option); • distorts choice between electricity and fuel with consequent negative environmental impacts;	3
Static efficiency	• external costs of CO_2 internalised twice for electricity • distorts choice between electricity and fuel	2
Administrative simplicity	• no greater burden for Group 1 sites; • UK government must administer both EU ETS and CCL;	4
Competitiveness	• Group 1 not compensated for electricity price increases;	3
Political acceptability	• double regulation of electricity likely to be opposed by Group 1; • Group 1 not compensated for electricity price increases; • possible advantage as backup regulation in event of low allowance prices	2
Total		**14**

Table 5.7 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 2 (CCL & EU ETS)

Criteria	**Relevant issues**	**Score**
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for both fuel and electricity efficiency;	3
Static efficiency	• external costs of CO_2 internalised twice for electricity and fuel; • distorts operation of EU ETS - minimum cost abatement no longer achieved;	1
Administrative simplicity	• burden for Group 2 sites is not significantly different from that with the EU ETS alone; • UK government must administer both EU ETS and CCL;	4
Competitiveness	• double regulation of fuel could undermine competitiveness of Group 2 sites, particularly if allowances auctioned; • possible subsidy of competitors if there is an effect on allowance prices; • Group 2 not compensated for electricity price increases;	2
Political acceptability	• double regulation of both fuel & electricity likely to be opposed by Group 2; • Group 2 not compensated for electricity price increases; • retention of CCL provides potential substitute for allowance auctioning; • possible advantage as backup regulation in event of low allowance prices;	2
Total		**12**

Table 5.8 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 4 (CCA & EU ETS)

Criteria	Relevant issues	Score
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for fuel & electricity efficiency; • retains target incentive for fuel & electricity efficiency in the case of low allowance prices (backup option);	3
Static efficiency	• external costs of CO_2 internalised twice for electricity and fuel; • distorts operation of EU ETS - minimum cost abatement no longer achieved;	1
Administrative simplicity	• major administrative burden for Group 4 sites- two sets of targets, two sets of monitoring/reporting requirements, and simultaneous participation in two trading schemes; • administration of trading schemes complicated by double coverage/crediting; • simultaneous participation of Group 4 sites in two trading schemes prevents fungibility of EU ETS and UK ETS allowances; • double counting in climate program • UK government must administer both EU ETS and CCAs;	1
Competitiveness	• double regulation of fuel & electricity could undermines competitiveness of Group 4 sites; • additional administrative costs could undermine competitiveness of Group 4 sites • possible subsidy of competitors if there is an effect on allowance prices; • Group 4 not compensated for electricity price increases;	1
Political acceptability	• double regulation of both electricity & fuel likely to be opposed by Group 4; • Group 4 not compensated for electricity price increases; • possible advantage as backup regulation in event of low allowance prices;	1
Total		**7**

Table 5.9 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 3 (CCA only)

Criteria	Relevant issues	Score
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for electricity efficiency; • retains positive environmental impact of downstream energy efficiency targets; • retains target incentive for electricity efficiency in the case of low allowance prices (backup option); • distorts choice between electricity and fuel;	3
Static efficiency	• External costs of CO_2 internalised twice for electricity and fuel; • distorts choice between electricity and fuel;	1
Administrative simplicity	• burden for Group 3 sites is no different from that with the CCAs alone; • administration of trading schemes complicated by double coverage/crediting; • double counting in climate program • UK government must administer both EU ETS and CCAs;	2
Competitiveness	• Double regulation of electricity could undermine competitiveness of Group 3 sites; • Group 3 not compensated for electricity price increases;	2
Political acceptability	• double regulation of electricity likely to be opposed by Group 3; • Group 3 not compensated for electricity price increases; • possible advantage as backup regulation in event of low allowance prices;	2
Total		**10**

5.6 Summary

This section has explored the interaction between the operation of the EU ETS and the that of the CCL/CCA package - assuming that the latter remains unchanged. It has demonstrated that the interactions are complex and include several overlapping examples of double regulation, double coverage and double counting. The interactions can be grouped into four categories:

- *price* - *price*: where the indirect impact of the EU ETS on electricity prices is additional to the direct price impact of the CCL;
- *price* - *target*: where the indirect impact of the EU ETS on electricity prices is additional to the direct impact of a target under the CCAs;
- *target* - *price*: where the direct impact of an emissions target under the EU ETS is additional to the direct price impact of the CCL;
- *target* - *target*: where the direct impact of a target under the EU ETS is additional to the direct impact of a target under the CCAs.

Table 5.10 summarises the interactions within these four categories.

Table 5.10 Categorising the operational interactions between the EU ETS and the CCL/CCA package

Type of interaction	**EU ETS**	**CCL/CCA package**	**Category**
price - price	indirect price	direct price	Group 1 electricity Group 2 electricity
price - target	indirect price	direct target	Group 3 electricity Group 4 electricity
target - price	direct target	direct price	Group 2 fuel
target - target	direct target	direct target	Group 4 fuel
no interaction	- -	- -	Group 1 fuel Group 3 fuel

The scale and consequences of each interaction depends upon a range of factors, the most important of which is the allowance price in the EU ETS. This in turn is a function of a number of variables including the stringency of the aggregate targets under the EU ETS and the extent to which the EU ETS is interfaced to other trading schemes and the international carbon market post 2008. If the allowance price is very high, the interaction between the EU ETS and CCL/CCA package could lead to substantial economic impacts for affected groups and therefore create pressure to modify the CCL/CCA package. Conversely, if the allowance price is very low, the economic consequences of the interaction could be relatively small. In these circumstances there may be some appeal in retaining the CCL/CCA package unchanged, in order to maintain downstream incentives to improve energy efficiency. This would also ensure continued funding of policy initiatives such as the ECAs (the ‘backup’ scenario).

Also relevant is the method of allowance allocation under the EU ETS. Theory suggests that the scale of *price-price* and *price-target* interactions in Table 5.10 should be independent of the method of allowance allocation, but in practice this may not be the case (section 2.1.3). Similarly, the impact of the *target-price* interactions in Table 5.10 is much greater for allowance auctioning than for free allocation.

As a consequence of the above uncertainties, it is difficult to make a judgement on the overall desirability of retaining the CCL/CCA package. But one factor which can be assessed with relative confidence is the impact on administrative costs, both for target groups and for the government. Generally, this is undesirable. In particular, the coexistence of the EU ETS and CCL/CCA package creates substantial administrative complexity for the energy intensive companies in Group 4 who would have two separate regulatory targets and would be simultaneously participating in two separate trading schemes. This seems a clear case of redundancy in regulation.

The policy choice here is not simply whether to continue with or remove the CCL/CCA package. Instead, the package can be modified in a variety of ways to ameliorate the negative impacts of interaction with the EU ETS. Similarly, the design of the EU ETS may be changed in a variety of ways to facilitate more positive interaction - although in this case the decisions will need to be taken at EU level. Section 7 explores these options in more detail.

6. Confusion over instrument timing

The implications of the EU ETS for UK climate policy depend finely upon timing. This section examines the timing issues for each instrument and explores the possibility of the UK opting out of Phase 1 of the scheme.

6.1 EU ETS

Phase 1 of the EU ETS runs from 2005 to 2008, while Phase 2 corresponds to the first commitment period of the Kyoto Protocol - 2008 to 2012. In Phase 1, participation will be mandatory, allowances will be freely allocated and the compliance penalty will be set at EUR50/tonne, or twice the market price, whichever is higher. In Phase 2, some allowances may be auctioned and the compliance penalty will be increased to EUR100/tonne (or twice the market price).

As discussed in section 1.2, the timetable for approval of the Directive and launching of the scheme is optimistic. Problems at both the EU and Member State level could delay the start of Phase 1. This would undermine the learning benefits of the scheme and also threaten EU compliance with the Kyoto targets, unless equivalent policies and measures were in place for the EU ETS target groups. If the start of Phase 1 is delayed by one year, it would have a total duration of only two years – which is feasible, but unwanted. If the start of Phase 1 is delayed by two years, there seems little point in having a pre-2008 scheme at all. In this instance, one option would be to abandon Phase 1 altogether and to begin the EU ETS in 2008, while a second would be to combine the first two phases into one six-year phase stretching from 2007 to 2012. But there may be difficulties in having a compliance period that straddled the beginning of the first commitment period.

6.2 Kyoto

The year 2008 is a watershed because it coincides with the beginning of the first commitment period. This is particularly important for the EU ETS. After 2008 (i.e. EU ETS Phase 2), cross-border trades in EU ETS allowances will need to be coupled to transfers of AAUs between the relevant Member States. If this were not the case, a net-buying Member State would run the risk of non-compliance with its Kyoto obligations, despite all EU ETS participants being in compliance with their individual targets.[65]

One way of implementing this requirement would be to devolve AAUs to the participant level. But this may not be the best way, owing to the complications that result from national eligibility criteria under the Kyoto Protocol such as the Commitment Period Reserve. Instead, a preferable option would be to keep EU ETS allowances and AAUs separate and to arrange a net transfer of AAUs between Member States at the end of the commitment period. The volume transferred would correspond to the net transfer of EU ETS allowances between participating Member States over the preceding four years.

[65] The threat is to individual Member State compliance, not to the EU overall.

Prior to 2008 (i.e. Phase 1), Member States do not have any AAUs available to transfer. There is a risk that a Member State that hosts net buyers of EU ETS allowances will make insufficient modifications to its national emission path during Phase 1, leaving it poorly placed for subsequent compliance with the Kyoto targets.

This risk is made worse by the banking provisions under the EU ETS. These mean that emission reductions achieved prior to 2008 can be banked into the commitment period. Banked allowances will allow higher emissions during the commitment period, but these emissions will not be backed by AAUs. Again, the compliance of a Member State which is a net buyer of banked allowances could be threatened. Furthermore, the compliance of the EU as a whole may be threatened if there is extensive use of banked allowances (although this appears less likely, as the installations which sold the allowances are unlikely to increase their emissions). A further problem is that the Directive proposes to give discretion to Member States over the extent to which installations within their country can bank allowances into the commitment period. But restrictions on banking can be easily circumvented. If one Member State outlawed the banking of allowances, installations could simply sell their surplus to another country and bank it there. A better approach would be to harmonise banking rules across the EU ETS.

The above suggests that Phase 1 trading may create risks for Member States compliance with their Kyoto targets. The options available to reduce this risk include:

- Making a net transfer of AAUs in 2008, corresponding to the net transfer of EU ETS allowances that occurred during Phase 1.
- Making it clear to EU ETS participants that any free allocation of allowances in 2008 will be based upon stringent baseline standards, rather than current or historic emissions, thereby giving an incentive to make early emission reductions. If partial allowance auctioning is anticipated for Phase 2, this will also give an incentive for early emission reductions, in order to reduce the cost of allowance purchases.
- Securing a certain level of emission reductions from EU ETS participants prior to 2008, separate from their EU ETS objectives. One way this could be achieved is through the retention of existing policies such as the CCL/CCAs as a ‘backup’, alongside the EU ETS. The national climate plan could then incorporate the projected emission reductions from these ‘backup’ regulations, rather than the allocations under the EU ETS.

Since EU ETS participants typically account for some 40-50% of Member State emissions, the timing issues for the EU ETS are of considerable importance for national climate policy.

6.3 CCL and CCAs

There is no definite timetable for the CCL and it is within the power of the UK Treasury to modify it at any time. However, the CCL plays a central role in the UKCP and is anticipated to continue at or above its current level until 2012. Also, any change in the CCL will have consequences for the CCAs and vice versa.

The CCAs are legal agreements between the government[66] and either individual firms or sector associations. In the majority of cases, these agreements continue in force until the 31st March 2013. Hence, the CCAs extend beyond the end of the Kyoto commitment period. However, for the majority of agreements, energy/emission targets have only been specified up to the 30th September 2010, which is halfway through the commitment period.

The government reserves the right to terminate individual agreements before 2013. Also, individual agreements may change over their lifetime as a consequence of facilities entering and exiting the agreements, the agreement reviews at the end of 2004 and 2008, the results of CHP appraisals, changes in output level and product mix, and negotiated changes in the currency of underlying agreements. This means that the number of facilities and the volume of emissions covered by the agreements is subject to change, as is their ultimate contribution to UK carbon targets.

6.4 The UK opt-out

The draft Directive anticipates the EU ETS beginning in 2005, with mandatory participation. If the Directive goes ahead as the Commission plans, the UK government will be faced with a choice in 2004 between either accepting the coexistence of the EU ETS with the CCL/CCA package, with all the attendant problems of double regulation and double counting, or modifying the CCL/CCA package (and possibly other policy instruments) only a couple of years after it was introduced. Neither option appears attractive, both may be unpopular and both run the risk of stranded investment. The extent of disruption will depend on the nature of the changes that are proposed, but at the time of writing the UK government does not appear to have given a great deal of thought to the specific options available.[67]

Given the above, a simple and attractive option for the UK is to negotiate a *national* opt-out of the Directive in Phase 1, thereby postponing the point at which changes need to be made. Proposals for this were included in earlier drafts of the Directive, but were dropped from the published proposals. The opt-out option appears to have widespread support within UK industry[68] and has become the central negotiating position of the UK government. Germany also wants to opt-out of the scheme up to 2008, in order to protect its negotiated agreements. If one or two other Member States adopt the same position, there will be a blocking majority under Council voting rules. This suggests that the a UK opt-out to 2008 is plausible scenario. However, the UK government appears to be in a minority of one in desiring an opt-out beyond that date.

Opt-out provisions raise equivalence of effort issues (section 2.4.2). A UK opt-out would mean that energy intensive industry in the UK would be subject to relative rather than absolute targets which are based upon cost effectiveness criteria that are arguably weaker than the allocation requirements under the EU ETS (section 4.5). Similarly, the UK electricity industry will have no aggregate carbon targets, being subject merely to the indirect impact of other policy measures such as the Renewables Obligation. Both may be argued to give competitive advantage to UK companies.

[66] Specifically the Secretary of State for the Environment, Transport & the Regions.
[67] This judgement is based upon interviews with government officials during the spring and summer of 2002.
[68] This judgement is based upon interviews with industry representatives during the spring and summer of 2002, together with the discussion in two workshops.

If an opt-out to 2008 is achieved, the transition to the EU ETS becomes considerably easier. First, industry will have had longer to prepare for the transition and the CCAs will be more than halfway through their intended life. Second, the energy and social policy issues described in section 4.6, such as fuel poverty, should be less of an obstacle. Third, there may be advantages in joining the EU ETS in that it may provide access to lower cost abatement through the EU or international market. In contrast, if the CCAs and the wider UK ETS remained disconnected from the EU ETS, access to the international market may be more problematic. In this context, it is worth noting that government has indicated its intention to close the Gateway in the UK ETS at the start of the Kyoto commitment period (DEFRA, 2001b).

6.5 Summary

The differences in timing between the EU ETS, the CCL/ CCAs and the Kyoto commitment period create some complications. The EU ETS is in phase with the Kyoto commitment period but is due to begin well before the CCAs end. In contrast, the CCAs extend beyond the end of the Kyoto commitment period, but targets are only negotiated up to 2010. The timing of the CCAs is established but the timing of the EU ETS is still uncertain. In addition, the possibility of trading prior to the Kyoto commitment period and banking allowances into the commitment period may create difficulties for Member State compliance.

The situation is greatly simplified if the UK can negotiate a national opt-out of the EU ETS up to 2008, thereby postponing the point at which changes need to be made. However, opting-out beyond 2008 is likely to be counterproductive if it restricts access to the international carbon market.

While a transition to the EU ETS would be easier 2008, it still raises difficult questions. But these are identical to the those would be raised by a transition in 2005 - it is merely the political context that would have changed. Given this, section 7 describes a number of options for modifying the CCL/CCA package and the EU ETS, without reference to whether these changes take place in 2005 or 2008. The discussion also explores a couple of options for modifying the EU ETS, notably the inclusion of opt-in/opt-out provisions at the installation level.

7. Reducing the confusion: policy options

The coexistence of the CCL/CCA package with the EU ETS creates problems of double regulation, double coverage and double crediting. These problems may be ameliorated to varying degrees by modifying the CCL/CCA package, the EU ETS or both. Any changes to the CCL/CCA package are the responsibility of the UK government and may be introduced at any time - although changes are subject to clearance by the European Commission under State Aid rules. In contrast, any modifications to the EU ETS will require agreement at the EU level and must be negotiated in the near future if they are to gain inclusion in the final text of the Directive.

There are a wide range of possible modifications available, and each may ameliorate some of the problems indicated in section 5. But all involve trade-offs. For example, removing the CCL on electricity will eliminate the possibility of double regulation of electricity, but at the same time reduce the incentive for downstream electricity efficiency. The evaluation and choice of options will therefore depend upon the relative weight given to different policy objectives, and this in turn will differ between various stakeholder groups. Similarly, the desirability of a particular option may be very dependent on contextual factors such as the allowance price in the EU ETS. Since most of these factors are uncertain or unknown, there is an irreducible element of uncertainty in any appraisal of policy options.

This section will introduce and evaluate a number of options for modifying the CCL/CCA package, the EU ETS or both. The selection of options is not intended to be exhaustive and it is not the intention to identify a single ‘preferred’ option. Instead, the aim is to illustrate the type of difficulties that arise and the nature of the trade-offs that can be made. The selection of options is based upon combinations of the following variables:

- *CCL*: either: a) leave unchanged; b) remove the CCL on electricity; or c) shift to a carbon tax.
- *CCA*: either: a) leave unchanged; or b) shift to fuel only;
- *EU ETS*: either: a) leave unchanged; b) include opt-in provisions at the installation level; or c) include opt-out provisions at the installation level; and
- *trading interface between CCAs & EU ETS*: either: a) interface via a Gateway; or b) prevent trading.

Two or more options are developed for each of the Groups identified in section 5. In each case, the rationale for the option is identified, together with its main advantages and disadvantages. The option is then appraised using the MCA framework developed in section 5.5. The aim of the appraisal is to compare the option with the coexistence scenario discussed in section 5, and *not* with a scenario of no EU ETS. While the latter may be preferred by some groups, it is not explored here. The aim of the appraisal is to identify whether the proposed modification appears likely to make the evaluation under any objective better or worse compared to that given in section 5.5, and to identify why this is the case.

The options are developed without reference to whether they are introduced in 2005, 2008 or some other date. This is because the issues are essentially the same - it is simply that the longer any changes can be postponed, the more feasible they become

Each option is discussed primarily in terms of its impact on the individual Group for which it is proposed. This is artificial, as any change in the CCL will have corresponding implications for the CCAs, and vice versa. But the aim is to separate out the issues as clearly as possible, before bringing the analysis together and developing some recommendations on the way forward for UK and EU climate policy.

7.1 Group 1: CCL only

Group 1 sites are subject to the CCL but are not participating in the EU ETS. They are indirectly affected by the EU ETS through increases in electricity prices. Coexistence of the EU ETS and CCL effectively leads to double regulation of electricity.

The multicriteria evaluation of the coexistence scenario for Group 1 is reproduced in Table 7.1.

Table 7.1 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 1 (CCL only)

Criteria	Relevant issues for Group 1	Score
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for electricity efficiency; • retains positive environmental impact of policy measures funded by CCL revenues (e.g. ECAs); • retains price incentive for electricity efficiency in the case of low allowance prices (backup option); • distorts choice between electricity and fuel with consequent negative environmental impacts;	3
Static efficiency	• external costs of CO_2 internalised twice for electricity • distorts choice between electricity and fuel	2
Administrative simplicity	• no greater burden for Group 1 sites; • UK government must administer both EU ETS and CCL;	4
Competitiveness	• Group 1 not compensated for electricity price increases;	3
Political acceptability	• double regulation of electricity likely to be opposed by Group 1; • Group 1 not compensated for electricity price increases; • possible advantage as backup regulation in event of low allowance prices	2
Total		**14**

7.1.1 Option 1a: modify the CCL rate for electricity

Rationale

Double regulation of electricity could be unpopular, particularly if the EU ETS allowance price was high. Conversely, removal of the CCL for electricity would run the risk of reducing the downstream incentive for electricity efficiency if allowance prices were low.

Given this, option 1a tries to steer a middle course. By reducing the size of the CCL on electricity (CCL_e), it attempts to mitigate the impact of double regulation. At the same time, by retaining some level of CCL_e, it attempts to retain the downstream incentive for electricity efficiency. There are various ways to implement this. One would be reduce the current level of the CCL_e by a fixed percentage, while another would be to make the annual CCL electricity rate variable, and a function of the previous year's EU ETS allowance price.[69]

Either approach would give a minimum level for the regulatory price signal on electricity. There is no corresponding maximum level, although such approaches have been discussed in the literature (Mckibben & Wilcoxen, 2002). Both minimum and maximum price levels represent approaches to mitigating the uncertainty over allowance prices in an emissions trading scheme. The objective of option 1a is to provide a price floor to retain incentives for energy efficiency, while the objective an allowance price ceiling is to prevent excessive economic impacts and improve the political acceptability of a trading scheme by reducing risk. The second is more commonly discussed in the literature, but the first may be relevant to UK policy objectives.

Advantages and disadvantages

The advantage of this option is the retention of a downstream price signal for electricity efficiency, which would be of particular benefit in the context of low allowance prices. In addition, some or all of the revenue benefits of the CCL would be retained, thereby reducing the need to change either other forms of government taxation or government spending.

The disadvantage of a fixed percentage cut in CCL_e is that the choice of level would be arbitrary. Similarly, the disadvantage of a variable CCL_e is that it creates uncertainty, leads to fluctuations in government income and could be complicated to implement. The option fails to remove the double regulation, or to correct the distortions that exist between fuel and electricity pricing.

Table 7.2 provides a multicriteria assessment of this option, in terms of the *difference* between this option and the coexistence scenario (Table 7.1).

Table 7.2 Multi criteria assessment of option 1a: changes compared to coexistence scenario

Criteria	Relevant issues for Group 1	Score
Environmental effectiveness	• *Slightly worse*: since price signal for electricity efficiency would be reduced	2
Static efficiency	• *Unchanged*	2
Administrative simplicity	• *Worse*: if CCL rate is variable	3
Competitiveness	• *Better*: impact reduced since electricity price reduced	4
Political acceptability	• *Slightly better*: goes some way to mitigate competitiveness concerns while retaining incentives for electricity efficiency	3
Total		**14**

7.1.2 Option 1b: remove the CCL on electricity

Rationale

This option eliminates the double regulation of electricity and places primary reliance on the EU ETS to meet emission targets for electricity generation. The EU ETS provides a price signal for electricity efficiency and may also incentivise electricity generators to engage in demand-side management if this offers lower cost abatement than supply side measures.

[69] For example: IF [PP_{EU}(i-1) <= X] THEN [CCL_e (i)= X - PP_{EU}(i-1)] ELSE [CCL_e (i)= 0]. Any such arrangement would require separate rules for the first year of the scheme.

While this option may be combined with other demand-side policies, such as information programmes, there is no additional regulatory intervention on electricity prices.

Advantages and disadvantages

This option is administratively simpler than Option 1a, and reflects a greater reliance on the efficiency benefits of emissions trading. The EU ETS is assumed to internalise the external cost of CO_2 emissions with an appropriate portion of this cost being passed on to electricity consumers. While other policies may be retained to overcome various non-price barriers to energy efficiency, there is no need to reinforce the price signal. The adverse impact of double regulation on industrial competitiveness would be removed, with a corresponding improvement in political acceptability.

The primary disadvantage is that, if allowance prices were low, the downstream price signal for electricity efficiency would be reduced, with a consequent reduction in investment. Abatement would be achieved through other means, such as purchase of allowances from other Member States and increased investment in fuel switching in electricity generation. In turn, this may conflict with other objectives in UK energy policy, such as the 20% target for CO_2 emissions and the desire to avoid excessive reliance on imported gas. A second disadvantage is that, in the absence of allowance auctioning, the revenue raised by CCL_e would be lost. This may lead to increases in other forms of government taxation or reductions in spending. It is possible that other aspects of the climate programme, such as the ECAs would be put at risk, with a corresponding implications for the UKCP. The overall fiscal implications could be made neutral by increasing the remaining CCL to make up the lost revenue. But this could undermine the acceptability of the proposal and attract opposition from fuel intensive users. Finally, since the implicit carbon price provided by the remaining CCL will be different from the EU ETS allowance price, the price distortions between fuel and electricity for Group 1 sites will be reduced but not eliminated. However, this is an inherent feature of a separate tax regime.

Table 7.3 provides a multicriteria assessment of this option, in terms of the *difference* between this option and the coexistence scenario (Table 7.1).

Table 7.3 Multi criteria assessment of option 1b: changes compared to coexistence scenario

Criteria	Relevant issues for Group 1	Score
Environmental effectiveness	• *Worse*: price signal for electricity efficiency would be reduced. May be less domestic abatement. Loss of revenue may threaten climate policy measures funded by the CCL.	2
Static efficiency	• *Better:* electricity price reflects external costs of CO_2 without other distortions	3
Administrative simplicity	• *Unchanged*: administration straightforward once CCL_e removed	4
Competitiveness	• *Better*: impact reduced since electricity price reduced	4
Political acceptability	• *Better*: Builds industrial support by mitigating competitiveness concerns. But loss of revenue (or need to recoup revenue from other sources) may impact on other stakeholder groups. Loss of environmental effectiveness may be opposed.	3
Total		**16**

7.1.3 Option 1c: remove the CCL on electricity and make it a carbon tax

Rationale
The rationale for removing the CCL on electricity is given above. This option goes one step further and changes the remaining (fuel only) CCL to a carbon tax.

This option recognises that the design of the CCL was constrained by a number of objectives including the desire to protect UK coal producers (section 4.2). These objectives were achieved through the design of the CCL itself, rather than explicitly through subsidiary policies and measures. In particular, the government chose a downstream energy tax rather than an upstream carbon tax. The choice of a downstream tax is of most importance to the coal industry as electricity generation provides its largest market (~25Mtoe in 2000). The industrial coal market is much smaller (~2Mtoe/year), concentrated in a number of energy intensive sectors and declining. Since protection of the UK coal industry appears to be diminishing in political importance, there should be an opportunity here to rationalise the taxation of business fuel on the basis of carbon content.

Advantages and disadvantages
Taxing business fuel on the basis of carbon content would ensure that the tax level was directly related to the fuel’s contribution to climate change. This is in contrast to the present situation where the most damaging fuel - coal - is the least heavily taxed. A uniform carbon tax would also ensure that all business fuels were taxed on the same basis. At present, HFO and gasoil are exempt from the CCL but liable for excise duties, which are in turn a legacy of policies imposed in the 1970s to reduce dependence upon imported oil. Since the UK has been a net oil exporter for nearly two decades, these duties no longer have an economic rationale. It would be better to remove them altogether and bring all fuels within the same tax regime. This would also make business fuel taxation administratively simpler and reduce the distortions both between fuels and between fuel and electricity use (although the price of carbon would still differ between the CCL and EU ETS regimes). The fiscal impact of a shift to a carbon tax could be identical to option 1b, since the level of the tax could be chosen to deliver comparable revenue to the fuel component of the current CCL. Finally, the reform of business energy taxation may be linked to the ongoing process to harmonise EU energy taxes (Newbery, 2001).

The primary disadvantages of this option are the negative impact on the industrial coal market and the additional boost it gives to natural gas - with corresponding implications for fuel diversity and energy security. But not only is the industrial coal market a small fraction of the electricity generation market, it is also concentrated in a small number of energy intensive sectors, such as iron & steel. These are subject to CCAs and hence not eligible for the full rate of the CCL. As a result, the level of opposition from coal producers and users should be less than was encountered in 1998/99 when an upstream carbon tax option was under consideration (Marshall, 1998). Similarly, natural gas is so obviously the fuel of choice throughout the industrial, public and commercial sectors that shifting to a carbon tax should have little impact on future patterns of fuel switching. The consequences for oil markets will depend upon the proposed level of the carbon tax relative to excise duties. As indicated in section 4.2, current levels of excise duty correspond to a carbon tax rate which is slightly greater than that for gas and more than twice that of coal.[70] Hence, HFO and gasoil should become relatively cheaper.

Table 7.4 provides a multicriteria assessment of this option, in terms of the *difference* between this option and the coexistence scenario (Table 7.1). This assessment combines both the removal of the CCL on electricity (option 1b) with the additional shift to a carbon tax.

Table 7.4 Multi criteria assessment of option 1c: changes compared to coexistence scenario

Criteria	**Relevant issues**	**Score**
Environmental effectiveness	• *Worse*: price signal for electricity efficiency would be reduced, with possibility of reduced domestic abatement. Loss of revenue may threaten climate policy measures funded by the CCL. The environmental effectiveness of fuel taxation should be improved, although in practice the effect may be relatively small.	2
Static efficiency	• *Better:* both electricity and fuel prices reflect external costs of CO_2 without other distortions	4
Administrative simplicity	• *Better*: once the change has been made, administration should be simpler than the current combination of CCL and excise duties	5
Competitiveness	• *Better*: overall impact on industrial competitiveness reduced since electricity price reduced. Impact of changes in fuel taxation will depend upon fuel mix in individual sectors.	4
Political acceptability	• *Better*: Builds industrial support by mitigating competitiveness concerns over electricity prices. Impact of changes in fuel taxation will depend upon overall level, and could be broadly neutral. But loss of revenue (or need to recoup revenue from other sources) may impact on other stakeholder groups. Interest groups may oppose the loss of environmental effectiveness and the threat to industrial coal markets.	3
Total		**18**

[70] The numbers are £8.15/tCO_2 for natural gas, £4.55/tCO_2 for coal, £8.9/tCO_2 for HFO and £11.6/tCO_2 for gasoil.

7.2 Group 2: CCL and EU ETS

Group 2 sites are subject to the CCL and are participating in the EU ETS - most likely as a consequence of having combustion plant of >20MW thermal input. As a result, they are subject to double regulation of both fuel and electricity. The implications for electricity costs are identical to those for Group 1, while the implications for fuel costs depend upon the method of allowance allocation.

The multicriteria evaluation of the coexistence scenario for Group 2 is reproduced in Table 7.5.

Table 7.5 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 2 (CCL & EU ETS)

Criteria	Relevant issues	Score
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for both fuel and electricity efficiency;	3
Static efficiency	• external costs of CO_2 internalised twice for electricity and fuel; • distorts operation of EU ETS - minimum cost abatement no longer achieved;	1
Administrative simplicity	• burden for Group 2 sites is not significantly different from that with the EU ETS alone; • UK government must administer both EU ETS and CCL;	4
Competitiveness	• double regulation of fuel could undermine competitiveness of Group 2 sites, particularly if allowances auctioned; • possible subsidy of competitors if there is an effect on allowance prices; • Group 2 not compensated for electricity price increases;	2
Political acceptability	• double regulation of both fuel & electricity likely to be opposed by Group 2; • Group 2 not compensated for electricity price increases; • retention of CCL provides potential substitute for allowance auctioning; • possible advantage as backup regulation in event of low allowance prices;	2
Total		**12**

7.2.1 Option 2a: remove the CCL on electricity

Rationale
This option is identical to option 1b. The rationale is to prevent double regulation of electricity, a problem which is common to both Group 1 and Group 2. Instead, primary reliance is placed on the EU ETS to meet emission targets for electricity generation.

Advantages and disadvantages
The advantages and disadvantages for this option are very similar to those for option 1b.

The primary difference is that for Group 1 this option leads to only single regulation for electricity and fuel (CCL for fuel and EU ETS for electricity), while for Group 2 this option still leaves double regulation of fuel -which is subject to both the CCL and the EU ETS. Double regulation of fuel distorts the operation of the EU ETS and the choice between fuel and electricity, as well as disadvantaging Group 2 sites relative to competitors which are not regulated under the EU ETS. In other words, this option only solves half the problem.

Table 7.6 provides a multi-criteria assessment of this option for Group 2, in terms of the difference between this option and the coexistence scenario (Table 7.5).

Table 7.6 Multi criteria assessment of option 2a: changes compared to coexistence scenario

Criteria	**Relevant issues**	**Score**
Environmental effectiveness	• *Worse*: price signal for electricity efficiency would be reduced. May be less domestic abatement. Loss of revenue may threaten climate policy measures funded by the CCL.	2
Static efficiency	• *Better:* electricity price reflects external costs of CO_2 without other distortions	2
Administrative simplicity	• *Unchanged*: administration straightforward once CCL_e removed	4
Competitiveness	• *Better*: impact reduced since electricity price reduced. But still disadvantaged by double regulation of fuel.	3
Political acceptability	• *Better*: Builds industrial support by mitigating competitiveness concerns. But loss of revenue (or need to recoup revenue from other sources) may impact on other stakeholder groups. Loss of environmental effectiveness may be opposed by some groups.	3
Total		**14**

A further option here is to change the remaining CCL to a carbon tax. The rationale, advantages and disadvantages of this option are similar to option 1c.

7.2.2 Option 2b: remove the CCL on electricity and exempt Group 2 from the CCL

Rationale

This option eliminates double regulation for both fuel and electricity. As in option 2a, all electricity consumption is made exempt from the CCL. In addition, any fuel consumption covered by the EU ETS is made exempt from the CCL. For most Group 2 sites this would mean that fuel used in the combustion plant was exempt, while fuel used in the process plant was not.

Advantages and disadvantages

The advantages and disadvantages for electricity use are identical to those discussed for option 2a. To this is added the impact on combustion plant fuel.

The primary advantage of fuel exemption lies in the improvement in static efficiency. Not only is double regulation avoided, but the relative price of different fuels, and that of fuel and electricity, now reflects their relative carbon contents. Fuel costs for Group 2 sites may then be greater or less than their non-Group 2 competitors depending upon the fuel mix, the relative cost of carbon in the CCL and EU ETS regimes, and the method of allowance allocation. With free allocation, the overall cost burden for Group 2 sites should be less than if they paid the full rate of the CCL.

The primary disadvantage is that, if allowance prices are low, the incentive for fuel efficiency at Group 2 sites will be reduced with a consequent reduction in energy efficiency investment. A second disadvantage is that, in the absence of allowance auctioning, the revenue raised by the CCL on fuel at Group 2 sites would be lost. In practice, neither of these problems is likely to be significant since the total volume of fuel use accounted for by Group 2 sites is likely to be very small.

Table 7.7 provides a multi-criteria assessment of this option for Group 2, in terms of the *difference* between this option and the coexistence scenario (Table 7.5)

Table 7.7 Multi criteria assessment of option 2b: changes compared to coexistence scenario

Criteria	Relevant issues	Score
Environmental effectiveness	• *Worse*: incentives for both fuel and electricity efficiency reduced. May be less domestic abatement as a result. Loss of revenue from CCL may threaten climate policy measures funded by the CCL.	2
Static efficiency	• *Better:* both electricity and fuel prices reflects external costs of CO_2 without other distortions	3
Administrative simplicity	• *Slightly worse*: should be fairly straightforward. But some complications with CCL on process plant fuel use, but not on combustion plant fuel.	3
Competitiveness	• *Better*: impact reduced since both electricity and fuel costs reduced.	3
Political acceptability	• *Better*: Builds industrial support by mitigating competitiveness concerns. But loss of revenue (or need to recoup revenue from other sources) may impact on other stakeholder groups. Loss of environmental effectiveness may be opposed by some groups.	4
Total		**15**

7.3 Group 3: CCA only

Group 3 sites are subject to a CCA but are not participating in the EU ETS. They are indirectly affected by the EU ETS through increases in electricity prices. Coexistence of the EU ETS and CCL leads to double regulation of electricity in that a price increase coexists with a CCA target. In addition, if the CCAs retain the baseline & credit trading arrangements, there are likely to be additional problems of double coverage and double crediting of electricity-related emissions.

The multicriteria evaluation for the coexistence scenario for Group 3 is reproduced in Table 7.8.

Table 7.8 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 3 (CCA only)

Criteria	Relevant issues	Score
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for electricity efficiency; • retains positive environmental impact of downstream energy efficiency targets; • retains target incentive for electricity efficiency in the case of low allowance prices (backup option); • distorts choice between electricity and fuel;	3
Static efficiency	• External costs of CO_2 internalised twice for electricity and fuel; • distorts choice between electricity and fuel;	1
Administrative simplicity	• burden for Group 3 sites is no different from that with the CCAs alone; • administration of trading schemes complicated by double coverage/crediting; • double counting in climate program • UK government must administer both EU ETS and CCAs;	2
Competitiveness	• Double regulation of electricity could undermine competitiveness of Group 3 sites; • Group 3 not compensated for electricity price increases;	2
Political acceptability	• double regulation of electricity likely to be opposed by Group 3; • Group 3 not compensated for electricity price increases; • possible advantage as backup regulation in event of low allowance prices;	2
Total		**10**

A wide range of options for Group 3 sites could be developed. For brevity, only three will be considered here (Table 7.9).

Table 7.9 Options examined for Group 3

Option	CCL	CCA target	Trading interface	EU ETS
3a	Fuel only	Unchanged	Gateway	Unchanged
3b	Fuel only	Fuel only	Gateway	Unchanged
3c	Fuel only	Fuel only	No trading	Opt-in

7.3.1 Option 3a: remove the CCL on electricity

Rationale

This is identical to option 1b. The primary rationale is to prevent double regulation of electricity for Group 1 and Group 2 sites. Electricity prices internalise carbon abatement costs without additional distortions from the CCL.

The rationale for Group 3 sites is less obvious. Since CCA targets are retained, there is still double regulation of electricity. But since this option is relevant to other groups, it is discussed here to illustrate its consequences for Group 3.

Advantages and disadvantages

For Group 3 sites, the advantages of this option are marginal and derive from the removal of the residual 20% of the CCL on electricity. This should have a small positive impact on competitiveness compared to the coexistence scenario.

The primary disadvantage of this option for Group 3 is that the rationale for the electricity component of the CCA targets is undermined.[71] The CCAs were adopted by Group 3 sites to avoid paying the full rate of the CCL, and the penalty for non-compliance with the CCA targets is a return to paying the CCL. But here, the CCL on electricity is removed and replaced with price increases of uncertain size from the EU ETS, which are paid regardless of whether the CCA target is met. Removal of the electricity component of the CCL also removes a large component of the non-compliance penalty. Non-complying facilities would still be required to pay the full CCL on fuel consumption, but in most cases this represents less than half of their current CCL costs (Table 5.3). The incentive for complying with the targets is therefore reduced and it is possible that the incidence of non-compliance could increase. In practice this is unlikely, since low cost abatement would still be available through the purchase of UK ETS allowances.[72]

This option would also not remove the double coverage and double crediting problems associated with electricity emissions.

Table 7.10 provides a multi-criteria assessment of this option for Group 3, in terms of the *difference* between this option and the coexistence scenario (Table 7.8)

Table 7.10 Multi criteria assessment of option 3a: changes compared to coexistence scenario

Criteria	Relevant issues	Score
Environmental effectiveness	• *Worse*: price signal for electricity efficiency marginally reduced. Loss of revenue may threaten climate policy measures funded by the CCL. Slight risk of greater non-compliance with CCA targets.	2
Static efficiency	• *Better:* electricity price reflects external costs of CO_2 without other distortions	2
Administrative simplicity	• *Neural:*	2
Competitiveness	• *Slightly better*: due to removal of residual 20% of CCL	2
Political acceptability	• *Worse:* Rationale for Group 3 electricity targets undermined.	1
Total		**9**

7.3.2 Option 3b: remove the CCL on electricity and change the CCA target to fuel only

Rationale

This is a logical extension of option 3a. The rationale is to remove the double regulation of electricity for Group 3 sites and place primary reliance on the EU ETS to meet emission targets for electricity generation. The CCAs operate as before, but are confined to direct emissions from fossil fuel.

Advantages and disadvantages

The primary advantage is that there is no longer double regulation of electricity at Group 3 sites. A second advantage is that the conflict over the ownership of Group 3 electricity emissions is removed, thereby avoiding double coverage and double crediting problems.

[71] Since the CCL targets are denominated in relative or absolute energy or emissions, the electricity component of the target is not identified separately.
[72] UK ETS allowances would only be required to cover the excess emissions over the CCA target, whereas the CCL penalty would apply to all fuel consumption over the following two years.

The primary disadvantage is the loss of the downstream incentives for electricity efficiency provided by the CCA targets. As discussed in section 4.3, these targets make an important contribution to the overall UKCP and were estimated by ETSU to deliver significantly greater emission reductions than would have been achieved through the CCL alone. If correct, this suggests that the price impact from the EU ETS would need to be much greater than that from the full CCL if the same level of downstream electricity efficiency were to be achieved. As with the options for Groups 1 & 2, the net result may be reduced investment in electricity efficiency.

A second disadvantage is that is the CCAs may need to be renegotiated. The agreements do not have separate targets for fuel and electricity, but subsume both within an overall target for energy use or carbon emissions. Removal of electricity will necessarily require a new set of agreements and is likely to trigger to a new round of negotiations. For example, if a sector perceives fewer opportunities for fuel efficiency than for electricity efficiency, it is unlikely to accept a level of stringency for a fuel-only target which is comparable to that in the existing agreements. Experience suggests that any renegotiation could be both time-consuming and costly.

Table 7.11 provides a multi-criteria assessment of this option for Group 3, in terms of the *difference* between this option and the coexistence scenario (Table 7.8).

Table 7.11 Multi criteria assessment of option 3b: changes compared to coexistence scenario

Criteria	Relevant issues	Score
Environmental effectiveness	• *Worse*: CCA electricity targets would be lost, and improvement in electricity efficiency likely to be less. Possibility that renegotiated targets for fuel emissions will be weaker than before. Price signal for electricity efficiency marginally reduced.	2
Static efficiency	• *Better:* electricity price reflects external costs of CO_2 without other distortions	2
Administrative simplicity	• *Worse:* Renegotiation of agreements likely to be required	1
Competitiveness	• *Better*: Due to removal of double regulation	3
Political acceptability	• *Better:* Costs for Group 3 less than in coexistence scenario.	3
Total		**11**

7.3.3 Option 3c: remove the CCL on electricity, change the CCA target to fuel only and allow opt-in to EU ETS

Rationale

The previous option leaves Group 3 in a similar situation to EU ETS participants, in that they have a target for fuel emissions and face price rises for electricity. But there are two key differences:

- *Targets*: The nature and stringency of the targets will differ between the EU ETS and CCA regimes, together with the basis on which the targets are derived and the process through which they are developed. Most Group 3 targets will be for energy rather than carbon emissions and will be relative rather than absolute. EU ETS targets take the form of an allowance allocation.

- *Trading:* Group 3 installations will have baseline and credit trading arrangements as part of the UK ETS, while EU ETS participants use allowance trading. The UK ETS may or may not interface to the EU ETS and any such interface is likely to require Gateway arrangements (section 5.3.2).

In this context, the rationale for Option 3c is to give individual Group 3 participants a *choice* between the two schemes. They may choose either to continue with their (modified) CCAs, or take on absolute targets and join the EU ETS. The opt-in option considered here operates at the level of the individual installation, but an alternative is for entire sectors to be allowed to opt-in. While many issues are common to both cases, there are some important differences. For example, sector opt-ins would need to be negotiated by the sector association and then may be difficulties in gaining agreement if the sector is inhomogeneous.

The choice made by an individual installation will depend upon an assessment of costs and benefits. This in turn will depend upon a variety of factors including: the choice between relative and absolute targets; the relative stringency of the CCA target and the anticipated EU ETS allowance allocation; the allowance prices in the two schemes; the interface arrangements between the two schemes; the nature of the interface between each scheme and the international carbon market; and the relative costs of monitoring and verification. With regard to the latter, it is worth noting that verification costs for the CCAs are relatively high (partly as a result of the need to measure product output and product mix) and that the scope for allowance sales is limited.[73]

The primary attraction of joining the EU ETS is likely to be either low cost abatement through allowance purchase, or higher prices for allowance sales. In turn, the scale of opportunities will be partly determined by the interface between the UK ETS and the EU ETS. The incentive to join the EU ETS may be increased if there were no fungibility between UK ETS and EU ETS allowances. In this scenario, the UK ETS would remain entirely isolated from the European market, the trading opportunities will be less and marginal abatement costs and allowance prices will differ between the two schemes.[74] An alternative scenario is closure of the Gateway, such that CCA companies could purchase EU ETS allowances but were not able to sell into the EU ETS. During the development of the CCAs, the UK government indicated its intention to close the UKETS Gateway in 2008, reflecting a desire to move towards absolute targets during the commitment period. This suggests that a combination of the opt-in option with restrictions on UK ETS trading, such as closure of the Gateway, may be attractive.

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[73] Allowances can only be generated *ex post* by CCA participants that have exceeded their milestone target (that is, at two yearly intervals). Allowances can only be generated between the end of the milestone period (which can be any time from 1st October to 31st December) and the end of the *reconciliation period*, which is the 31st January of the following year. This gives a total period of between one and four months in which to generate allowances. Also, allowances can only be generated for overcompliance during the milestone period. Overcompliance in the year preceding the milestone period does not count and cannot be banked.

[74] Fungibility will bring the marginal abatement costs and allowance prices in two schemes closer together. If the UK ETS allowance price is increased, this will benefit allowance sellers but create high costs for allowance buyers. If the UK ETS allowance price is reduced, this will benefit allowance buyers but reduce revenues for allowance sellers.

Advantages and disadvantages

The primary advantage of this option is that it widens the scope of the EU ETS and hence brings more installations under the absolute emissions cap. This in turn gives both Member States and the EU ETS greater assurance of meeting their Kyoto obligations. Effectively, this option provides an opportunity to convert Group 3 CCAs from relative to absolute targets well before their planned end date of 2013. Moreover, the conversion is made voluntarily by the installations themselves, rather than through government modification of the agreements.

A second advantage of opt-in provisions is that they encourage Group 3 sources with low-cost emission reduction opportunities to make those reductions available to EU ETS participants. This in turn should increase allowance supply, lower allowance prices and bring marginal abatement costs down. As with project credits, such a mechanism allows low cost abatement opportunities to be exploited such that the aggregate EU ETS emissions cap is achieved at less cost.

A second possibility is that a Group 3 source chooses to opt-in because purchasing allowances in the EU ETS offers lower cost abatement than is currently available in the UK ETS. This is only likely to be the case if there are restrictions on the fungibility of EU ETS and UK ETS allowances. This mechanism will raise allowance demand in the EU ETS, increase allowance prices and raise marginal abatement costs. Both types of opt-in should bring marginal abatement costs within the cap closer to those within Group 3, although the former route is more likely in practice. One consequence of allowing opt-ins is that Group 3 firms should not be at a competitive disadvantage relative to EU ETS participants, since they also have the option of joining the scheme.

The primary disadvantage of this option is that it requires agreement at the EU level. The opt-in process could also complicate the administration of the EU ETS, since the number of sources will be increased and allocation criteria may need to be defined for installations lying outside of the core sectors.[75] Particular complications could result if installations were allowed to join at different times, although this could be avoided if opt-ins were only permitted at the beginning of Phase 1 or Phase 2. Administrative difficulties have been encountered with comparable provisions that allow industrial installations to opt-in to the US Acid Rain Program (Sorrell, 1994).

Opt-in provisions also create the risk of injecting hot air into the EU ETS. There is an important difference between: a) a source with low marginal abatement costs opting into the scheme, reducing emissions below its allowance allocation and selling the surplus; and b) a source opting into the scheme, receiving an allowance allocation that exceeds its current emissions (or its required emissions under regulations such as IPPC) and selling the surplus. The first is legitimate and lowers marginal abatement costs inside the cap, while the second introduces hot air into the scheme and raises aggregate emissions.[76] Technically, this is a problem of adverse selection and results from asymmetric information between the regulator and firm when defining the allowance allocation. The problem may be particularly acute if allowance allocations are based upon historic emissions. While in theory the allocation criteria in the EU ETS should eliminate this problem, the criteria may be difficult to implement in practice (section 4.5). Analogous problems have been encountered in both the US Acid Rain Program (Montero, 1998) and in the UK ETS (ENDS, 2002d) and have

[75] Particularly important if some form of benchmarking is to be used.
[76] Since the hot air allowances will be sold and used to cover emissions elsewhere in the scheme.

threatened the credibility of each scheme. The hot air problem is also directly analogous to the problem of ‘additionality’ in project based schemes (Begg et al, 2002).

In practice, the decision to opt-in will be influenced by transaction costs and the information available *ex ante* on likely allowance allocations under the EU ETS.

Table 7.12 provides a multi-criteria assessment of this option for Group 3. This adds the consequences of the opt-in provisions to the evaluation given for option 3b in the previous section.

Table 7.12 Multi criteria assessment of option 3c: changes compared to coexistence scenario

Criteria	Relevant issues	Score
Environmental effectiveness	• *Worse*: CCA electricity targets would be lost, and improvement in electricity efficiency likely to be less. Possibility that renegotiated targets for fuel emissions will be weaker than before. Price signal for electricity efficiency marginally reduced. Opt-in provisions bring more installations within the absolute cap, but create risk of injecting hot air into the EU ETS.	2
Static efficiency	• *Better:* electricity price reflects external costs of CO_2 without other distortions. Opt-in provisions encourage convergence in marginal abatement costs between installations within and outside the EU ETS.	3
Administrative simplicity	• *Worse:* Renegotiations of agreements likely to be required. Opt-in provisions create administrative complications for both regulator and participating companies.	0
Competitiveness	• *Better*: Removal of double regulation of electricity. Opt-in provisions may reduce competitive distortions.	4
Political acceptability	• *Better:* Costs for Group 3 less than in coexistence scenario. Opt-in provisions may have industry support.	4
Total		**13**

7.4 Group 4: CCA and EU ETS

Group 4 sites are subject to a CCA and are also eligible for the EU ETS. There is double regulation of electricity, in that an indirect price increase coexists with a CCA target, and also double regulation of fuel, since fuel emissions are subject to targets in both the CCA and the EU ETS. Group 4 sites participate in both EU ETS allowance trading and UK ETS credit trading, with consequent problems of double coverage and crediting. The precise coverage of combustion plant and process emissions may differ between the two schemes.

The multicriteria evaluation of the coexistence scenario for Group 4 is reproduced in Table 7.13.

Table 7.13 Multi criteria assessment of the coexistence of the EU ETS with an unchanged CCL/CCA package: Group 4 (CCA & EU ETS)

Criteria	Relevant issues	Score
Environmental effectiveness	• overall environmental impact greater than either instrument acting alone, due to greater incentives for fuel & electricity efficiency; • retains target incentive for fuel & electricity efficiency in the case of low allowance prices (backup option);	3
Static efficiency	• external costs of CO_2 internalised twice for electricity and fuel; • distorts operation of EU ETS - minimum cost abatement no longer achieved;	1
Administrative simplicity	• major administrative burden for Group 4 sites- two sets of targets, two sets of monitoring/reporting requirements, and simultaneous participation in two trading schemes; • administration of trading schemes complicated by double coverage/crediting; • simultaneous participation of Group 4 sites in two trading schemes prevents fungibility of EU ETS and UK ETS allowances; • double counting in climate program • UK government must administer both EU ETS and CCAs;	1
Competitiveness	• double regulation of fuel & electricity could undermines competitiveness of Group 4 sites; • additional administrative costs could undermine competitiveness of Group 4 sites • possible subsidy of competitors if there is an effect on allowance prices; • Group 4 not compensated for electricity price increases;	1
Political acceptability	• double regulation of both electricity & fuel likely to be opposed by Group 4; • Group 4 not compensated for electricity price increases; • possible advantage as backup regulation in event of low allowance prices;	1
Total		**7**

Two options are available to address the double regulation of electricity:

- remove the CCL on electricity; and
- make the CCA fuel only

These correspond to options 3a and 3b, in the previous section. The implications for Group 4 sites are identical to those for Group 3. But these options only address half the problem for Group 4 as they do not deal with the double regulation of fuel.

The additional options explored here are:

- replacing the CCAs with the EU ETS; and
- allowing opt-outs of the EU ETS at the installation level.

7.4.1 Option 4a: replace the CCAs with the EU ETS and exempt Group 4 from the CCL

Rationale

As described in section 5.4, the double regulation problems for Group 4 exhibit a baroque complexity. The coexistence of the CCAs with the EU ETS appears to be a clear case of redundancy.

The rationale for this option is to remove this complexity. Primacy is given to the EU ETS in regulating emissions from Group 4 sites - both directly through participation in the scheme, and indirectly through electricity price increases that reflect carbon abatement costs.

For double regulation to be fully eliminated, Group 4 sites must also be made exempt from the CCL (they were previously exempt from 80% of the CCL). There are two options:

- exempt Group 4 sites from the CCL on both fuel and electricity; or
- remove the CCL on electricity and exempt Group 4 sites from the CCL on fuel;

These options are equivalent in terms of their impact on Group 4 sites, although the wider impacts of the second are very different. An alternative is require Group 4 sites to continue paying 20% of the CCL as at present, regardless of their compliance with EU ETS targets. In practice, the inclusion or otherwise of 20% of the CCL on fuel is unlikely to make a major difference.

Advantages and disadvantage

The primary advantage is that all of the double regulation problems are removed and administrative costs are greatly reduced. In addition, abatement costs for most Group 4 sites are reduced, economic efficiency is improved and the distortions to competition created by the double regulation are eliminated. The operation of the EU ETS is no longer distorted and abatement can be achieved at least cost.

A second advantage is that the double coverage and double crediting are eliminated. The ownership of fuel and electricity emissions are clarified and the complexity described in section 5.4 is removed. Also, this option allows fungibility between UK ETS and EU ETS allowances. As described in section 5.4.2, the dual participation of Group 4 sites in both trading schemes would have prevented this fungibility

The primary disadvantage is political - there is opposition to the EU ETS amongst Group 4 companies who would prefer to continue with relative targets under the CCAs. As described in section 6, the UK government would also prefer to leave the CCAs unchanged.

As with option 3b, this option removes the downstream incentive for electricity efficiency provided by the CCA targets. Hence, if EU ETS allowance prices are low, a possible result is reduced investment in electricity efficiency. Aggregate fuel emissions from Group 4 sites will also be higher than in the coexistence scenario (section 5.4.2), with the magnitude of the difference depending upon the relative price of EU ETS and UKETS allowances.[77] If allowance prices are low, Group 4 companies will cover their obligations through allowance purchase leading to domestic UK emissions being higher than anticipated in the UK climate program. In other words, the 'backup' regulation is removed.

Table 7.14 provides a multi-criteria assessment of this option for Group 4, in terms of the *difference* between this option and the coexistence scenario (Table 7.13).

[77] This assumes that, in the aggregate, the CCA targets are binding relative to the EU ETS allowance allocations (section 5.4.1). Note also that this result depends upon the relative price of allowances in the two schemes and not upon the relative stringency of CCA targets and EU ETS allowance allocations at individual sites (section 5.4.2).

Table 7.14 Multi criteria assessment of option 4a: changes compared to coexistence scenario

Criteria	**Relevant issues**	***Score***
Environmental effectiveness	• *Worse*: CCA electricity targets would be lost, and improvement in electricity efficiency likely to be less. Price signal for fuel and electricity efficiency marginally reduced. Fuel emissions will be higher.	2
Static efficiency	• *Better:* Fuel and electricity costs reflect external cost of CO_2 without other distortions. EU ETS can minimise abatement costs.	3
Administrative simplicity	• *Better:* Greatly improved for both Group 4 and government. No double regulation, double counting or double crediting.	3
Competitiveness	• *Better*: Removal of double regulation of electricity and fuel. Abatement cost reduced	2
Political acceptability	• *Better:* Costs for Group 4 less than in coexistence scenario. Likely to be greatly preferred to coexistence scenario, although not preferred relative to a scenario of no EU ETS.	2
Total		**12**

7.4.1 Option 4b: allow Group 4 installations to opt-out of the EU ETS and continue with their CCL 1 As.

Rationale

While the previous option may have advantages compared to the coexistence scenario, it runs counter to the preferences of both energy intensive industry and the UK government who would prefer to continue with the existing CCAs (at least during Phase 1). As discussed in section 6, the UK is attempting to achieve this through the negotiation of a *national* opt-out. An alternative is to allow opt-outs at the *installation* level, with the aim of giving Group 4 participants a choice between the continuing with their CCAs or joining the EU ETS. If such a provision were included in the EU ETS, it would be subject to the demonstration of 'equivalence of effort' by the opt-out installations in terms of the stringency of emission targets, the associated, monitoring, reporting and verification requirements and the provisions for non-compliance.

If opt-outs are allowed at an installation level, this could lead to a situation where some installations in a sector are included in the EU ETS and some are not. An alternative would be to allow opt-outs at the sector level, so that each sector was either included or excluded from the EU ETS. A sector opt-out could also be achieved through the installation opt-out provisions if all the installations in a sector chose to act together. There are pros and cons with both approaches, but for brevity only the installation level opt-out will be considered here.

Group 4 installations would be eligible to opt-out if they could demonstrate that the CCAs met the equivalence of effort criteria. In contrast, it would be much more difficult for installations in non-CCA sectors such as electricity generation and oil refining to opt-out, since these installations have relatively few existing regulations that could be considered equivalent to the EU ETS. Hence, even if all Group 4 companies chose to opt-out, this option would not be equivalent to a national opt-out provision since electricity generators, oil refineries and other companies would still be subject to the cap.

Since the generators are in the scheme, any installation that chose to opt-out and retain its existing CCA would be subject to double regulation of electricity. This may be one incentive to not to opt-out. Alternatively, the options outlined for Group 3 could be considered, including changing the CCA targets to fuel only. But this could complicate the demonstration of equivalence of effort, as the targets that are being assessed for equivalence are themselves subject to change.

The opt-out option has similarities to the opt-in option. With an opt-in provision, Group 4 companies are included in the cap and have no opportunity to leave, but Group 3 companies have the opportunity to join. With an opt-out provision, Group 4 companies are included in the cap and have an opportunity to leave, but Group 3 companies have no opportunity to join. With an opt-in provision the cap can increase in size, but cannot shrink, while with an opt-out provision, the cap can shrink but cannot increase. In principle, both opt-in and opt-out could be accommodated at the same time, but since each option could be burdensome to administer, a combination of the two is likely to be excessive.

As with opt-ins, the choice made by Group 4 installations will depend upon an assessment of the costs and benefits. This in turn will depend upon a range of factors, many of which - such as EU ETS allowance prices – are likely to be uncertain. In principle, the primary attraction of opting-out of the EU ETS would be to minimise abatement costs. Movements out of the cap (by high cost participants) should lower allowance demand, lower allowance prices, reduce marginal abatement costs and bring abatement cost within the cap closer to those outside. But in practice, factors such as expected output growth (or decline), transaction costs and the future evolution of the CCA and EU ETS regimes would also need to be taken into account. As with opt-ins, the incentive to opt-out of the EU ETS would be reduced if there were no fungibility between UK ETS and EU ETS allowances, or if CCA companies could purchase EU ETS allowances but were not able to sell into the scheme (i.e. one way trading, or a closed Gateway). Conversely, if there were full fungibility between UK ETS and EU ETS allowances, an installation that opted out could retain the benefits of relative targets and still have full access to EU ETS trading. Hence, if there were restrictions on UK ETS trading, fewer companies are likely to opt-out.

Advantages and disadvantages

The primary advantage of this option is political: the opportunity to opt-out will make the EU ETS more acceptable to industry and certain Member State governments. An opt-out option at the installation or sector level could be a suitable compromise to gain agreement in the Council of Ministers, without going as far as exempting a Member State completely from Phase 1. The fact that electricity generators are unlikely to be able to use this option is important, as it reduces the risk of competitive distortions in cross-border electricity trade. This is of limited concern for the UK as cross-border electricity trade is relatively small (and almost entirely one-way), but it is important for other Member States.

There are, however, several disadvantages. Since an absolute cap has greater environmental integrity than relative targets, opt-out provisions would lower the environmental effectiveness of the EU ETS regime. This could threaten both Member State and EU compliance, although much depends on the effectiveness with which ‘equivalence of effort’ is interpreted and applied. But demonstrating equivalence of effort presents three difficulties:

- *Scope*: As section 3 has demonstrated, there are differences in the scope of the EU ETS and the CCAs, including their coverage of electricity. How can their emission reductions be considered equivalent when they cover different emission sources in different ways?
- *Form*: The CCAs have relative targets while the EU ETS has absolute. These cannot be considered equivalent because: a) absolute targets gives certainty in the environmental

outcome, while relative targets do not; b) absolute targets give scope for auctioning and revenue raising while relative targets do not (although this is not relevant for Phase 1); and c) relative targets act as a subsidy on production, leading to higher emissions for the same level of marginal abatement cost (Gielen et al, 2002). Group 4 installations that have chosen to opt-out may have a competitive advantage and the resulting increase in output from these installations may lead to a net increase in emissions.

- *Stringency*: There are likely to be differences in stringency between CCA and EU ETS targets, since the basis on which they are derived and the process through which they are developed is different. Section 4.3 suggested that the current CCA targets are relatively weak and may fall short of the allocation criteria listed in the Directive.

For this option, equivalence of effort will need to be determined at the level of individual installations, since some installations in a sector may choose to join and some to leave. Most probably the assessment would need to take place only once the beginning of Phase 1, since giving installations the opportunity to opt-out during Phase 1 is likely to be counterproductive and impractical. The process of demonstrating equivalence of effort could be both costly and time-consuming. One option would be to estimate the allocation to different installations under the EU scheme, and then to assess whether their existing targets are 'equivalent' to this estimated allocation. But this implies considerable effort to assess bottom-up allocations, which seems unnecessary when the intention is not actually to allocate allowances. It is likely that assessing equivalence of effort for this option would be more burdensome than for the national opt-out option, since the latter would require only a single decision on the overall equivalence of the UK climate program. A sector level opt-out option may be a suitable compromise here, as equivalence of effort will only need to be assessed at the sector level. But any administrative advantages are likely to be obtained at the expense of accuracy, since in principle a sector level assessment would need to be obtained by summing the opportunities at each individual installation.

Table 7.15 provides a multi-criteria assessment of this option for Group 4, in terms of the *difference* between this option and the coexistence scenario (Table 7.13). This adds the consequences of the opt-in provisions to the evaluation given for option 4a in the previous section.

Table 7.15 Multi criteria assessment of option 4b: changes compared to coexistence scenario

Criteria	**Relevant issues**	***Score***
Environmental effectiveness	• *Worse*: CCA electricity targets would be lost, and improvement in electricity efficiency likely to be less. Price signal for fuel and electricity efficiency marginally reduced. Fuel emissions will be higher. Opt-outs reduce the environmental effectiveness of the EU ETS.	1
Static efficiency	• *Better:* Fuel and electricity costs reflect external cost of CO_2 without other distortions. EU ETS can minimise abatement costs. But opt-out options undermine efficiency of EU ETS.	2
Administrative simplicity	• *Better:* Greatly improved for both Group 4 and government compared to coexistence scenario. No double regulation, double counting or double crediting. But opt-out option could create major complications.	1
Competitiveness	• *Better*: Removal of double regulation of electricity and fuel. Abatement cost reduced. Opt-out option may benefit Group 4 installations but introduce competitive distortions.	2
Political acceptability	• *Better:* Costs for Group 4 less than in coexistence scenario. Likely to be preferred to coexistence scenario, although not preferred relative to a scenario of no EU ETS. Opt-out option should reduce industry concerns over the competitiveness impacts of the EU ETS and may help secure agreement at the EU level.	3
Total		**9**

7.5. Summary and recommendations

Table 7.16 provides a summary of the multicriteria evaluations of each option. A total score for each option is derived very simply by summing the individual scores under each criteria. The scoring process is highly subjective and in practice different stakeholder groups may both assign different scores to each option and give different weightings to each criteria. Nevertheless, with the scorings given here we may conclude that:

- All of the options offer an improvement on the coexistence scenario. In other words, leaving the CCL/CCA package unchanged is likely to be the worst possible option.
- The majority of the options improve economic efficiency at the expense of environmental effectiveness. But most of the options which improve economic efficiency also improve political acceptability.
- Allowing opt-ins to the EU ETS can offer a number of advantages, particularly if combined with restrictions on the fungibility of EU ETS and UK ETS allowances. In contrast, the opt-out option scores badly on all criteria except political acceptability.
- Removing the CCL from electricity offers a number of advantages, as does exempting EU ETS participants from the CCL.

To draw stronger conclusions than this, it would be necessary to: first, decide the priority to be given to individual criteria; and second, take a view on the future course of EU ETS allowance prices. If allowance prices were anticipated to be *low*, this could provide grounds for retaining some elements of the CCL/CCA package as ‘backup regulation’. For example, the CCL on electricity could be retained. Conversely if allowance prices were anticipated to be *high*, the need for backup regulation would be reduced and greater priority could be given to economic efficiency. The difficulty is that forecasts of future allowance prices are highly speculative. They depend in part upon assumptions about the interface between the EU ETS and the international carbon market after 2008, but the development of these interfaces is only partly within the UK's control. Key decisions on UK climate policy will need to be taken before 2008, and possibly before 2005 – that is, well before allowance prices can be forecast with any confidence.

Table 7.16 Summary evaluation of options for modifying the CCL/CCA package or the EU ETS

Options	Description	Environmental effectiveness	Static efficiency	Administrative simplicity	Competitiveness	Political acceptability	Total
Group 1	***Coexistence scenario***	***3***	***2***	***4***	***3***	***2***	***14***
1a	Modify CCL rate for electricity	2	2	3	4	3	14
1b	Remove CCL on electricity	2	3	4	4	3	16
1c	As 1b, and make CCL a carbon tax	2	4	5	4	3	18
Group 2	***Coexistence scenario***	***3***	***1***	***4***	***2***	***2***	***12***
2a	Remove CCL on electricity	2	2	4	3	3	14
2b	As 2a and exempt Group 2 from CCL	2	3	3	3	4	15
Group 3	***Coexistence scenario***	***3***	***1***	***2***	***2***	***2***	***10***
3a	Remove CCL on electricity	2	2	2	2	1	9
3b	As 3a and change CCA to fuel only	2	2	1	3	3	11
3c	As 3b and allow opt-in to EU ETS	2	3	0	4	4	13
Group 4	***Coexistence scenario***	***3***	***1***	***1***	***1***	***1***	***7***
4a	Replace CCA with EU ETS and exempt from CCL	2	3	3	2	2	12
4b	As 4a and allow opt-out from EU ETS	1	2	1	1	3	8

8. Eliminating the confusion: policy recommendations

8.1 Principles

This report has thrown some light on the 'climate confusion', highlighted the need for policy decisions and illustrated the nature of the trade-offs that need to be made. To make specific recommendations, it is necessary to establish some core principles and and considerations. These are listed below. The basic recommendation is that greater priority should be given to economic efficiency and administrative simplicity when developing future policy options.

The report recommends that greater priority should be given to economic efficiency and administrative simplicity when developing policy options. The principles and considerations which underlie this choice are as follows:

- *Need for change*: The EU ETS will provide the framework for trading in the long-term, whether the UK joins in 2005 or 2008. But coexistence of the EU ETS with the existing CCL/CCA package appears untenable. This means that evaluation of possible changes to the CCL and CCAs needs to begin now.
- *Goals*: The development of policy options should not be based upon short-term expedients, but upon clear principles and long-term goals. For climate policy, a stable an effective policy framework is required during the commitment period. This means that policy should be developed by *working back* from where we want to be in 2008, rather than making minor adaptations to the existing mix.
- *Complexity*: The existing UK policy mix is excessively complex and the relationship between different instruments is poorly understood by individual target groups. Hence, any changes should aim to simplify this mix and not to add further complexity.
- *Objectives*: The objectives of individual policies should be clear. At present, the efficiency of the CCL is undermined because it is trying to meet several objectives at once in a manner that is far from transparent. Whether or not all these objectives are sensible, it should be possible to achieve several of them by combining a more efficient price instrument with supplementary measures to ameliorate unwanted impacts on, for example, the fuel poor.
- *Carbon pricing*: Energy users in all sectors should pay for carbon emissions, whether through taxation or emissions trading. In the long term, organisations in the public, commercial and industrial sectors should *either* be paying a carbon tax *or* participating in a trading scheme. The CCAs should be seen as a transitional measure only. Supplementary policies will be required to address other barriers to energy efficiency and to achieve other policy objectives (e.g. promoting renewables). But for each target group, only a single instrument should be used for carbon pricing.
- *Revenue raising*: Revenue recycling should be used to enhance the economic efficiency, environmental effectiveness and political acceptability of a carbon tax (as with the CCL). Similar benefits are only possible with the EU ETS if allowance auctioning is used. A pragmatic solution is to auction a small proportion of the allowances initially, and to

increase that proportion over time. While industrial opposition to allowance auctioning is understandable, there appears to be no good reason why the UK government should continue to oppose *any* allowance auctioning in the EU ETS.

- *Electricity:* The treatment of electricity emissions is of central importance. The EU ETS gives ownership of these emissions to electricity generators (direct allocation), while UK climate policy gives ownership to electricity consumers (indirect allocation). The former is preferable because: first, it gives ownership of electricity emissions to the companies directly responsible for the control of those emissions, thereby incentivising both fuel switching and energy efficiency; and second, it facilitates cross-border electricity trade in the EU.
- *Targets:* Absolute targets are to be preferred over relative targets because of their greater environmental integrity and consistency with the national emission targets under Kyoto. The argument that absolute targets provide a 'cap on growth' is difficult to defend in the context of global carbon trading and projections of low allowance prices.
- *Trading:* Allowance based trading (i.e. EU ETS) is to be preferred over baseline and credit trading (i.e. CCAs) due to its greater economic efficiency, lower transaction costs and consistency with the Kyoto framework.
- *Supplementaritry:* A combination of the US withdrawal from Kyoto, excessive 'hot air' and generous sink provisions means that the international carbon market during the first commitment period is likely to be oversupplied. This creates a real risk that abatement in the EU will be achieved through purchasing cheap hot air rather than through domestic action. But domestic abatement may be incentivised by either restricting the interface between the EU ETS and the international carbon market, or by retaining (or establishing) 'backup' regulations for EU ETS participants. This is an important and difficult policy choice for the UK, since future allowance prices are highly uncertain and the UK has only limited control over the future evolution of the EU ETS. However, since both the Commission and other Member States would like the EU ETS to encourage domestic abatement, there appears a good chance that the import of hot air into the EU ETS will be restricted. This suggests that 'backup' regulations should be abandoned as they are likely to undermine economic efficiency, be more complex to administer and lead to additional costs for the target groups.

8.2 Recommedations

These principles and considerations lead to the following recommendations for changes to the policy mix when the EU ETS is introduced:

- The CCL should be removed from electricity and extended to all fossil fuels. The CCL should replace excise duties on oil products.
- The basis of the CCL should change from energy to carbon content.
- The level of the fuel-only CCL should be increased and the existing programmes funded by the CCL should continue.
- Eligible installations should join the EU ETS and their existing CCA agreements should be terminated.

- CCA facilities not eligible for the EU ETS should renegotiate their agreements such that the targets relate to fuel consumption only.
- Participants in the EU ETS should be exempt from the CCL.
- Before 2008, trading between the UK ETS and the EU ETS should be controlled by a Gateway. After 2008, there should be no trading between the two schemes

The analysis has also suggested that opt-in provisions at the installation or sector level could be a valuable addition to the EU ETS, while opt-out provisions at this level appear undesirable. A preferable approach may be to expand the sectoral coverage of the EU ETS over time.

The recommendations are conditional upon restrictions being placed on the import of hot air into the EU ETS. If these conditions are not met, 'backup' regulations should again be considered.

The changes proposed above will be far more difficult to implement by 2005 than by 2008. A national opt-out of Phase 1 therefore appears an attractive alternative as a transitional measure.

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