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Energy Efficiency and Trading

Part I: Options for Increased Trading in the Energy Efficiency Commitment

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Executive Summary

This report considers trading arrangements to improve the cost-effectiveness of UK policy to promote household energy efficiency. We consider trading under the current programme, the Energy Efficiency Commitment (“EEC”, or “the Scheme”), as well as under a more formal “white certificate scheme.” (The EEC sets energy reduction targets for major electricity and gas suppliers.) Both trading in the EEC and a white certificate scheme involve trading energy savings, i.e., *reductions* in household energy use. We also consider a shift to a “cap-and-trade” programme that would establish a cap on the overall or average level of a household energy use or CO₂ emissions as a means of attaining household energy efficiency improvements. Finally, because one of the motivating factors for the EEC is to reduce greenhouse gases, the report discusses linkages with the European Union cap-and-trade programme for carbon dioxide (the EU Emissions Trading Scheme, or “EU ETS”).

The findings of the report are based upon reviews of the experience with the EEC and its trading provisions as well as interviews with scheme stakeholders, including all participating EEC energy suppliers.

Theoretical Benefits of Trading in an Energy Efficiency Scheme

In the context of an energy efficiency scheme, trading consists of commercial transactions in which credits for valid energy efficiency measures are bought and sold. Such transactions have two main potential benefits:

- § *Reducing costs.* Trading provides incentives to undertake energy-saving activities where it is most cost-effective to do so. Under trading, high cost participants (i.e., those with high-cost alternatives for reducing household energy use) can pay those with lower cost to undertake measures on their behalf, reducing the overall cost of the measures undertaken.
- § *Reducing risk.* Trading also can help reduce uncertainty by spreading activity efficiently across participants and time. In particular, the risk of non-compliance can be reduced by giving participants access to other participants’ compliance options, and the risk of higher costs can be offset by transferring activity to other, lower-cost participants.

Against these benefits, trading provisions generally require somewhat greater complexity and administration, with corresponding increases in costs to participants and scheme regulators. Whether these greater administrative costs are outweighed by the cost savings afforded by trading is an empirical question.

Trading Provisions in the EEC

The EEC currently accommodates three basic forms of “trading”, taking a broad view of how the term is to be understood:

- § *Horizontal trading.* EEC allows for trading between energy suppliers (i.e., those with EEC obligations), both of targets (thereby increasing the energy-saving requirement) and of certified energy savings “credits”. These can be described as “horizontal” trading provisions because they represent exchanges among participants with obligations under

the Scheme. The potential cost savings from horizontal trading depends on variations in the cost of achieving energy savings among suppliers.

- § *Inter-temporal trading.* The EEC also allows participants to apply efficiency measures completed in one compliance period to their targets in a subsequent period. This “carry-over” or “banking” provision represents internal trading. The cost savings provided by inter-temporal trading depends on how much the cost of achieving energy savings is likely to increase in the future.
- § *Vertical trading.* Energy suppliers also are allowed to meet their required savings target by purchasing credits for measures carried out by other, legally distinct parties. This provision in effect creates a market for energy saving “credits” under the scheme, as a result of commercial transactions between energy suppliers that have the EEC obligation and developers of energy efficiency projects. The cost savings provided by vertical trading depend on variations in cost between different organisations in the supply chain of energy efficiency measures.

Trading Activity in EEC 2002-2005

The three types of trading have assumed very different importance as the EEC has been implemented. Horizontal trading has not been a prominent feature of EEC. Indeed, no trading of certified savings “credits” has taken place, although there have been instances of trading of targets. Also, two scheme participants have operated joint energy saving programmes, effectively creating a “bubble” arrangement for compliance activity

By contrast, inter-temporal trading has proven very popular with scheme participants. Suppliers carried over 26 TWh of certified savings from EEC 1 to EEC 2. This corresponds to 42 percent of the EEC 1 target, or 20 percent of the EEC 2 target.

The most important form of trading has been vertical trading, which accounts for almost all activity in EEC. Suppliers have contracted with various types of “third party” project developers to undertake energy efficiency activities, with the resulting energy savings counted towards their target. In addition to end-user equipment installers, various intermediaries have emerged in this market, including housing managers, government agencies, charitable organisations and managing agents. The activities that are outsourced thus include not only the installation of energy-saving measures, but also the tasks of identifying opportunities for projects, marketing, reporting, and complying with administrative requirements.

Potential Benefits of Trading in the EEC

We undertook surveys of participants to evaluate expectations about trading benefits. Stakeholders generally believe that the relative importance of these three different types of trading is likely to persist during EEC 2. The following are the specific conclusions of our review.

Horizontal trading. Stakeholders’ assessments of the importance of the various forms of trading mirrored the extent of activity. Thus horizontal trading was not considered an

important part of the scheme. Suppliers generally have access to similar types of measures, delivery routes, third party contractors, and regions. As a result, their costs are not likely to vary much, and there thus is relatively little benefit from horizontal trading. However, as information about costs is considered commercially sensitive and therefore not available, this could not be confirmed directly.

Inter-temporal trading. By contrast, inter-temporal trading was thought by most suppliers to be a very important part of scheme rules, as there was reason to believe that costs would increase over time. Stakeholders identified several reasons for costs changing over time, most of which pointed to higher future costs.

§ Increasing cost of measures undertaken, reflecting:

- increasing technological cost of remaining savings opportunities as low-cost alternatives were exhausted;
- search costs to locate measures;
- subsidy requirements to encourage uptake; and
- administrative costs with changes to scheme complexity and scale.

§ Changing willingness to pay by consumers, for example, because of varying energy prices.

§ Changes in the supply chain of energy efficiency measures, with particular emphasis on the availability of capacity.

§ The possibility of innovation, including the possibility that new measures with lower costs may be introduced.

§ Changes to scheme rules between compliance periods, including

- the “uplift” attributable to particular measures;
- the energy savings credits obtainable from measures; and
- the eligibility of particular measures for credits.

Vertical trading. Vertical trading clearly was regarded as of key importance to the Scheme. The cost-effectiveness of the current scheme therefore depends to a large extent on the effective functioning of this market for energy-reduction credits. Stakeholders generally indicated that they had access to a competitive market for energy efficiency measures. There were some exceptions, including concern by at least one stakeholder that recent increases in the cost of some measures might reflect poor competition or other market imperfections rather than underlying fundamentals.

Stakeholders generally did not think that there were measures that were eligible under Scheme rules but which were not effectively incorporated in the vertical market for energy efficiency measures. Most thought that strong incentives existed for both suppliers and project developers to find mutually advantageous trading opportunities. Also, most thought that appropriate institutional arrangements (e.g., tendering agreements, brokering by managing agents) were in place to allow trades to take place.

Barriers to Trading

The surveys did uncover some barriers to trading. Not surprisingly, the greatest barriers were seen for horizontal trading (which has seen few trades).

Barriers to horizontal trading. Factors mentioned by suppliers as obstacles to horizontal trading include:

- § *Commercial sensitivity.* The fear that engaging in horizontal trading could reveal information to competitors had acted as a deterrent.
- § *Expectation of increasing costs.* Suppliers generally found it more attractive to bank savings than to trade the surplus generated.
- § *Penalty structure and risk exposure.* The very large potential penalty for non-compliance also contributed to the preference for banking over horizontal trading of overcompliance.
- § *Verification procedures.* Verification only takes place at the end of the period, prior to which suppliers do not have credits that they could trade, while trading of targets was felt to be risky before the final and verified compliance position is known.
- § *Transaction costs.* Procedures for exchanging either credits or target obligations were considered unnecessarily cumbersome, and the absence of standard agreements a barrier to trading.
- § *Priority group requirement.* Suppliers felt that the Priority Group (“PG”) requirement was a particular source of risk, and that the non-exchangeability of PG and non-PG activity reduced the opportunity for trading.
- § *Non-EEC benefits of compliance activity.* Suppliers also felt that energy-saving measures had some auxiliary benefits unrelated to direct EEC compliance, such as marketing and brand promotion. Trading with competitors therefore could be unattractive.

On balance, it appears unlikely that these barriers have significantly reduced Scheme cost-effectiveness. The preference for inter-temporal trading or for keeping ancillary benefits in-house simply reflects the higher value of these alternatives relative to horizontal trading. Some of the other barriers (transaction costs, absence of anonymity) seem unlikely to be very large and might be expected to be surmounted relatively easily—for example through brokers. The fact that they are not suggests that the *benefits* of horizontal trading may be quite low. On balance, the main reason for the small volume of horizontal trading appears to be the absence of benefits from such transactions, rather than flaws in scheme design.

It nonetheless is possible that changes to Scheme design may help encourage more trading than currently takes place. The most important design parameter may be to increase the frequency of verification, enabling participants to be sure of the approved status of the activity or credits being traded. Earlier verification also would give participants greater certainty about their compliance position, making trading of both savings and targets less risky. Against this, some participants thought that more frequent or continuous verification may entail higher administrative costs.

Barriers to intertemporal trading. Stakeholders did not indicate any significant barriers to intertemporal trading. Insofar as banking is used in part as an insurance mechanism against future risks, it is possible that a reduction of uncertainty (notably about future targets) would

lead to a reduction of banking. This may make participants more willing to use obtained credits in horizontal trading, which in theory could make the scheme more cost-effective overall. But we did not uncover any indication that this would provide substantial cost savings.

Barriers to vertical trading. While the vertical market generally was felt to be working well, some potential obstacles to cost-effective transactions were identified:

- § *Search costs.* Given the small size and large number of potential project developers, it may be difficult for suppliers to find them and coordinate trading.
- § *Minimum economic scale of measures.* There may be a preference for measures that can be replicated on a large scale, potentially excluding some cost-effective but small or one-off measures.
- § *Availability of project developer capacity.* Some suppliers thought that a lack of capacity (especially in insulation) may become a factor that impedes the functioning of the market.
- § *Market imperfections.* Some suppliers and project developers thought that some parts of the market may be uncompetitive, implying market power either on the part of suppliers or third parties.

Overall assessment of barriers. A comprehensive assessment of barriers in the market for efficiency measures is beyond the scope of this study. The available information indicates that the above concerns are not serious. For example, the emphasis on large-scale measures seems more likely to be an appropriate reflection of the higher per-unit costs of certifying small measures than any flaw in the market. Importantly, no stakeholder was able to identify specific sources or types of available, *cost-effective* energy efficiency measures that would be eligible under the scheme but that currently are not undertaken.¹

Evaluation of a Transition to a White Certificate Scheme

A transition to a tradable white certificate (“TWC”) scheme would involve formalising trading arrangements and creating a standardised energy savings commodity that could be “produced” by a wide range of groups and bought and sold freely in a market setting. Under current rules, savings credits are traded implicitly, as embedded in the energy efficiency measures contracted with third parties and funded by suppliers. Under a TWC scheme, formal certificates would be issued to the party undertaking energy efficiency activities. These certificates could be sold to suppliers, who in turn would surrender TWCs to the scheme regulator to demonstrate compliance with targets.

The main difference between a TWC scheme and current arrangements thus is a formal separation of underlying measures from the savings credits they generate. Credits could be traded in a market independently of the market for energy efficiency measures. The TWC market thus would be a modification and extension to the current *vertical* trading market between suppliers and energy efficiency project developers. The TWC market need not affect horizontal trading between suppliers and may in fact further reduce the need for trading

¹ Various measures that are not currently eligible, including some so-called “behavioural” measures, were identified, but the absence of these measures represents a conscious decision by policy-makers, rather than a market failure.

between suppliers, as all would have access to the new TWC market. As the two types of exchange (TWCs and horizontal trading between suppliers) concern different trading parties, the current low level of horizontal trading would not in itself constitute a reason to introduce TWC arrangements. There also does not seem to be much reason to expect that inter-temporal trading would be affected by the introduction of a TWC scheme.

Under TWC arrangements project developers potentially could generate certificates without having to reach prior agreements with energy suppliers. This could decrease transaction costs, as suppliers would not need to know and approve the details of measures before they were undertaken. Insofar as current contracting arrangements are a hurdle that impedes the take-up of otherwise cost-effective measures, this could make possible some approaches to energy savings that currently are not being undertaken.

Note, however, that the survey evidence suggests that there are few additional cost-effective measures that would be generated by a TWC programme. Most stakeholders did not think it was likely that a significant number of additional measures would be made available, although all noted that the question is inherently difficult to answer. Indeed, no stakeholder was able to identify a specific type or mechanism for energy savings that would be more likely to be developed under a TWC arrangement than under direct contracting with suppliers.

Trading in a certificate spot market also may change the distribution of risk to participants, as project developers may undertake measures with less certainty about the price at which they could sell the resulting certificates. Many project developers are small organisations who are likely to find it difficult to take on projects without a guaranteed sale. Conversely, suppliers put a premium on guaranteed delivery and the ability to monitor continuously their compliance position against targets. These considerations are likely to persist under a TWC scheme. Suppliers and contractors therefore may need to enter into long-term or forward contracts for energy efficiency measures to alleviate these concerns. In this case, it is not clear that the outcome in a TWC market would differ much from the outsourcing or sub-contracting arrangements currently in place.

It seems likely that a TWC programme would have somewhat higher administrative costs than under the current trading arrangements. The generation of TWCs by project developers would require direct contact with the scheme regulator, which therefore would need to expand its ability to deal with multiple, smaller developer organisations. From the developers' perspective, the requirements of monitoring, reporting and verification ("MRV") may be too onerous for many small participants. One potential outcome therefore is "pooling", whereby other organisations manage these requirements. This could be similar to the current situation, where suppliers (and even some intermediaries) manage MRV procedures for the projects being undertaken.

In sum, there may be relatively few benefits of a TWC scheme relative to the current set of trading arrangements under the EEC. Although it is possible that more low-cost projects would be forthcoming, the cost savings may not outweigh the somewhat greater administrative costs and the transition costs of moving to the other scheme.

Evaluation of a “Hybrid” EEC and TWC Scheme

One other possibility would be to create a “hybrid” program that would make partial provisions for the use of TWCs within the current EEC arrangements. This would require TWCs to be certified as valid options to demonstrate compliance with EEC targets. As with a full TWC scheme, institutional arrangements for the issuing, transfer, and retirement of certificates would be required. Other detailed considerations include the treatment of the EEC Priority Group requirement within a TWC framework.

A potential concern is that the market for certificates would be smaller and less liquid in a partial TWC scheme. It also is unclear to what extent a “hybrid” scheme would differ from a full transition to a TWC scheme. If, as would be recommended, any party were able to generate certificates under a TWC scheme, this right also would extend to suppliers. With such arrangements suppliers also would arguably be generate TWCs for the type of activity they currently undertake, and the distinction between the “EEC” part and the “TWC” part of the scheme therefore would not be clear-cut and potentially limited to details of verification procedures.

Evaluation of an Energy or CO₂ Cap-And-Trade Scheme

An alternative and more fundamental change to the EEC would be to move from the current project-based approach, with an obligation denominated in energy savings, to a cap-and-trade approach. In a cap-and-trade programme, suppliers would be allocated an absolute amount of energy or associated CO₂ they could supply (possibly in terms of energy or CO₂ per customer), and could choose any combination of energy supply, energy efficiency measures, or trading activities to comply with their cap.

One important consideration is the energy and emissions to which the scheme would apply. With a trading scheme applied to suppliers, it would be necessary to distinguish energy supplied to households from that used by other groups not subject to the cap. Another consideration is the interaction of the scheme with the EU ETS if the programme were targeted at CO₂ emissions. As emissions from electricity generation already are covered by the EU ETS, it is not clear that there would be any substantial environmental gain from including them in another cap-and-trade scheme. It therefore would be important to distinguish energy from sources within and outside the EU ETS.

The chief attraction of a cap-and-trade scheme would be the possibility that a wider range of cost-effective energy efficiency measures could be implemented, and that it could potentially facilitate a shift in the energy supply market towards an “energy service” model. In addition, a cap-and-trade approach could eliminate some of the difficulties associated with identifying energy savings under credit-based schemes. By removing the restriction of an “approved list” of measures that is necessary in a project-based scheme, scheme participants would face fewer restrictions and scheme costs could potentially be reduced. A cap-and-trade approach could however reduce incentives for certain types of energy-saving initiatives that target all energy consumers, rather than each suppliers’ own customers.

The viability of a cap-and-trade scheme also would depend on the extent to which the obligated parties would be able to influence the capped quantity (whether CO₂ emissions or energy supplied). This influence may be limited by the difficulty of affecting consumers’

behaviour. If this influence is limited the reductions achievable could be small compared to other influences on energy demand. Moreover, to the extent other such other influences (such as weather and fuel prices) fluctuate it may not be possible to set a cap to which the obligated parties could realistically adhere. The use of “safety-valve” provisions, such as linking to other trading scheme or a buy-out price therefore are likely to be necessary to mitigate such problems, but may compromise the aim of ensuring improvements in energy efficiency in the UK.

The implementation of a cap-and-trade scheme for household energy efficiency, however, would be a challenging undertaking. Capping energy also would represent a significant departure in the application of the cap-and-trade principle, as the quantity capped would not be an undesirable commodity (emissions), but rather a desirable good (energy use) that is traded in a standard product market. It would be important to analyse the welfare consequences of such a cap in detail. (These concerns do not apply to the same extent in the case of a cap on CO₂ emissions.)

Overall, the transition to a cap-and-trade approach would raise complex issues of implementation, as well as fundamental questions about the role of government in the rationing of goods.² Further research would be required to investigate the merits of such an approach more fully.

Implications of interactions and linking to other trading schemes

The presence of the EU ETS has important implications for the design of energy efficiency policy, including any trading scheme for energy efficiency. The most important consequence is that *policies affecting CO₂ emissions from facilities participating in the EU ETS will have no immediate CO₂ reduction benefits*. For example, a reduction in electricity consumption as a result of some measure would mean generators either could sell more allowances or purchase fewer allowances. But aggregate emissions would not change since other participants in the EU ETS would use any “freed-up” allowances to cover increases in emissions (or reduced emissions abatement). This is modified insofar as such policies lead to a decision to tighten the EU ETS in future phases, in which case they could indirectly affect total CO₂ emissions (but only through their effect on the EU ETS cap).

There also is the possibility of making explicit provisions for interactions by making the allowances or certificates of one scheme available to the other. Full linking into the EU ETS would be difficult to achieve and, moreover, would not be desirable, as it would raise problems of double counting of emissions reductions and thus undermine the EU ETS cap. It also would be practically difficult to develop rules that would make the CO₂ reductions embodied in certificates or allowances issued in an energy efficiency scheme fully fungible with EU ETS allowances.

The same problems would not necessarily arise if EU ETS credits were allowable for compliance with obligations in a UK energy efficiency scheme. Indeed, this may be an attractive option for a “safety valve” provision, putting an upper limit on the price of

² It may be instructive to consider whether there are differences between a cap on overall or per-capita energy consumption and a cap on overall or per-capita food consumption.

compliance. The drawback of such arrangements is that EU ETS allowances (or credits generated in energy efficiency schemes in other countries) would not contribute to the local and non-environmental objectives of UK energy efficiency policy. This includes the objective of energy supply security, social objectives to reduce fuel poverty, and the benefit to UK consumers of improvements to energy efficiency.

Conclusions

The following are conclusions from this study:

- § Trading is an important element of the EEC.
- § The major trading activity consists of inter-temporal trading (banking of energy saving credits for use in a subsequent period) and vertical trading (purchasing energy saving credits from non-participants).
- § In contrast, trading among participants is little used.
- § Most EEC participants believe that the current trading arrangements are working well, and that there are few barriers to cost-saving trading.
- § There may be relatively few cost-saving gains from switching to a formal TWC programme, and these gains do not appear to outweigh the potential additional administrative costs.
- § Switching to a “hybrid” system (i.e., allowing TWC credits to be created within the current trading system) has the potential to encourage additional energy efficiency measures but its impact is likely to be limited.
- § Developing a cap-and-trade programme for household energy use (or for CO₂ emissions from household energy use) would represent a major departure from the current programme. Such a programme may encourage additional low-cost energy-saving measures if it resulted in a large-scale transformation of the energy supply market. Because of the major changes it would entail, it would also be complicated to establish. Further study into the relationship of a cap-and-trade scheme to an “energy services” approach to energy supply is recommended.
- § Creating a CO₂-based cap-and-trade programme would be complicated because of the double-counting of emissions already included in the EU ETS. On the other hand, an energy-based cap could raise concerns about rationing. For either of the two, relative or per-capita “caps” appear to be the most appropriate.
- § Linking UK energy efficiency schemes to the EU ETS or other international schemes has the potential to offer scheme participants cheaper options for compliance but may compromise current policy objectives, notably the aim to improve energy efficiency in the UK.
- § Further detailed recommendations and areas for further study are included in the concluding chapter.

1. Introduction

1.1. The EEC and UK Energy Policy

The 2003 Energy White Paper established four objectives for UK energy policy (DTI, 2003b):

- 1) to put ourselves on a path to cut the UK's carbon dioxide emissions - the main contributor to global warming - by some 60% by about 2050 with real progress by 2020;
- 2) to maintain the reliability of energy supplies;
- 3) to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and
- 4) to ensure that every home is adequately and affordably heated.

The White Paper awarded energy efficiency a key role in this context, stating that “[t]he cheapest, cleanest and safest way of addressing our energy policy objectives is to use less energy”. Half of the emissions reductions from the Climate Change Programme to 2010 are expected to result from energy efficiency improvements, of which half are attributable to energy savings made in the household sector.

The main vehicle for achieving energy savings in the household sector is the Energy Efficiency Commitment (“EEC”, or “the Scheme”), introduced in 2002 and following on from an earlier demand-side management (“DSM”) scheme (the Energy Efficiency Standards of Performance scheme). The first phase of the EEC ran from 2002 to 2005 (“EEC 1”), and the provisions for the second phase, which will run from 2005 to 2008 (“EEC 2”) were laid down in the Electricity and Gas (Energy Efficiency Obligations) Order 2004. The government has proposed a third phase from 2008 to 2011 but targets for this period have yet to be established.

The scheme, which is administered by Ofgem, requires electricity and gas supply companies to achieve a specified quantity of “lifetime-discounted, fuel-standardised energy benefits” by the end of each period, through improving household energy efficiency. The EEC will contribute to the UK's greenhouse gas targets under the Kyoto Protocol, with estimated savings of 1.4 MtC (5.1 MtCO₂)/year by 2005 and a further 2.5 MtC (9.2 MtCO₂)/year by 2008. The scheme also includes a strong social component, in that half of the investment must be targeted at priority low-income households. In order to account for social as well as other improvements adequately, EEC targets are denominated in terms of “energy benefits” rather than straightforward energy savings, acknowledging “comfort taking” and other social improvements as a result of the measures implemented.

1.2. Objectives and Structure of the Report

This report considers how the use of flexibility provisions, or “trading”, in the EEC could help further the aims of the scheme. The formal trading of “white certificates” represents one form of flexibility, but this is not the only type of flexibility considered. Instead, “trading” is interpreted in broad terms to apply to a variety of mechanisms that help ensure that energy efficiency measures are undertaken in a cost-effective manner.

The structure of this report is as follows. Chapter 2 provides a framework for analysing the design parameters of a scheme to encourage energy efficiency on the pattern of EEC, with particular emphasis on trading provisions. Chapter 3 provides a brief overview of the implementation of these design parameters in EEC, and also discusses the functioning of various aspects of the EEC to date. It also reports the views of various stakeholders in the Scheme. Chapter 4 discusses the different types of flexibility provision in more detail, identifies the circumstances under which such provisions can be expected to generate benefits for scheme participants, and discusses the prevalence of these circumstances under EEC. Chapter 5 identifies the barriers to trading that exist in the current scheme and considers the possible modifications that could be made to make the scheme more flexible. Chapter 6 considers the possibility of using a “Tradable White Certificate” (“TWC”) approach in EEC, discussing the changes that would be necessary, as well as some of the likely impacts on the energy efficiency measures undertaken, as well as the effects on the cost and risk of various aspects of the Scheme. Chapter 7 discusses the implications of applying the cap-and-trade principle to household energy efficiency policy. Chapter 8 considers how the presence of the EU ETS affects the benefits of different designs for energy efficiency policy, and also analyses the implications of linking a UK trading scheme for energy efficiency scheme to other trading scheme. Chapter 9 provides a brief summary of the main conclusions and recommendations. We list the organisations consulted as part of the research for this project in Appendix A.

2. Scheme Design and Implementation Parameters

The term “Demand-Side Management” (“DSM”) has traditionally been used to refer to activities undertaken by an integrated electricity or gas utility to influence the amount and timing of energy use. Relevant activities include technological improvements to transmission and distribution systems, improvements in the efficiency of energy use by consumers, and changes in the timing of energy use through arrangements such as “smart metering” and interruptible loads. Prior to energy market liberalisation, DSM frequently formed part of a broader Integrated Resource Planning (“IRP”) activity, which required new energy supply resources to be evaluated on a comparable basis to activities such as energy purchases, DSM and co-generation. (Gillingham, Newell *et al.*, 2005)

Energy market liberalisation has led to a dismantling of more traditional forms of DSM, together with changes in the institutional arrangements through which energy efficiency improvements are implemented (including the increased involvement of government agencies and non-profit organisations). Nevertheless, various countries continue to impose obligations to improve energy efficiency, either on energy distributors or energy suppliers. In these schemes, the term DSM is interpreted more narrowly to refer to energy efficiency improvements on the customer side of the meter. The objective of such schemes is no longer IRP by a vertically integrated utility. Instead, energy efficiency improvements are required for a variety of reasons, including:

- § *Supply security*: The scheme may reduce primary energy consumption and reduce reliance on energy imports.
- § *Environmental policy*: The scheme may reduce the environmental costs associated with energy production and consumption and contribute to targets for CO₂ and other emissions.
- § *Technology policy*: The scheme may support energy efficient technologies that are not competitive under current market conditions, but could become competitive through market support (e.g., micro CHP).
- § *Market failures*: The scheme may overcome failures in the “market” for energy efficiency, such as asymmetry of information between buyers and sellers.
- § *Social policy*: The scheme may help improve the quality of life of low-income consumers that find it difficult to fund energy efficiency improvements themselves.

The EEC is an example of such a DSM scheme in which obligations are imposed upon electricity and gas suppliers to improve household energy efficiency. The multiple objectives of the scheme reflect each of the categories listed above. Like other DSM schemes, the EEC contains detailed provisions defining the obligations of the participants in the electricity and gas market.

This chapter introduces some of the features commonly found in contemporary DSM schemes, with particular emphasis on the design parameters relevant to schemes with “trading” provisions. Specifically, we discuss the following aspects of a DSM scheme:

- § Basic elements of a DSM scheme
- § Target group and location of obligation
- § Definition and allocation of energy savings targets

- § Definition and certification of eligible energy savings activities
- § Monitoring and verification of energy efficiency activities and compliance

We then explore the “trading” provisions of DSM schemes in more detail.

2.1. Basic elements of a DSM scheme

The type of DSM scheme considered here have important methodological similarities with project-based emissions trading schemes. In both cases, compliance is demonstrated by undertaking certified projects that reduce emissions or energy consumption below a counterfactual baseline.³ In the case of DSM schemes the “credits” represent “energy savings” (or equivalent), while in the case of emission trading schemes the credits represent “emission reductions”. In both cases, the savings or such reductions are measured with respect to a counterfactual baseline that must be estimated. Since the “value” of the credits (e.g., kWh energy savings, tCO₂ avoided emissions) cannot be measured directly, but only calculated with respect to a counterfactual baseline (e.g., kWh energy consumption), this introduces a substantial element of uncertainty into the scheme. In particular, there is a risk that the “additionality” of individual projects and/or the assumptions for baseline energy consumption will be disputed, thereby undermining the credibility of the scheme (Ellerman, Joskow, and Harrison, 2003)

Other features common to both project-based emissions trading and DSM schemes include: the timeframe for crediting projects; the system boundaries for those projects; the risk of leakage (where, for example, decreased energy consumption within the project boundary is offset by increased consumption outside); and the trade-off between accuracy and administrative costs in the monitoring, verification and certification of individual projects.

A typical DSM scheme can be structured into five main elements:

- § *Savings “credits”*. These represent a measured and verified unit of “energy savings” from energy efficiency activities undertaken by some party. In a traditional DSM scheme, such credits are the accounting unit for targets and are used by participants to demonstrate compliance with their obligations. As discussed below, “tradable white certificates” add additional features to credits to transform them from an accounting unit into a fungible commodity associated with a particular set of trading rules.
- § *Scheme obligation and target group*. An obligation must be placed on a target group to achieve a certain level of measured and verified energy savings, demonstrated through the delivery of a certain quantity of savings credits to the regulator at the end of each compliance period.
- § *Project developers*. These are the parties undertaking energy efficiency activities that can be measured, certified and verified.

³ The relevant analogy is to project-based emissions trading schemes, rather than the more general category of “baseline and credit” trading schemes. With the latter the baseline could be a fixed emissions limit or benchmark, with credits awarded to participants that reduce emissions below this limit. Since there is no uncertainty in this baseline, there are fewer grounds for challenging the credibility of the relevant credits. In contrast, the baselines in project-based schemes are based upon *projections* of future emissions or energy use. These projections are inherently uncertain and open to challenge.

- § *Administration and enforcement.* This includes the reporting, monitoring, verification, and enforcement of obligations and scheme rules.
- § *Market mechanisms.* Broadly defined, these are scheme rules determining how the activity of project developers is translated into “credits” that can be used by the target group to demonstrate compliance with their obligation.

Several features of this general framework should be noted. First, the obligated parties are defined in general terms and need not be restricted to any particular energy carrier (e.g., electricity, gas) or any particular location within the energy supply chain (e.g., generation, transmission, distribution, supply, consumption). Second, the energy efficiency providers (carrying out the actual energy efficiency projects) are also defined in general terms, and may include both the target group itself (e.g., energy suppliers) as well as non-obligated actors such as energy service companies (ESCOs). Third, the savings credits serve as an accounting tool, to demonstrate to the regulator that a specified amount of energy has been saved. Finally, the scheme requires that responsibilities be assigned for monitoring, verification and enforcement, and these activities may be undertaken in a number of ways by a variety of public or private sector organisations.

We discuss these various features and their implementation in EEC in more detail in Chapter 3.

2.1.1. Tradable White Certificates

The terminology used above needs to be distinguished from “tradable white certificates” (“TWCs”). The term savings “credits” is used to denote any records of savings certified by the regulator as valid for compliance under scheme rules.

By contrast, a TWC can be held and traded by a larger group of organisations, providing a formal and official record that a certain quantity of verified energy efficiency activity has been undertaken. Certificates theoretically can be generated independently of the organisations on which the obligation is imposed and traded in a secondary market. By making certificates tradable, a commodity is created, and demand for this commodity arises from their validity to demonstrate compliance with the targets under the scheme. The result of this arrangement is the separation of credits for savings from the underlying efficiency activities, and the potential emergence of a formal market in certificates. However, as “credits” in EEC embodies many of these qualities as well, the distinctions are not always clear-cut. We discuss this in more detail below, in particular in Chapter 6.

Italy has the only fully-fledged TWC scheme Europe, and the Italian model has informed debate on the topic throughout the EU (Pavan, 2002). Proposals for a French TWC scheme are at an advanced stage of development, but implementation of this scheme has been delayed until 2006 (Moisan, 2005). The development of TWC schemes in other Member States appears at best to be at a rudimentary stage. While several Member States (e.g., Belgium, Ireland) have imposed energy efficiency obligations upon energy companies, these have yet to incorporate trading. There is interest in the concept in Norway and Sweden, but as yet no firm proposals. A working group at the International Energy Agency is promoting the concept, but only a handful of countries are participating (IEA, 2005). Perhaps the most

promising development is the recent establishment of a two-year research project on white certificate schemes, funded by the European Commission.

Outside the EU, there is a so-called Energy Efficiency Certificate Trading scheme in New South Wales (MacGill and Outhred, 2003), but closer inspection reveals this to be a project based GHG emissions trading scheme. The concept has been discussed in the US, but to date there have been no practical proposals for implementation (Swisher, 2002). The proposed Directive on Energy End-use Efficiency and Energy Services (COM(2003)739) commits the Commission to examine the scope for a separate Directive on white certificates, but this is not required before 2012.

2.2. Target group and location of obligation

A key decision in the development of a DSM scheme is the choice of *target group*: that is, the organisations and/or individuals on whom the obligation to acquit credits is to be imposed.

Energy savings activities ultimately are undertaken by changes in technology or the behaviour of end-users. However, imposing the obligation on consumers may not be a realistic option as they are likely to lack the capacity to meet the obligation and the administrative requirements could be onerous. Most schemes therefore impose obligations on a smaller number of actors further up the energy supply chain, notably, on energy suppliers. In a scheme where the intention is to encourage energy efficiency improvements both by large consumers (e.g., industry) and small consumers (e.g., households), it may be feasible to have large consumers participating directly in the scheme, with energy suppliers taking on obligations on behalf of smaller consumers.

A related decision is whether the obligation should cover suppliers of all the “energy carriers” used by final consumers (e.g., coal, oil, gas, electricity), or merely a subset of these. The most common targets for DSM schemes are gas and electricity markets, since these have natural monopoly elements and have historically been the focus of economic regulation. However, if the obligation is confined to one or both of these, suppliers of other energy carriers may gain a competitive advantage in areas where multiple fuels may be used (e.g., household heating).

If the obligation is imposed on gas and electricity companies, a choice also is required on the appropriate location of the obligation (Langniss and Praetorius, 2003). DSM schemes typically have operated with an obligation on an actor within the energy supply chain, either electricity generators, transmission system operators (TSOs), distribution network operators (DNOs), or energy suppliers. Separate companies may carry out these functions, or there may be differing degrees of vertical integration. A relevant factor is the extent to which the relevant party can be expected to have knowledge of, or involvement with, end-use efficiency. Generators are the furthest removed from consumers, and therefore may not meet this criterion. Similarly, transmission and distribution companies may not be the best choice, and locating the obligation on these would require changes to regulatory price control mechanisms to ensure that the costs of the scheme could be recovered. In contrast, energy suppliers can operate within competitive markets and can use their direct contact with energy consumers to facilitate energy efficiency programmes.

Against this, there arguably exists a conflict of interest for energy suppliers, as energy efficiency measures among their own customers result in smaller sales of their product. The extent to which this is a problem depends on the size of obligations, and on whether suppliers are able to effect measures outside their own customer group (and thus reduce the volume supplied by competitors instead). Nonetheless, it may be that placing the obligation on a DNO or other parties avoids the creation of some of the perverse incentives that may arise from a supplier obligation.

Some more detailed decisions also will be required. For example, it needs to be decided whether the obligation should be imposed only above a certain size threshold in terms of consumer numbers or kWh supplied. There also need to be detailed rules for the accommodation of changes in the target group, for example, movements above or below the size threshold over time, new entrants to the supply market or exit from the market.

2.2.1. Definition and allocation of targets

The definition and allocation of a target is closely linked to the objectives of the scheme. If the primary objective of the scheme were to reduce energy consumption, denomination of the target in units of energy saved may be the most appropriate. In principle, savings could be measured against a historic or counterfactual baseline of aggregate energy consumption (kWh) by a reference group of consumers. This effectively would translate into a cap on total energy consumption by that group. Alternatively, the energy savings could be measured relative to total customer numbers (kWh/customer).

In practice, the majority of DSM schemes (including the EEC) follow a different approach. While they specify an overall target in terms of total kWh energy savings (or, in the case of the EEC, an equivalent measure such as “energy benefits”), they make no reference to historic or counterfactual baselines for aggregate consumption by a consumer group. Instead, the targets refer to the total energy savings required from investment in individual energy saving *projects*, such as the installation of cavity wall insulation in a certain number of households. Each individual project leads to a corresponding quantity of kWh energy savings that is either estimated using standard factors or measured against a project-specific counterfactual baseline. With this setup, the specification of a required quantity of energy savings effectively translates into a required quantity of investment in energy saving projects, although there may be flexibility as to the location and type of investment. Provided investments are “additional”, i.e., would not have been undertaken in the absence of scheme requirements, the obligation should reduce initial energy consumption below what would have occurred in the absence of these projects.

In general, targets for energy savings may be classified according to three criteria:

1. *Primary versus final*: The targets may refer to primary energy consumption or final energy consumption. In the former case, fixed or variable conversion factors will be required to translate reductions in end-use electricity consumption into reductions in primary energy consumption, taking into account the fuel mix in electricity generation

and the losses in conversion, transmission and distribution.⁴ The choice between primary versus final energy consumption may depend on the relative priority given to different policy objectives, such as supply security and fuel poverty.

2. *Periodic versus single*: Targets may be specified for a number of compliance periods, such as each year of the scheme, or a single target may be specified for the end of the scheme. Periodic targets may increase in stringency each period, since projects established in one year will continue to deliver energy savings in the following year and for the duration of the project's life.
3. *Cumulative versus lifetime*: The targets may refer to the savings in energy consumption achieved during the relevant compliance period, or may refer to the total energy savings achieved during the lifetime of the projects that have been installed. In the case of the former, the savings in each compliance period result both from projects installed within the current period and projects installed within previous periods. In the case of the latter, total lifetime energy savings are calculated by taking into account the performance of each project, the date of installation and the estimated lifetime (e.g., 40 years for cavity wall insulation). Lifetime energy savings is the most appropriate measure when there is a single target specified for the end of the scheme. The savings in future years may or may not be discounted. One important consequence of lifetime savings target is to increase the incentive to install long-lived projects, such as thermal insulation.

In addition to these considerations, many schemes have objectives that may not be adequately reflected by targets in terms of energy savings alone. Additional conditions therefore may be used to differentiate "savings" by type and location. Options for doing so include:

- § *Specific environmental objectives*. Where energy savings are seen primarily as a climate policy instrument, it may be desirable to denominate targets instead in emissions of CO₂ emissions. In practice, this entails differentiating savings by the CO₂ emissions characteristics of the energy use "avoided" by the savings undertaken. This in turn can vary by energy carrier, location, time of day and time of year. A denomination in terms of CO₂ potentially could help facilitate the integration of energy savings schemes with other climate policy instruments, notably emissions trading schemes for greenhouse gases.
- § *Social objectives*. Where energy efficiency schemes have a social policy component, there may be a different value attached to energy savings depending on the consumer group, and this may be reflected in the target denomination. In particular, a common concern is that the obligated party will find it most cost-effective to effect savings among the better-off energy consumers who are able to share some of the cost of measures, creating a risk that the beneficiaries of the scheme are better off than average.
- § *Geographically restricted objectives*. Some objectives may be specific to the reduction of energy use within a particular area. This may include social objectives or the promotion of energy supply security through energy demand reductions. In these cases, energy savings may need to be undertaken within a particular area, notably, within the country.

⁴ For example, a 1kWh reduction in the consumption of electricity by end users may lead to an approximately 3kWh reduction in the consumption of primary energy, accounting for heat loss in generation as well as transmission and distribution losses.

- § *Temporal objectives.* There also may be a preference for energy savings to be achieved at a particular point in time, notably, giving higher weighting to savings undertaken at an earlier date. Earlier savings may be preferred as future savings are uncertain. Also, it may be thought that savings in the future are not “additional”, e.g., because technological improvements mean that savings would have been undertaken anyway.
- § *Other technological / behavioural objectives.* Different weighting also can be given to savings effected through particular measures or methods. This can have several different potential aspects, e.g., differentiation between:
- savings effected through the installation of equipment (“technological” savings), and savings achieved through changes in consumer use of energy (“behavioural” savings);
 - previously approved measures and new measures, such as giving extra credits to innovative technologies; and
 - particular technological measures, including the promotion of individual technologies (e.g., micro-CHP) and the promotion of diversity in the measures undertaken.

Taken together, these considerations constitute a basis for determining the denomination of targets, and therefore also the unit of “credits” in the scheme.

Having established the units for measuring targets, these need to be allocated to the individual participants of the scheme. One possible basis is to divide the targets according to the number of customers that each of them serves within the relevant customer groups, or by the aggregate sales to these customers. A minimum size threshold for participation in the scheme is a possibility, in order not to deter new entrants or to avoid imposing disproportionate fixed costs on small suppliers. Similarly, if there is reason to believe that larger suppliers’ benefit from economies of scale in delivering energy efficiency programmes, there may be ground for applying more stringent targets to these suppliers. Rules for the treatment of new entrants and changes in market share may also need to be devised. Several of these allocation issues are analogous to those faced within cap and trade emissions trading schemes, although since *targets* are being allocated rather than tradable commodities with a market value, there are also some important differences (Harrison and Radov, 2002).

There also are several other detailed design parameters that need to be decided. For example, the length of the target period will influence the uncertainty and risk faced by scheme participants. The size of the accounting unit / credit for energy savings also needs to be decided, (for example, 1 kWh or 100 kWh), since this can influence the size of projects (e.g., large units may make small projects infeasible).

2.3. Definition and certification of eligible energy efficiency activities

The eligibility of projects that generate credits will depend closely on the scheme objectives and principles for setting targets outlined above. In principle, a wide definition of eligibility helps maximise the opportunity for cost saving and minimise the costs to energy suppliers and consumers. At the same time, it may conflict with some of the broader objectives of the scheme and may increase the administrative costs associated with monitoring and verification. Assuming that the target group is energy suppliers, decisions are required on whether eligible measures should include:

1. *Only energy efficiency activities, or also activities that achieve related objectives, such as fuel switching, renewable generation, or non-CO₂ abatement?* Since energy efficiency schemes focus primarily on energy efficiency improvements, wider GHG abatement activities are likely to be excluded. Similarly, fuel switching may only be included in so far as it reduces aggregate primary energy consumption.
2. *Only verified investment in energy efficient technology, or also activities that “passively” encourage such investment, such as information campaigns?* Measures in the latter category are difficult to monitor and verify, and present difficulties in demonstrating “additionality”.
3. *Only activities within the host country, or also those in other countries?* While investment abroad may help fulfil the climate objectives of the scheme it may not contribute to all of the objectives of the scheme.
4. *Only activities that affect particular energy carriers / fuels?* For example, if the scheme is confined to electricity suppliers, should eligible activities be confined to those that improve electricity efficiency, or should efficiency improvements for gas, oil and/or coal be allowed? Similarly, if the scheme includes both electricity and gas suppliers, should electricity suppliers gain credit from investing in gas efficiency and vice versa.⁵
5. *Only activities that improve end-use efficiency, or also those that affect other parts of the energy supply chain?* This choice depends upon whether savings in primary energy consumption are the primary objective, or whether improvements in end-use efficiency are desired for other reasons (e.g., overcoming fuel poverty).
6. *Only activities that improve end-use efficiency in particular sectors, or activities in all sectors?* Generally speaking, a larger set of eligible measures and participants helps identify the most cost-effective energy savings. On the other hand, smaller consumers (both households and SMEs) are often thought to face the biggest barriers to improving energy efficiency, while large consumers are often targeted by other policy measures. With no restriction on sectors, an energy efficiency scheme may lead to low-income consumers subsidising energy efficiency improvements in large industrial and commercial organisations.
7. *Only activities that affect particular groups within those sectors, or activities in all consumer groups?* A requirement that suppliers invest solely in projects that reduce the energy consumption of their own customers would be likely to increase costs. But it is quite possible that restrictions will be introduced on other grounds, requiring some or all of the investment to take place in low-income households. This would require credits to be differentiated by project location, potentially increasing the overall cost of the scheme.
8. *Only certain types of energy efficient technology, or all technologies?* The regulator will need to ensure that all qualifying projects achieve “additional” energy savings, while there may also be other objectives such as promoting certain categories of technology. One possibility is to establish a list of qualifying technologies (e.g., cavity wall insulation, compact fluorescent light bulbs), with associated methodologies for calculating the

⁵ For example, the Italian TWC scheme requires gas suppliers to obtain 50 percent of their certificates from projects that improve gas efficiency, and electricity suppliers to obtain 50 percent of their certificates from projects that improve electricity efficiency.

energy savings those technologies achieve in different types of application. Technologies not included on the list would not be eligible. A more flexible option would be to allow participants to propose additional technologies or site-specific projects, provided that they are able to demonstrate “additional” and quantifiable energy savings. The issues here are analogous to those for project based emissions trading schemes, such as JI and CDM (Jackson, Begg et al., 2001). However, it is likely that the projects encouraged by a TWC scheme will be smaller than most JI/CDM projects.

Some or all of these types of differentiation may be required for a general requirement to undertake energy efficiency measures to be translated into actions that concur with scheme objectives. Against this, differentiation of targets and eligible measures may reduce the scope for cost saving by potentially excluding some activities and increase administrative costs

2.4. Monitoring and verification of energy efficiency activities and compliance

The project-based approach means that the quantity of energy “saved” cannot be directly measured, but must be estimated by comparing measured or calculated energy consumption with a (counterfactual) baseline. The credibility and success of the scheme depends upon how these baselines are calculated for different types of project, and this may be a focus of controversy. The regulator will wish to ensure that qualifying projects achieve energy savings that are *additional* to those that would have been achieved in the absence of the DSM scheme. This “additionality” criterion presents a number of methodological difficulties.

2.4.1. Principles of additionality, baselines and monitoring

The certification of energy savings from energy efficiency projects involves two types of risk (Chomitz, 1998). First, there is the risk of certifying energy savings that are not additional, in that they would have occurred in the absence of the TWC scheme (a “Type II” error). Second, there is the risk of not certifying energy savings that are genuine (a “Type I” error). Type II errors reduce the energy savings achieved by the TWC scheme and divert subsidies away from projects that provide genuine savings, while Type I errors deny funding to worthwhile projects and increase aggregate costs. The methodology for estimating baselines and verifying additionality must achieve an appropriate balance between the two.

There are at least two interpretations of “additionality” in the literature on DSM schemes (Baumert, 1998). The first, *financial additionality*, refers to whether a project would have taken place in the absence of financial support from the scheme. One possibility is that a project would not have been financially viable in the absence of subsidies from the scheme, while another is that various non-price barriers, such as lack of information, would not have been overcome.

Making this criterion operational is problematic, not least because the most cost-effective projects are the least likely to be additional. Possibilities include:

- § accepting any energy-saving project supported by the participating companies as financially additional;

- § accepting any project that falls within certain technical or other categories (e.g., micro CHP) as financially additional;
- § requiring a demonstration of additionality through financial analysis; or
- § requiring a demonstration that specific barriers to implementation are overcome.

The first two approaches are restrictive while the latter two potentially are costly and prone to manipulation.

The second interpretation, *environmental additionality*, relates to the quantified energy savings that can be attributed to a particular project over a specified period of time. In other words, it represents the difference between a baseline or “business as usual” scenario for energy consumption and the measured or estimated consumption following implementation of the energy-saving project.⁶ The key to environmental additionality is therefore the standardised or project-specific baseline, which may be based upon historical data or forecasts, and may refer to either relative (e.g., kWh/tonne) or absolute (e.g., kWh) energy consumption.

There is considerable experience with baseline construction in US DSM schemes (Chomitz, 1998), project-based emissions trading schemes (Jackson, Begg *et al.*, 2001) and the “performance contracting” industry, where energy service companies (ESCOs) contract to provide energy saving projects to clients (Goldman, Hopper *et al.*, 2005). DSM schemes may draw on this experience, but if they are focused upon relatively small-scale projects (e.g., in households) they are likely to require relatively simple rules.

A key issue for baseline construction is whether the baseline is fixed (“static baseline”) or whether it is updated on a regular basis to allow for changes in various factors that affect energy consumption (“dynamic baseline”). These could include weather conditions, occupancy patterns, and user behaviour and these would need to be monitored at the appropriate level. More controversially, the baseline could be updated to allow for changes in those factors that could reduce or eliminate the financial additionality of the energy-saving project. For example, increases in energy prices could make it more likely that a consumer will invest in energy efficiency, or higher standards of energy efficiency may be required by government regulation. Such ex-post changes could increase the “environmental integrity” of the scheme, by increasing the probability that the certified energy savings are additional. At the same time, it would introduce potentially significant uncertainty over the value stream from energy-saving investments and increase the risk to potential investors. To some extent, the balance between these issues can be conceptualised in terms of the allocation of risk, both the regulator’s risk of not achieving policy objectives and the participants’ financial risk when undertaking measures to fulfil their obligation.

Related to the baseline is the *crediting lifetime*, or the period over which savings credits can be generated by a project. This may be expected to vary between technologies and may be less than the technical lifetime of the project. As noted, since uncertainty over energy savings may be expected to increase over time, a specified crediting lifetime may potentially

⁶ As noted above, energy efficiency policy may have objectives other than environmental improvement. Our use of the term *environmental additionality* reflects standard usage in the literature.

be combined with discounting the number or value of credits at a fixed percentage rate. Alternatively, the number or value of credits may be discounted according to the quality of the system for establishing baselines and/or monitoring and verifying actual energy consumption. For example, in the Conservation and Verification Protocols for the US Acid Rain Program, utilities are given the choice between using a comparison group method to establish net energy-savings,⁷ inspecting regularly to ensure that measures remain in place, and using a default method which requires no inspection. The emission credits are discounted at 0, 25 and 50 percent respectively in these three approaches.

2.4.2. Additionality, baselines and monitoring in DSM schemes

DSM policies normally target small-scale energy-saving projects for which sophisticated approaches to monitoring and verification are likely to be inappropriate. Many schemes therefore place emphasis on simplified procedures, including:

- § standardised factors or formulae for estimating energy savings, based on easily measurable data that is available at the time of making the investment;
- § static baselines that are not (or only rarely) adjusted for subsequent changes in exogenous factors such as occupancy patterns and energy prices; and
- § estimation of actual energy consumption following the investment, rather than on-site measurement.

The attraction of this approach is that monitoring and verification is greatly simplified: the regulator merely needs to ensure that a specified number of installations have taken place to an acceptable technical standard. This may be achieved through some form of sampling. Further refinements are possible to help align eligibility with policy aims. For example, it may be necessary to adjust the estimated savings to account for estimated rebound effects (e.g., where the occupants enjoy higher internal temperatures as a result of the insulation) and for the location of the project in the energy supply chain (e.g., end-use projects save more energy than those further up the supply chain). Such adjustments may be expected to vary with the type of project (e.g., rebound effects are larger for heating systems than for lighting) and its location (e.g., rebound effects are larger for low-income households than for high-income households).

In cases where energy savings depend heavily on particular variables, such as the number of hours of use, project-specific rather than standardised baselines may be necessary, combined with the monitoring of relevant variables at the level of the individual project. This combination of dynamic baselines with measured consumption would allow adjustment of energy savings over time as well as providing an incentive to maximise those savings. A relevant model here is the use of performance contracts for energy efficiency, which are used extensively in US public and commercial buildings (Sorrell, 2005).

⁷ There are two possibilities here (Chomitz, 1998). First, conducting a before and after comparison of the energy consumption of consumers participating in the TWC scheme. Second, comparing the energy consumption of participants with those of a control group. Both approaches require the use of baselines that are not pre-specified but observed during project execution (dynamic baselines). Both are also subject to methodological difficulties and entail considerable monitoring costs.

In other cases, a project developer may argue that standard factors are inappropriate for a particular project, and may wish to propose an alternative methodology and demonstrate its validity. The same applies to energy saving technologies for which standard factors have not been developed. These options increase the monitoring and verification costs for both project developer and regulator, but these must be traded off against the potentially greater energy savings. In practice, more than one monitoring and verification methodology may be required: for example, simple approaches for small-scale, standardised projects in the household sector, and more complex approaches for larger projects in industry where the energy savings are site-specific.

In all cases, the methods chosen for monitoring and verification must trade-off administrative costs against the risk of Type I and Type II errors. An emphasis on straightforward methods will economise on monitoring and verification costs while increasing the risk of Type II errors.

2.5. Compliance and enforcement mechanisms

Adequate compliance and enforcement mechanisms will be necessary to ensure both the credibility of the DSM scheme and the effective operation of trading mechanisms that may be present in the scheme. Participants must comply with the monitoring, verification and reporting protocols for projects as well as meeting their individual energy saving targets.

Compliance with targets may be enforced through a financial penalty. This can be specified in relation to the kWh of energy “not” saved, or can be unrelated to the extent of non-compliance. A fixed per kWh penalty effectively creates a ceiling on the overall cost the scheme. A relatively low penalty may mitigate the price risks of the scheme, while at the same time creating the parallel risk that the energy saving target will not be achieved (Jacoby and Ellerman, 2004).

An alternative to a fixed penalty could be the imposition of more stringent energy saving targets for subsequent compliance periods. Compliance may be assessed at the end of each compliance period (for a cumulative savings target) or at the end of the scheme (for a lifetime savings target), and in both cases a reconciliation period may be used, to give participants an opportunity to acquire additional credits if they have failed to comply. If participants remain out of compliance at the end of the reconciliation period, more severe penalties could be imposed.

2.6. Market design and mechanisms

An important feature of energy efficiency schemes is that project developers typically are not the same organisations as those on whom obligations are imposed. This is an important difference between energy efficiency and emissions trading schemes. In emissions trading, the obligation typically is imposed on the source of emissions, which also is expected to be the party able to take the actions necessary for emissions abatement. For example, the obligation in a NO_x trading programme can be imposed on electric utilities, who can receive compliance credits by altering their equipment (e.g., install low-NO_x burners) in a way that demonstrably reduces emissions.

By contrast, the obligated party in energy efficiency schemes typically does not itself carry out energy efficiency measures. Markets for energy efficiency measures, such as the installation of insulation or retailing of energy efficient appliances, typically exist separately from the supply of energy. The energy efficiency scheme therefore requires rules that determine how the “ownership” of the savings arising from a particular energy efficiency measure can be attributed to an energy supplier, which in turn can claim credit for these to demonstrate compliance under the scheme.

The most common arrangement for this is sub-contracting, whereby the supplier (or other target group organisation) contracts with a third-party project developer, who in turn carries out the eligible energy efficiency measures. This is similar to other commercial contracts, specifying a time period for delivery and defining the obligations of each party. Sub-contracting also can be carried out in several steps, with suppliers contracting with one organisation, which in turn contracts with others to carry out the energy savings measures. In both cases, such arrangements require certification procedures whereby the regulator recognises the supplier’s ownership of the resulting savings, such that these contribute towards the supplier’s obligation.

The rules that allow for suppliers to claim ownership in this way are a form of “market mechanism”, as they establish how one party (the energy supplier) can carry out transactions with another party in order to acquire credits for compliance. As there typically would be a payment from the supplier to the contractor, sub-contracting can be regarded a form of vertical “trading” in energy efficiency. Whether formal credits are issued or not, the effect is to establish a market for energy efficiency credits, as implicitly embodied in energy efficiency measures.

2.6.1. White certificate schemes

This trading can be further formalised. This is the idea behind the concept of “white certificates”, which establishes methods by which credits for savings are turned into a fungible commodity. A white certificate in this context is a standardised and official record certifying that a specified amount of savings have been carried out according to scheme rules, and which is recognised by the regulator for the purposes of scheme compliance. Such records can be made “tradable”, i.e., bought and sold by various parties.

An important result of such arrangements is that the value of energy savings for scheme compliance purposes is separated from the original measure undertaken. For the purposes of compliance with scheme obligations, it does not matter to the supplier what original measure was undertaken. This creation of a separate commodity for scheme compliance is a key feature of certificates scheme more generally. For example, in a “green certificates” scheme to encourage electricity generation from renewable energy sources, the green certificate can be traded entirely separately from the electricity market. This makes the certificate both an accounting unit and a valuable and standardised commodity.

For this commodity to be created additional scheme provisions are necessary. It needs to be specified which organisations are able to generate, hold, and “redeem” certificates. As with the set of eligible energy efficiency measures, it generally is more likely that if a larger set of actors is authorised to generate certificates more cost-effective measures will be included. Similarly, unrestricted access to trade may help the development of an efficient market, for

example through the participation of brokers or other intermediaries. Similar to emissions trading schemes, a scheme registry is likely to be required in order to record holdings of certificates, to track changes in certificate holdings as a result of trading, and to record the withdrawal of certificates used to demonstrate compliance.

The certificate market is likely to work best if certificates are fully fungible, but fungibility may be restricted to achieve certain policy objectives. In particular, where savings targets are differentiated by the factors mentioned above (beneficiaries, location, etc.), different classes of certificates may be required. For example, the Italian white certificate scheme requires electricity suppliers to achieve 50 percent of their energy saving targets through reductions in electricity consumption, while the remainder may be achieved through reductions in any form of primary energy. Similar rules applied to gas suppliers. These restrictions are implemented through the use of three types of certificate - electricity, gas and other fossil fuels - that are only partially fungible.

2.6.2. Banking and borrowing

In addition to trading between different entities at the same point in time, schemes also may contain provisions for trading across time periods, i.e., allowing savings to be used for compliance in different from that in which they were generated. Such “carry-over” or “banking” allows energy efficiency measures undertaken in one period to be used to meet targets in subsequent periods. Experience with emissions trading suggests that this additional temporal flexibility can increase the scope for cost saving (Ellerman, Joskow et al., 2000). Banking may be unrestricted, or there may be various restrictions. For example, there may be a limit on the proportion of the obligation that can be met through credits for savings generated in a different period. Or, there may be a maximum lifetime period for credits, beyond which they no longer are valid for compliance purposes.

The converse of banking is “borrowing”, which allows a participant to under-comply during one compliance period provided that they over-comply during a subsequent compliance period. The equivalent of an interest rate may be imposed (consistent with the discounting of savings over time discussed above). As with emissions trading schemes, existing and proposed energy efficiency schemes generally have included banking but have not included borrowing, reflecting concerns about the possibility of long-term non-compliance. However, a modified version of borrowing may in effect operate through the compliance regime. For example, the punishment of non-compliance through the imposition of more stringent energy saving targets for subsequent periods amounts effectively to a form of borrowing.

Banking and borrowing can occur between periods if compliance is assessed at the end of each period (e.g., for a cumulative savings target). But if compliance is only assessed at the end of the scheme (e.g., for a lifetime savings target), their use is more problematic. While it may be anticipated that the scheme will be extended and that banked credits will have value, this will be subject to some uncertainty. Generally, a scheme with periodic assessment of compliance is likely to generate significantly more trading activity than one with a single assessment of compliance at the end of the scheme.

2.7. Summary

The design of a “DSM scheme” similar to EEC requires consideration of a range of factors, many of which are common to environmental policies involving an obligation or project-based crediting (such as project-based emissions trading schemes). However, certain features of DSM schemes introduce additional complexity, such as the need to estimate energy savings through comparison with a counterfactual scenario. The potential denomination of the target in terms of lifetime energy savings (rather than savings in the current compliance period) also represents a substantial departure from many other schemes. In addition, DSM schemes typically have multiple objectives, some of which may be unrelated to environmental policy. This introduces separate design considerations and may reduce the scope for cost saving, as well as the fungibility of certificates with other schemes.

3. Overview of the Operation of EEC to date

This Chapter uses the concepts developed Chapter 2 to discuss the design and operation of the EEC. The discussion is based around the six categories of design features introduced in Chapter 2. In each case, we summarise the design features of the EEC and the views of stakeholders on those design features. This information is taken from 21 interviews with 18 different stakeholders in the period October 2005 to January 2006, including representatives of all eight energy suppliers participating in the EEC. The trading elements of the EEC are discussed in more detail in Chapter 4.

3.1. Target group and location of obligation

The EEC places energy-saving obligations on suppliers of gas and electricity to domestic customers. During EEC 1 (2002 to 2005) the minimum size threshold for participation in the scheme was 15,000 domestic customers, but this has been increased to 50,000 customers during EEC 2 (2005 to 2008). Qualifying energy savings apply to the use of coal, electricity, gas, liquid petroleum gas, and oil by household customers, with no restrictions on the share of energy savings to be achieved from each energy carrier.

The obligation rests with companies holding a gas or electricity supply license. Difficulties may arise in the event of exit or entry of suppliers from or to the market. In particular, it is unlikely that the regulator will be able to enforce the obligation of a supplier that is exiting from the market. When another supplier takes responsibility for the customers of the exiting supplier, it does not need to assume the EEC obligation. In the Renewables Obligation, the exit of suppliers from the market has raised concerns about the level of demand for—and hence the future value of—green certificates. Similar concerns could arise if the EEC were transformed to a more formal white certificate scheme.

Stakeholders, including suppliers, generally considered that electricity and gas suppliers were the most appropriate group on which to impose an obligation. The chief reason for this was that suppliers already have contact with and are known to consumers, which is not the case for other players in the energy supply chain such as electricity or gas distribution companies. It also was noted that it might be desirable to have the obligation on entities that are subject to licensing conditions, as it otherwise may be legally difficult to enforce scheme provisions.

Some stakeholders raised the possibility of imposing the obligation on parties outside the electricity and gas supply chain. One supplier thought that if the installation of insulation was the primary outcome of the scheme, it would be more appropriate to engage directly with the insulation industry, perhaps through a subsidy scheme. This echoes the broader evolution of energy efficiency programmes from obligations on utilities to more broad-based market transformation programmes. Another possibility raised by stakeholders was to locate the obligation on Local Authorities. This was based on the observation that Local Authorities already have some obligations under the Home Energy Conservation Act (“HECA”), and that there was an increasing trend for some EEC measures to be carried out in partnership with Local Authorities.

3.2. Definition and allocation of targets

Credits and targets in the EEC are defined in terms of “lifetime-discounted fuel-standardised terawatt hours” (TWh) of energy benefits. Although the EEC applies only to gas and electricity suppliers, the energy benefits may be achieved through investments affecting any types of energy carrier.

The denomination of targets reflects the multiple objectives of the Scheme. First, the targets are denominated in terms of kWh “energy benefits” rather than energy savings, to reflect the fact that investment in household energy efficiency may improve comfort levels without necessarily reducing energy consumption. Energy benefits are quantified for different categories of energy efficiency project and can remain positive even when projects lead to no reduction in energy consumption. Second, these energy benefits are calculated for the lifetime of the relevant projects, with future savings discounted at 3.5 per cent annually. Third, the energy benefits are “fuel-weighted,” to reflect the relative contribution of different energy carriers to reductions in primary energy consumption at the national level.⁸ For example, reductions in electricity use are credited with more than twice the energy benefits of reductions in gas use. Finally, for EEC 2 the fuel weighting is adjusted to allow for the relative CO₂ content of different fuels. Improvements in the efficiency of coal used for household heating will therefore be credited with more kWh energy benefits than improvements in the efficiency of gas use. The scheme therefore emphasises reducing CO₂ emissions rather than reducing energy consumption per se, but at the same time has objectives that go beyond CO₂ abatement alone.

During Phase 1 of the EEC, suppliers were required to invest in measures that delivered a total of 64 TWh of energy benefits by the end of 2005. The corresponding target for Phase 2 is 130 TWh by the end of 2008. Supplier targets are based on the number of household consumers served by each supplier and are revised annually. During EEC 1, more stringent targets were applied to larger suppliers in order to reflect economies of scale in administering energy efficiency programmes. However, this provision has been eliminated for EEC 2 (2005-2008).

Stakeholders generally thought it unimportant whether the current denomination was changed more directly to reflect CO₂ emissions. Most remarked that CO₂ was adequately accounted for in the current denomination, although some thought that denomination in terms of avoided CO₂ emissions could make it easier to communicate with customers. One stakeholder thought that a change to a white certificate scheme should be accompanied by a change to a more straightforward denomination in CO₂, as one of the benefits of white certificates would be to facilitate fungibility with other policies, and emissions trading schemes in particular.

All suppliers thought that targets were demanding and indicated that the cost of compliance with EEC requirements was a significant part of overall company costs. Generally speaking, suppliers felt that increasing costs have meant that internal company interest and resources devoted to EEC have increased. Also, most suppliers stated that (at least in the

⁸ Interestingly, this weighting is also applied to measures whose benefits are largely taken up in improved comfort levels and hence lead to no reduction in primary energy use.

long-term) the costs of the EEC were passed on to consumers through the unit charge for electricity. However, they also stressed that it was difficult to separate the “EEC component” of the electricity price from other influences, notably the wholesale electricity price. Furthermore, suppliers commented that it was difficult precisely to attribute costs directly to EEC as these were difficult to measure and incurred by many different divisions of the company. For example, EEC imposes requirements on legal and other administrative departments but these are not necessarily ever tallied and assigned directly to an “EEC line item” in company accounts.

Suppliers also stressed that uncertainty about future levels of targets, beyond 2008, was very unwelcome as it made it difficult to plan and invest in future activity, including assessment of the need for innovation. We discuss aspects of the future development of costs and general sources of uncertainty that suppliers face in more detail in Chapter 4

3.2.1. Priority Group Requirement

The EEC requires that 50 percent of energy efficiency measures be achieved among a Priority Group of customers, defined as those in receipt of certain welfare benefits or credits.

Suppliers generally indicated that fulfilling the PG requirement was onerous and that the cost of measures for the PG group was significantly higher than for the non-PG group. The chief reason for this was that suppliers could not require PG customers to contribute towards the cost of the measures. In addition, the cost of finding PG customers and the extra documentation requirements added to the expense. While suppliers were reluctant to cite specific cost figures, one indicated that measures in the PG were around twice as expensive per kWh generated while others said it probably was more than that. As discussed below in Section 6, the existence of two different targets with different costs would have implications for the feasibility of establishing a white certificate programme.

Another aspect of the PG requirement mentioned by suppliers was the risk of non-compliance if economic opportunities for efficiency measures were to decrease. To date, the majority of PG compliance activity has been carried out either through lighting or through insulation programmes in partnership with social housing providers and/or Local Authorities. However, suppliers indicated that changes to the rules in EEC 2005-2008 meant that lighting had become less cost-effective. Also, the cost of insulation schemes in the PG were thought to be increasing rapidly and at a greater rate than costs in the non-PG group. The main reason cited was that the PG population was relatively small compared to the target, creating a need to make a greater percentage savings in total PG consumption to achieve a given absolute amount of savings. In addition, the marketing possibilities and third-party routes to reach PG customers were fewer and more expensive, and access to a social housing provider was frequently a necessity. If this is correct, it may be that the difference in cost between PG and non-PG will diverge further in the future.

3.2.2. Definition and certification of eligible energy efficiency activities

Ofgem, in its capacity as scheme regulator, determines whether particular activities are eligible to count towards suppliers’ obligations under the scheme, and also determines the savings attributable to a particular measure. Proposed measures must be notified to Ofgem within a month of commencement, including details about how they would be promoted and

implemented, and who would be expected to benefit. Ofgem also determines the calculation of energy savings arising from a particular measure, based on the methodology set out by Defra. This includes an adjustment to address the “additionality” issues discussed above and an estimation of the likely “rebound” (or “deadweight”) effects for each measure.

In practice, the procedures for approving, notifying and calculating the energy savings resulting from each measure are highly standardised. This reduces the uncertainty faced by suppliers about the cost-effectiveness of a measure and minimises the administrative costs for both suppliers and Ofgem.

All suppliers stressed that greater stability and predictability in the savings attributable from particular measures would be welcome. Some cited the changes in rules between EEC 2002-2005 and EEC 2005-2008 as undesirable and felt that although suppliers generally benefited from the changes, the very fact that rules were changed was harmful as it created uncertainty and made planning and advance investment difficult. One aspect of this was the investment made in relationships with third parties (notably manufacturers) in lighting and appliance sectors, which were felt no longer to be cost-effective methods to achieve savings. Another concern was that insufficient capacity for energy efficiency measures would be availability in future years. Several stakeholders drew attention to how changes in the Scheme rules may affect the supply chain for energy efficiency measures. In particular, it was thought that a “start-stop” cycle of demand for third-party services could undermine the functioning of the market.

3.2.3. Overall compliance activity

The EEC 2002-2005 required electricity and gas suppliers to achieve an energy savings target of 62 TWh in households in Great Britain between 1 April 2002 and 31 March 2005. There originally were twelve suppliers with obligations under the EEC.⁹ Ten of these met their targets, while two ceased trading and consequently also did not meet their EEC obligations. This resulted in a shortfall of nearly 1 TWh. As required by the scheme, at least 50 percent of the savings were achieved in the Priority Group.

EEC 2 began on 1 April 2005 and suppliers had the option to bank any energy savings in excess of their EEC 1 targets to count towards their new targets. The total amount of over-compliance in the 2002-2005 period amounted to just under 26 TWh, which corresponds to around 42 per cent of the Phase 1 target (62 TWh). Because of adjustments in the energy savings calculations, this corresponds to 35 TWh in Phase 2, or nearly 27 percent of the Phase 2 target (130TWh). This suggests that the exit of two suppliers had little effect on aggregate compliance.

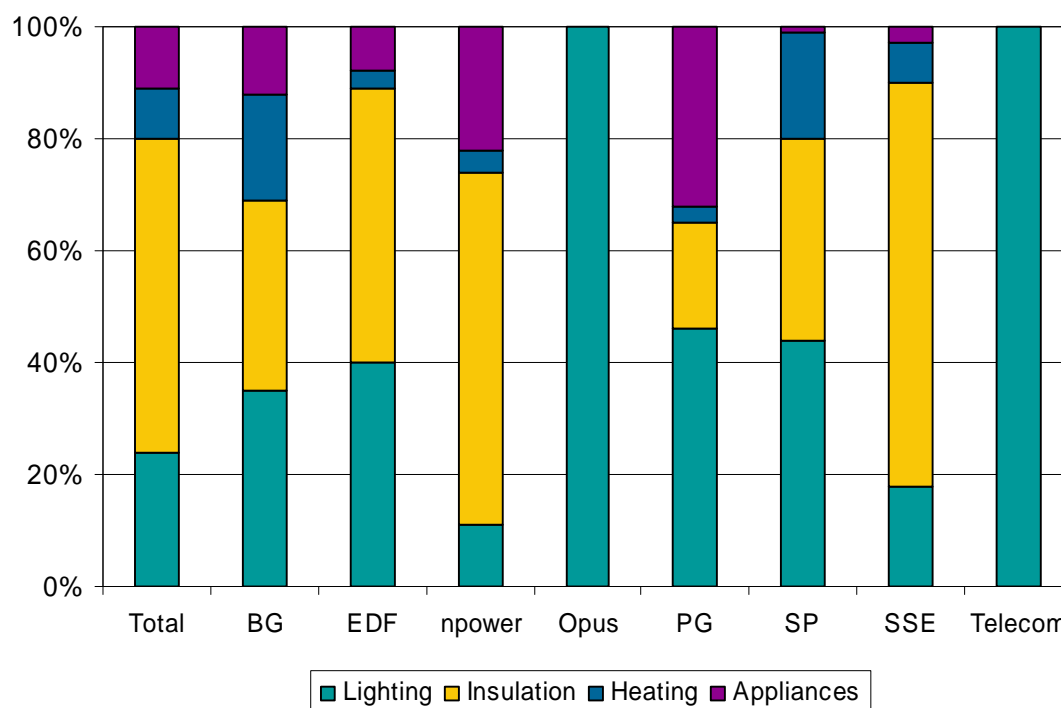
3.2.4. Types of measures undertaken

Targets were achieved through a combination of measures, of which various forms of insulation was the most significant, followed by distribution of energy efficient light bulbs, expansion of the market for energy efficient appliances and improvements in household

⁹ The suppliers were Atlantic Electric and Gas, British Gas, Cambridge Gas, Dee Valley, EDF Energy, npower, Opus Energy, Powergen, Scottish and Southern Energy, Scottish Power, Telecom Plus, and TXU Energi. TXU Energi and Atlantic Electric and Gas went into administration and administrative receivership respectively during period

heating systems. Figure 3.1 shows the proportion of savings achieved by each measure, for each supplier and overall.

Figure 3.1
Savings Measures Undertaken by Suppliers in EEC 2002-2005



Source: Ofgem (2005)

Most suppliers expected that insulation would become even more important in EEC 2 than in EEC 1, particularly in the non-PG segment. (This also was the basis on which overall targets were set.) The main reason for this was that changes to the rules for lighting and appliance schemes (in particular, the calculation of the “heat replacement effect”) made these less cost-effective.¹⁰

The dominance of insulation was considered by some suppliers to be inimical to the aims of the Scheme. Some suppliers were concerned that the EEC was at risk of becoming a “single-measure scheme”. These suppliers felt that such an outcome was undesirable, as it would not constitute a well-rounded approach to energy efficiency policy. For example, they considered it inefficient that the current scheme resulted in a single measure being undertaken in a large number of houses, while a better approach would be to look at buildings as a whole and consider multiple measures within households receiving an initial measure. Others argued that although EEC is a good instrument for general energy efficiency policy it is an unnecessarily complicated mechanism for improving the thermal insulation of the housing stock; a subsidy scheme for insulation was suggested as a less cumbersome way to achieve the same outcome. Other stakeholders noted that compared to other measures, insulation is

¹⁰ This refers to the treatment of heat produced by lighting and appliances. For example, replacing a normal tungsten light bulb with a compact fluorescent causes less waste heat to be produced, leading to increased demand for space heating.

“invisible” and therefore not a good contributor to behavioural change, which may provide a better longer term strategy for improving energy efficiency. Finally, the dominance of insulation as the preferred measure was held by some to mean that EEC would not be a good mechanism for encouraging innovation or the emergence of new approaches to energy savings.

Some suppliers thought that other measures could become competitive as the availability of additional insulation opportunities decreased. Against this, other suppliers feared that scheme targets and rules were not realistically accounting for a potential gap in measures in future periods and that not enough consideration had been given in modelling to “what comes after insulation”.

3.2.5. Innovation and energy service uplifts

The Scheme contains special provisions to encourage particular delivery methods, *viz.* the “innovative” and “energy service” measures. “Innovative” in this context means measures that have not previously been used to generate savings under EEC, and which can be demonstrated to be superior to existing methods. For the purposes of EEC, an “energy service action” is one that leads to an improvement of a household’s energy efficiency by at least 13 percent, and which is accompanied both by an energy audit and by a long-term credit agreement between the supplier and the householder. Measures deemed to be in these categories are given a 50 percent “uplift”, albeit subject to constraints on the proportion of total credits that can benefit from these provisions.

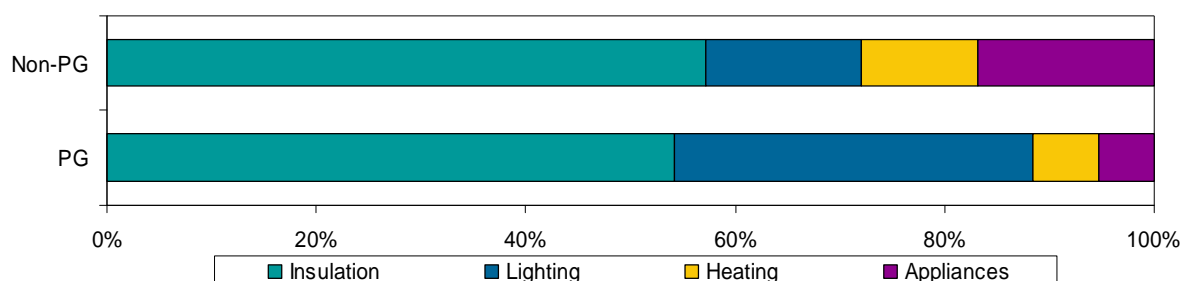
Suppliers generally felt that these provisions were welcome, and that the innovation uplift could become more important with time, as insulation became less dominant. However, stakeholders also noted that innovative or other “non-standard” activity accounted for a very small proportion of total savings effected. Some remarked that procedures for certifying untried measures were cumbersome, and also cited the uncertainty about the return to investments in innovation. However, most thought that the main reason for the dominance of established measures was that existing and approved measures were cost-effective.

Suppliers generally did not think that an energy service approach to EEC compliance was viable, as it was normally significantly more expensive than other measures – despite the uplift. Despite this, some suppliers said they had either existing or planned energy service products that they hoped to make available to customers, although on a limited scale and more as pilot projects than as core business activities. In general, stakeholders did not think that there was a viable energy services business model for the household sector under current scheme rules and given prevailing energy prices.

3.2.6. Activities in the Priority Group

There was a systematic difference in the measures undertaken in the PG and non-PG segments, with a greater proportion of lighting measures and a smaller amount of insulation among PG customers. Figure 3.2 shows the measures used to demonstrate compliance with the 2002-2005 EEC targets. This does not include the savings carried over to the 2005-2008 period, a disproportionate share of which derived from insulation measures.

Figure 3.2
Percentage energy savings to EEC target by type of measure



Source: Ofgem (2005)

3.3. Monitoring and verification of energy efficiency activities and compliance

As noted above, Ofgem is the administrator of the EEC and has overall responsibility for the determination of individual targets and *ex ante* approval of proposed measures. In addition, Ofgem is responsible for monitoring the outcome of measures once completed to confirm the exact types and numbers of measures undertaken. To gain approval, suppliers and project partners must supply adequate documentation confirming that measures have been undertaken. Monitoring is also required of the quality of installed measures, the degree of customer satisfaction and the proportion of savings that are achieved in the Priority Group

In EEC 1, Ofgem monitored progress towards the target through quarterly reports from suppliers on the activity undertaken, together with estimates of the energy savings achieved. These in turn were communicated to stakeholders through Ofgem's quarterly "EEC Update" reports. In addition to ongoing monitoring, there was independent verification of activity through two rounds of independent auditing during EEC 1 compliance status was determined at the end of EEC 1, including formal adjudication by Ofgem on whether the activity undertaken by suppliers constituted "qualifying action" under the Energy Efficiency Order ("EEO"), including whether 50 percent of total approved energy efficiency measures had been achieved in relation to the Priority Group. Consistent with the "deemed savings" approach of the EEC, there was no monitoring of actual energy use "before and after" the installation of particular measures, but savings were estimated using standardised factors.

As noted, savings credits are awarded once for the estimated lifetime energy savings of an individual project, rather than for the energy-savings within the current compliance period. As an example, for EEC 1, it was specified that the installation of cavity wall insulation in a detached house save an average of 5.24 MWh per year over a period of 40 years. This figure:

- § varied with easily measurable variables such as the type or age of house, but did not vary with hard to measure variables such as the efficiency of the boiler;
- § implied a static baseline that did not vary in response to subsequent changes in key variables such as house occupancy, energy prices or changes in building regulations; and
- § was an estimate of energy savings and did not depend on measurements of actual consumption within individual households;

Suppliers are not required to comply with targets each year, but only at the end of each three-year period. Compliance with the PG requirement is a necessary condition for overall compliance. Penalties for non-compliance with the targets are designed to be dissuasive. The exact size of the penalty would be determined by Ofgem on a case-by-case basis, with a maximum fine amounting to 10 percent of total turnover. One stakeholder commented that the size of this penalty may mean it lacks credibility, and that it was unclear whether it would be enforced in all circumstances (e.g., in the event a supplier missed its target by a small amount).

Suppliers generally thought that monitoring, reporting and verification (“MRV”) requirements were substantial, requiring significant administrative effort and sophisticated IT systems. Opinion differed about the scope for relaxing requirements. Some suppliers thought that there were easy steps that could be taken, while others thought that simpler procedures would mean less rigorous procedures, potentially threatening the integrity of the scheme and leading to uncertainty about whether savings were additional to “business as usual”. With some exceptions, suppliers generally thought that current procedures struck an appropriate balance, given the general framework of the EEC. Suppliers raised concerns that the increasing scale and complexity of the scheme was increasing MRV and other administrative costs.

Suppliers noted that Ofgem and suppliers currently are reviewing procedures and that both wish to see simplifications. The possible areas mentioned included the requirement for customer satisfaction surveys and the retention of documents over the long-term.

All stakeholders commented that the PG requirement significantly increased the administrative burden. Also, some thought that the documentation requirements in this group were likely to dampen the uptake of measures, potentially significantly. Some commented that the documentation requirements to establish that a particular consumer was in the priority group constituted an intrusion of privacy and that customers were reluctant to provide this information to their electricity supplier.

In addition to external monitoring and reporting, all suppliers said that they had systems in place internally for the continuous monitoring of progress relative to target, typically on a monthly basis. This indicates that, while the communication of information to Ofgem posed an additional burden, much of the monitoring of progress is anyway carried out by suppliers and is likely to be part of any system based on an obligation with heavy potential penalties.

3.4. Market mechanisms and design

Suppliers differed in the extent to which they were directly involved in the identification and execution of energy savings programmes. Suppliers carry out some marketing directly to their own electricity customer base, for example, through bill inserts and the use of information about customers to target marketing about schemes. However, most suppliers said this route to reach customers is becoming less important, partly because the returns to such advertising are declining, but mainly because the total volume of savings required for compliance is far higher than what can be achieved by suppliers directly.

Most of the savings undertaken under the EEC thus are carried out by third-party contractors. A wide range of different organisations are involved, including:

- § Managers of housing stock (Social Housing Providers, Local Authorities, housing developers),
- § Installers of energy efficiency measures,
- § Manufacturers and retailers of energy efficient products,
- § “Managing Agents” and other intermediaries between other groups of third parties and suppliers,
- § Marketing outlets (charities, doctors, benefit groups, etc.)
- § Consultants (providing advice, taking on part or all of the management of suppliers’ target)
- § Other government programmes (notably, Warm Front and Welsh and Scottish equivalents)

“Third parties” thus play several roles in the supply chain of energy efficiency measures including the generation of ideas, marketing, identification of locally required measures, consultancy on implementation, intermediation between suppliers and consumers, funding, documentation for monitoring and reporting, equipment manufacture and installation. The system can perhaps best be described as one of outsourcing, where suppliers contract for EEC-compliant savings in a market for energy efficiency services.

Suppliers generally thought that the market for energy-saving measures was competitive and functioned well. The possible exception was retail chains, owing to the limited number of national chains of white goods and other appliances, and to the fact that some retail chains had entered into exclusive arrangements for EEC activity with a single energy supplier. More generally, some expressed a concern that smaller energy suppliers were unable to enter into exclusive or long-term agreements with third parties and that this may mean that their costs and risks of procuring in the third-party market are higher.

Suppliers differed in their approach to procurement from third parties. Some relied mainly on a tendering process for individual contracts, with a view to obtaining the best price in each case. Others preferred to rely on long-term bilateral contracts with installers and agents. It was acknowledged that the latter approach might result in higher prices on individual projects, but at least one supplier thought that an important advantage was that it had more control over the quality of the efficiency measures installed. This was thought important as poor quality (e.g., delays, malfunctioning equipment, etc.) could damage the relationship with the customer and put the supplier’s brand at risk. Other advantages of long-term agreements included the certainty of having access to a reliable third party for future projects and the lower transaction costs associated with dealing with a single supplier.

While all suppliers relied heavily on this form of outsourcing, there was general agreement that suppliers needed to maintain an interest in individual projects. This was partly because suppliers wished to preserve a link with the customer benefiting from the energy efficiency measures, but also because close involvement was felt to be required to monitor programmes and ensure they resulted in the savings that were planned.

3.5. Summary

EEC currently includes a range of eligible energy efficiency measures, implemented by a wide range of different organisations. However, there is an increasing emphasis on a few measures, especially cavity-wall insulation. Some stakeholders thought this risked turning the scheme into a single-activity operation rather than a broad-based energy efficiency activity. However, the focus on some activities may just be a reflection of their cost-effectiveness.

Most stakeholders agreed that the location of the obligation on suppliers was appropriate, and most suppliers thought it unimportant whether the current denomination was changed more directly to reflect CO₂ emissions. All suppliers thought that targets were demanding and cited compliance with EEC requirements as a significant cost for their company. Most indicated that costs probably were passed through to consumers, at least in the long run, but stressed that detailed information could not be provided for reasons of commercial sensitivity. Many suppliers regarded the priority group requirement as an onerous aspect of the scheme primarily because it is expensive, but also because a scheme with multiple objectives was more complicated.

All suppliers stressed that greater stability and predictability would be welcome, especially in the savings attributable from particular measures and the long-term targets to which suppliers will be subject.

The scheme involves a range of different types of third party organisations in the supply chain of energy efficiency measures. Most stakeholders interviewed thought that the scheme has been successful creating efficient delivery of the eligible energy efficiency measures.

4. Operation of Flexibility Provisions in The Current EEC

This Chapter discusses the use of flexibility provisions in the EEC scheme. It starts with a theoretical overview of the general situations where “trading”, broadly defined, would be expected to contribute to the cost-effectiveness of a DSM scheme. Next, we analyse the potential benefits of such trading within the EEC. Finally, there is an overview of the use of flexibility provisions in EEC 1.

4.1. Theoretical overview of trading provisions

In general terms, the aim of introducing trading provisions in a scheme to promote energy savings is to help ensure that scheme objectives are achieved in a cost-effective way. Trading can promote this by providing incentives for the identification and implementation of the cheapest available measures.

In general terms, there are two main potential benefits from trading. First, trading has the potential to lower the total cost of achieving a given aim. The significance of this benefit depends on the degree on *cost heterogeneity*, i.e., differences in the costs per unit of savings between different participants or over time. Participants with low cost savings opportunities can generate credits on behalf of high-cost participants in return for a financial payment. This allows both parties to benefit, with the cost savings depending upon the cost differential between the participants.

Second, trading can help mitigate the risk to participants. The risk may be one of high costs, in the event a particular participant faces increased costs that other participants do not. In addition, trading provisions can help protect against the risk of non-compliance. From the point of view of a participant, the ability either to purchase credits or draw on a pool of “banked” credits can help avoid non-compliance and any penalties associated with this. From the point of view of the regulator, the risk of not meeting scheme aims is decreased if individual participants are able to draw upon the compliance opportunities of all participants rather than on those available to themselves only.

Both cost heterogeneity and opportunities for risk mitigation may arise in a number of different contexts: between similar participants with different access to savings measures; between costs faced by the *same* participant but at different points in time; or between different types of organisation, where only one has an obligation under the scheme. Each of these cases is discussed in more detail below.

Against these potential benefits, trading provisions generally require more complicated rules, for example, to allow energy savings to be reliably certified and transferred to others. The requirements for monitoring, reporting, and verification also may need to be more demanding. In addition, there may be transaction costs associated with using the market, such as brokering fees, contractual arrangements, or time spent in locating the cheapest available seller. Such administrative costs need to be weighed against the benefits of trading.

We discuss below three main forms of flexibility provisions in this section:

§ *Horizontal flexibility*: Where trading is allowed between different participants in the EEC scheme.

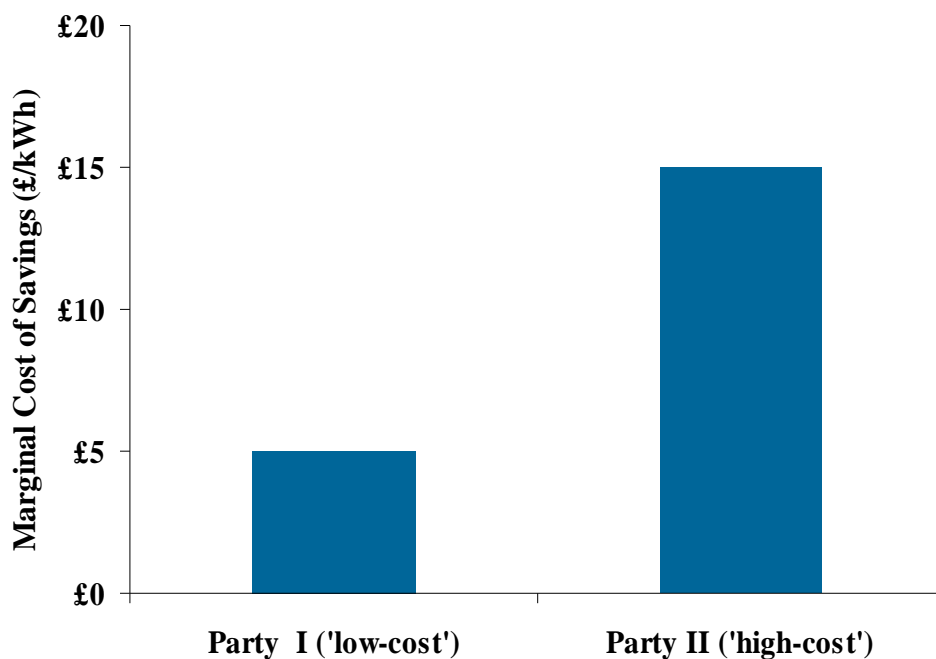
- § *Vertical flexibility*: Where participants are allowed to meet their required savings target by claiming credit for measures carried out by other, legally distinct parties. In effect, the implementation of energy efficiency measures is *outsourced* or *sub-contracted* to third parties.
- § *Temporal flexibility*: Where a participants' overcompliance with a target during one target period is allowed to be carried over (or "banked") and used for compliance during the subsequent target period.

4.1.1. Horizontal flexibility: conventional trading

Perhaps the most familiar type of trading provisions are those for horizontal trading, i.e., trading between participants with an obligation under the scheme. In an energy savings scheme, such trading normally would denote transactions between parties with an obligation to ensure that savings are undertaken, typically energy suppliers. Cost heterogeneity arises in this context when costs differ between suppliers.

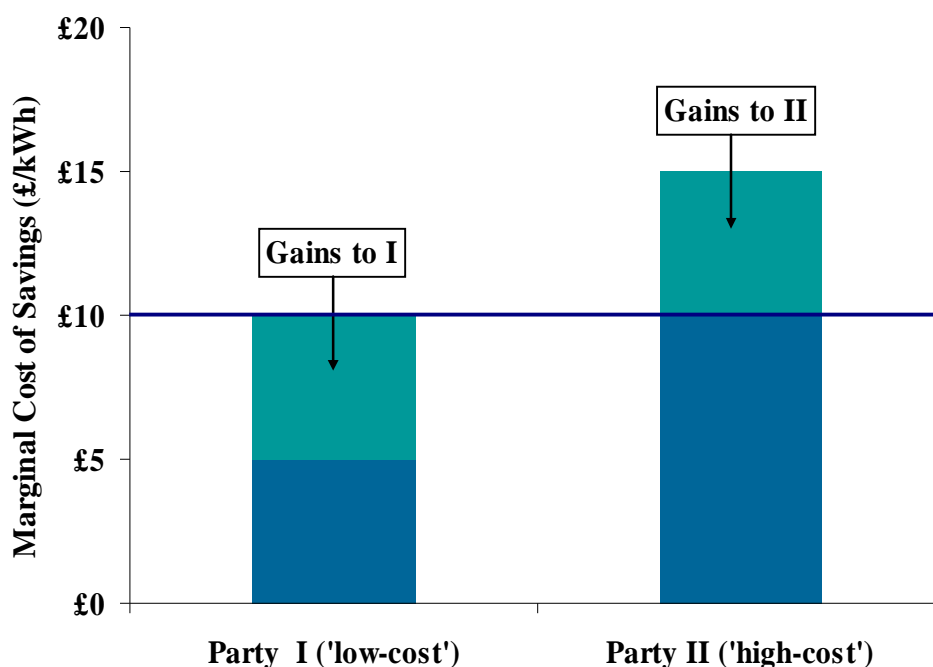
The benefits of trading in such a situation can be illustrated using a simple numerical example. Figure 4.1 shows the marginal (i.e., per-unit) costs of savings for two different suppliers. Party I is "low-cost" and able to effect savings at a cost of £5 per MWh saved, while Party II's costs to accomplish equivalent savings are £15 per MWh saved. Under a "command-and-control" type of regulation, each supplier would have an obligation to undertake their own savings, and Party I would pay £5/MWh while Party II would pay £15/MWh.

Figure 4.1
Example of compliance cost heterogeneity
between participants in a trading scheme



In this situation, both suppliers can gain from a reallocation of savings whereby Party I agrees to undertake some savings in Party II's stead. In other words, Party I and II can "trade" savings, such that Party II buys from Party I. In Figure 4.2, the effects of a trade at a price of £10 per MWh are illustrated. For each MWh exchanged at these costs and price, Party I makes a gain of £5 by selling savings at a price higher than their own cost of effecting the saving; conversely, Party II makes a gain of £5 from buying at a cheaper price than it would have cost them to effect the equivalent savings themselves. The total gain is £10 per MWh, compared to the situation where no trading takes place.

Figure 4.2
Potential cost savings from trading in the presence
of cost heterogeneity between participants



This is a stylised and very simple example, but illustrates how the presence of cost differentials offers the scope for cost savings through trading.

Horizontal trading also can take different forms depending on how transactions are specified. Specifically, it is useful to distinguish between:

- § *trading of targets*: where one participant takes on responsibility for meeting a portion of the target of another participant, in exchange for a payment;
- § *trading of credits or certificates*: where one participant sells verified energy savings, or “credits” to another participant; and

The three categories can be seen as an evolution from “bubble” arrangements, as found in some emissions trading schemes, to a formal certificate scheme. Both vertical flexibility and temporal flexibility are possible with each type of horizontal trading scheme, or indeed without any horizontal trading.

There are some other important distinctions between the three categories. Trading of targets can take place before any energy efficiency measures have taken place, whereas both credits and certificates require certification before trades can take place. Target trading thus is similar to a forward contract for credits / certificates.

The forms of trading also differ in the types of organisations that can engage in them. Only suppliers (or other entities upon whom an obligation is placed) can engage in trading of targets, and without formal certificates, the option of trading credits also is only relevant to suppliers. By contrast, under a certificate scheme trading is likely mainly to take place between entities with different status, specifically between project developers (with a right to generate certificates) and the target group (with an obligation to acquit certificates towards

their target). Certificate trading therefore shares important characteristics with vertical trading, which is discussed in more detail in the next section.

4.1.2. Vertical flexibility: third-party contracting

Another form of “trading” is one that takes place between a party with an obligation and another party that is not directly affected by the scheme. In the context of energy savings, such a participant can be referred to as a “third party”, to denote that they are neither the beneficiaries of the savings measures, nor a party subject to an energy saving obligation.

Trading between a party with an obligation and a third party may be termed “vertical trading”, as the party with an obligation in effect sub-contracts or out-sources the work to undertake savings measures to a party that has more expertise or otherwise is better able to undertake the measures. The difference from horizontal trading is that cost differences arise because the two parties are different types of organisation.

In an energy savings scheme, vertical trading is possible if the scheme contains provisions that allow the party with an obligation to meet its required savings target by claiming credit for measures carried out by other, legally distinct parties. A typical example would be a contract between an insulation installer and an energy supplier that is subject to an obligation. Cost differences arise because it would be more expensive (or even impossible) for the supplier to carry out the installation of insulation using its own personnel and organisation. More generally, there are several other reasons why a third party can achieve cost savings compared to the supplier, including:

- § It specialises in energy efficiency services and therefore has lower costs, for example, because of economies of scale in the provision of services.
- § It is typically selected through a process of competitive tendering that provides an incentive to minimise bid costs.
- § It is frequently subject to performance incentives within the contract that provide an ongoing incentive to minimise costs.
- § It has better information about cost-effective opportunities for projects.

Vertical flexibility can also be understood using the figures depicted above. In this case, the “low-cost” party is the insulation installer, whereas the “high-cost” party is the supplier. Both can gain from a situation where one pays the other to undertake the measure. Insofar as the insulation installer earns a margin on the measures it undertakes, it gains from carrying out the measures on the supplier’s behalf. The supplier, meanwhile, stands to gain if it would be more expensive to carry out the measures within its own organisation (although this may be only a theoretical possibility for many measures).

4.1.3. Intertemporal flexibility: banking and borrowing

Another form of “trading” concerns cost differences over time rather than across participants. For example, participants may wish to use credits generated in one compliance period for

compliance in subsequent periods. This commonly is referred to as “banking” or “carry-over” of credits. A participant would be expected to carry credits over if it believed that the discounted future cost of obtaining credits (whether through own compliance or horizontal trading) were likely to be higher than the cost of obtaining those credits in the present.

The benefits from such provisions again are analogous to those under horizontal trading, and can be understood using the graphs presented above. In the case of banking, the “low cost” party represents savings undertaken in the present, while the “high cost” party represents savings by the same organisation but at a later date and higher cost. As in the case of horizontal trading, intertemporal trading of this form can help substitute expensive (future) savings for more cost-effective ones (in the present). Indeed, experience with emissions trading schemes (chiefly in the USA) to date suggests that banking commonly has been an important factor in contributing to the cost-savings from emissions trading.¹¹

In addition, as discussed above, banking / carry-over can help lower the risk faced by participants. One primary source of risk is price volatility, where the cost of credits fluctuates over time. If there is a pool of banked savings, such volatility can be significantly lowered and risk exposure decreased.¹² Closely related to price volatility is the risk that companies are unable to generate enough credits to meet their compliance targets. This may be similar to a situation of increasing costs of credits, but also may occur because of uncertainty about the level of future targets, the eligibility of measures for the generation of credits, etc. The significance of this risk depends on scheme rules, notably on the penalties associated with non-compliance. Hence, even in the absence of cost differences over time, participants may benefit from banking provisions as a means to reduce risk.

Decisions about whether or not to use banking provisions must take into account the opportunity cost of capital. By using resources to invest in credits for banking, a company foregoes the opportunity to use them for other investments, and hence also foregoes the return on capital that those investments would have earned. The company’s decision to carry credits over therefore will only be taken if the expected benefits from cost differences and risk mitigation outweigh this opportunity cost.

It is less common to allow “borrowing” of credits, i.e., the use of credits that have not yet been verified but are expected to be so. Borrowing could help promote cost-effectiveness in a situation where the current cost of generating savings credits is higher than it is expected to be in the future. As discussed below, decreasing costs probably are unusual. In addition, the regulator may feel that borrowing provisions causes uncertainty for the scheme, as it may be difficult to enforce the payback of the “debt” that borrowing companies would build up.

¹¹ See, Ellerman, A. Denny., Joskow, Paul L., and Harrison, David ‘Emissions trading in the U.S., Experience, Lessons, and Considerations for Greenhouse Gases’, Pew Center on Global Climate Change, 2003.

¹² This mechanism has been observed in several emissions trading schemes, perhaps most notably in the case of the California RECLAIM trading scheme for emissions of nitrogenous oxides, where the absence of banking provisions is likely to have contributed significantly to drastic emissions credit price spikes, and possibly exacerbated the power market crisis in 2000.

4.1.4. Administrative and transaction costs

There are a number of administrative costs associated with trading schemes that may not arise with more standard “command-and-control” regulations. We briefly discuss two categories of cost that will be relevant to our discussion of costs in Chapter 5: namely, administrative costs and the transaction cost of using the certificate market.

4.1.4.1. Administrative costs

Energy savings schemes have many similarities with credit-based emissions trading schemes. As in these schemes, there generally is a requirement that energy savings / emissions reductions have been undertaken before any credits can be traded.¹³ As discussed, this feature normally is present to ensure that the certified savings are “additional” to a “business as usual” scenario. The corresponding issue has arisen in credit-based emissions trading schemes, where there has been significant concern about the possibility of “anyway tonnes” or “paper credits”, i.e., credits for emissions reductions that would have been made without the incentives provided by the emissions trading scheme.¹⁴

While all project-based schemes (whether they include trading or not) require some form of monitoring regime, these requirements may need to be more demanding in order to make trading possible. The scheme therefore faces the trade-off discussed in the initial chapter on design parameters. On the one hand, lax rules about “additionality” risk certifying savings that are not genuine, thus compromising the objectives of the scheme (environmental and otherwise). On the other hand, stringent rules risk may either ban some types of measures altogether or (more commonly) drive up the transaction costs of creating credits.

The two other principal approaches to trading that have been used in emissions trading schemes are “cap-and-trade” arrangements and “averaging” arrangements. In both these cases, credits are created automatically as a consequence of scheme rules and procedures, and there is no need for the potentially complicated certification procedures that characterise credit-based schemes. The potential applicability of these approaches to an energy savings scheme is discussed in subsequent chapters.

Another aspect of administrative costs is the creation of the additional institutions required for trading. At a minimum, trading requires that mechanisms be in place to establish how a particular measure undertaken relates to a particular firm’s compliance position. Depending on the form of trading provisions, this may include formal trading registries for credits or certificates, or may include a more elaborate audit trail of participants’ claim to the credit for particular measures.

¹³ By contrast, in a cap-and-trade approach credits or allowances are issued initially by the regulator, alongside a requirement that each unit of emissions be accompanied by an allowance. The total amount of emissions controlled by restricting the total number of allowances available. In this approach, there thus is no need for pre-certification of credits. An alternative approach is “averaging” schemes, which involve the offsetting of emissions from higher-emitting sources with lower emissions from other sources, so that the average emission *rate* achieves a predetermined level. In these schemes, certification is automatic when emissions rates are verified.

¹⁴ The situation is different in the case of trading of targets, where no prior certification is required.

4.1.4.2. Transaction costs

Participants also face costs directly related to any transactions they carry out. Instances of such costs include:

- § *Search and information costs.* These are costs associated with finding trading partners and co-ordinating a trade. In many cases, participants may not be aware of the existence of cost differences, or may not be able to identify who has costs different from their own.
- § *Bargaining costs.* These are costs associated with the agreement of the terms of a trade. This includes agreement of the price of the exchanged, but also relevant contractual terms. In addition, there may be costs that arise because of strategic behaviour (e.g., delay) and the resources spent on discussion and negotiation.
- § *Enforcement costs.* These are costs associated with identifying and enforcing compliance with the terms of a contract.

A less obvious cost associated with transactions is the cost of disclosing information. Many potentially mutually beneficial trading opportunities exist among participants that are competitors. A concern therefore may be that the act of placing an offer to buy or a bid to sell reveals information about the own compliance costs and valuation of credits, information which may be commercially sensitive.

Cumulatively, transaction costs may be very substantial and may form significant barriers to trading. Markets therefore typically have mechanisms in place that are designed to mitigate these problems. One such mechanism includes the communication of a “market price”, that is, an indication of the typical price at which transactions take place and at which participants interested in trading can expect to be able to carry out trades. This provides potential participants with an indicator against which their own costs can be gauged and which therefore informs them of whether it is worthwhile to engage in trading.¹⁵

Another mechanism is the use of standardised terms of exchange, thereby avoiding the potentially expensive negotiation of terms specific to each single trade.¹⁶ Finally, an important mechanism is the use of intermediaries, such as brokers, lawyers, consultants, and (in the case of large markets) exchanges, which help make exchange anonymous as well as reduce the other costs mentioned. However, the use of such services carry a cost in return, such as intermediaries’ fees. In addition, intermediary services and standardised agreements generally require a large market to emerge, and may not be generally available.

The viability of measures to overcome transaction costs depends on the volume and frequency of trading. If only very little trading takes place, it is unlikely that a single “market

¹⁵ A number of such “market price” estimates have emerged in emissions trading schemes. For example, in the EU ETS, there are published prices of the cost of emissions allowances on a number of dedicated exchanges, but also services that aggregate information from a number of brokers that facilitate trades. The result is an indication of a single “market price”, from which individual trades are unlikely to deviate by a large amount.

¹⁶ For example, in the case of the European Union Emissions Trading Scheme a number of standardised agreements have been used, including the International Emissions Trading Association (IETA) Master Agreement for the EU Scheme, the European Federation of Energy Traders Allowance Appendix, and version of the International Swaps and Derivatives Association Master Agreement. (Baker & McKenzie “Comparison of EU Allowance Trading Agreements”, November 2004),

price” will emerge, that standard trading agreements will be developed or that sufficient business would be available to intermediaries. The size of transaction costs that participants face therefore depends upon the liquidity and size of the market. With high costs, there may exist potential gains to trade that are not realised.

4.1.5. Summary

The potential benefits from trading include lower overall costs and decreased risk to participants and to scheme objectives. The extent of the gains is closely linked to the existence of cost heterogeneity, and the level of uncertainty (including regulatory uncertainty) among participants. In general, the greater the differences in cost and the greater the uncertainty, the more a scheme can stand to gain from trading provisions. Against this, trading entails administrative and transaction costs that may prevent it from working effectively.

4.2. Potential for benefits from flexibility and trading in the EEC

This section uses the above framework to identify sources of cost heterogeneity and the associated potential benefits from the use of “trading” provisions in the EEC. Accordingly, we first discuss sources of cost heterogeneity in EEC, followed by a brief discussion of sources of uncertainty faced by participants. Both sections use the information obtained through interviews with stakeholders. The role of transaction costs in creating barriers to trading is discussed separately in Chapter 5

4.2.1. Sources of cost heterogeneity in the EEC

There are several sources of cost heterogeneity in the EEC. These include differences between measures, delivery methods, regions, etc. at a single point in time. In addition, there are differences over time.

4.2.1.1. Cost differences between types of measures

A large number of measures qualify for energy savings under the EEC and these are very heterogeneous in terms of cost, delivery method, and type. This suggests that the cost savings from a flexible approach as opposed to a “command-and-control” system potentially are substantial.

The diversity of measures undertaken in EEC 1 suggests that suppliers found a number of different schemes cost-effective. As noted, the installation of insulation is likely to be the most cost-effective measure in the near future, reflecting the long lifetime of insulation measures, as well as the recent changes in the rules concerning the savings attributable to energy efficient lighting and appliances.

Suppliers generally felt that they had access to the full range of measures through third-party contracting (vertical “trading”). There also was some indication that cost differentials had been achieved through specialisation. For example, one supplier had a particular expertise with heating measures, while another felt they had an advantage through good contacts and early experience with measures in the owner-occupier segment of the insulation market.

If all suppliers have access to the full range of measures, differences between measures need not be a reason for “horizontal” trading. This would change if suppliers had differential access to types of measures.

4.2.1.2. Cost differences by delivery route

There also are differences in cost between different types of delivery route, i.e., the method by which a particular type of energy savings measures is carried out. As noted above, suppliers rely heavily on third party contracting, and cost differences between suppliers may arise if they have differential access to the most efficient delivery routes.

As noted above, suppliers’ delivery routes differ in several respects, including type of preferred marketing outlets, degree of involvement / outsourcing of management, and extent to which long-term agreements with third parties are used. This suggests that suppliers may face different cost *structures*, and possibly also different amounts of expenditure on various aspects of their procurement chain for energy efficiency services from third parties. However, it is less clear that *total* costs differ. Like any organisation procuring a good or a service, suppliers face the incentive to minimise their cost given their own expertise and experience, and the existence of a diversity of strategies for doing so within EEC is not, *prima facie*, evidence for difference in cost.

Consistent with this, Suppliers generally did not believe that significant cost differences existed, although it was mentioned that smaller energy suppliers might find it more difficult to form long-term relationships with suppliers of energy efficient equipment.

4.2.1.3. Cost differences by region

Costs also were perceived to differ across regions. One supplier indicated that costs in the South East may be 20 percent higher than in the North, per unit of savings achieved. Many suppliers also felt that it was more expensive to effect savings in large cities than elsewhere. On the other hand, some remote areas only had a few installers and high transport costs, both of which served to increase costs. There also were differences in the housing stock and other infrastructure that had an impact on the cost of achieving savings; for example, parts of the country (notably, London) have a high prevalence of solid-wall and/or flat-roof housing, and the potential for savings through cavity wall and /or loft insulation therefore was felt to be limited. Another factor was competition “hot-spots” where several suppliers had programmes running, driving up the cost of energy saving.

Differences in cost by region could lead to horizontal trading if suppliers had differential access to particular regions. This might not be an unreasonable expectation, given some suppliers’ historical dominance in certain regions. However, suppliers generally indicated that this was not the case, and that they had access to a market for energy efficiency measures carried out by third parties across a large part of the country. There may also be an incentive for suppliers to seek to achieve savings where they do not supply energy, since they avoid the opportunity cost of reduced energy sales. Therefore although regional cost differences may be significant they may not be a significant source of cost heterogeneity to suppliers, because suppliers are able to contract for measures to be carried out across the country.

4.2.1.4. Cost differences by time period

There was general agreement among suppliers that costs were increasing and are likely to continue to do so, perhaps substantially, for the next few years. For example, one supplier indicated that insulation costs have been rising at 8 percent per year, while another thought the cost increase was on the order of 30-40 percent from 2002 to 2005.

Reasons why costs of similar measures may differ – either increase or decrease – by time period include changes to:

- § *Technological costs.* The general view was that, as measures have been implemented in order of increasing marginal cost, the opportunities available in the future are likely to be more expensive than those that have been undertaken to date.
- § *Search costs.* Suppliers felt that customers are becoming less likely to respond to marketing initiatives, reflecting the fact that those most likely to respond may already have done so. The implication is that higher expenditure on marketing is required for each kWh saved.
- § *Administrative costs.* Some suppliers cited the growing scale and complexity of EEC and associated energy savings programmes as reasons for increasing costs of internal procedures. Factors mentioned include: the cost of contract negotiation with partners, monitoring and documentation, IT systems expenditure, the cost of management time, budgeting considerations, and other personnel requirements.
- § *Consumers' willingness to pay.* Some suppliers stated that recent increases in wholesale electricity and gas prices may have had the effect of making customers more interested in energy savings measures (potentially counteracting other factors that would make measures more expensive to implement). This would have the effect of decrease subsidy required of suppliers to encourage uptake of measures – may change over time. Several other factors could have a similar effect: for example, unusually cold weather could make consumers more interested in insulation.
- § *The supply chain of energy efficiency measures.* One supplier claimed that the capacity for installing insulation may not be keeping up with demand, and that prices may rise as a result. More generally, with increased demand (specifically, increased willingness to pay) by suppliers the price of measures may increase even if the supply-side of third-party services is unchanged.
- § *Innovation or technological change.* This may mean that future measures become cheaper. However, most suppliers indicated that they did not think that any major new approaches were likely to emerge in the near future. Specific measures mentioned as possibilities included solid wall insulation, but also measures such as micro-CHP, heat pumps, and (in the longer run) use of “smart metering” and other methods to encourage behavioural change, depending on future scheme rules for these measures.
- § *Scheme rules and other regulations.* These too influence the value and cost of measures. A prominent recent example is the change in the “uplift” and savings attributable to different measures, which made the carry-over of insulation from EEC 1 to EEC 2 more attractive than savings generated from other measures, even where they had the same value for the purposes of EEC 2 compliance. Another important example is the

introduction of the new Building Regulations, which alter EEC-eligible savings from energy efficiency boilers.

In sum, there are several reasons why costs of EEC compliance may vary over time, and thus why suppliers may benefit from the carry-over provisions. In most cases, costs were expected to increase over time.¹⁷

4.2.1.5. Other sources of cost differences between suppliers

Some suppliers also mentioned the existence of cost differences that depend on the characteristics of the individual suppliers. One example is the efficiency of internal procedures for items such as contracting, legal review, IT systems, reporting mechanisms, and similar. This is similar to any other business practice, where efficiency from organisation to organisation is likely to differ.

Another potential source cost differences would arise if the average cost varied with the amount of savings undertaken. All suppliers agreed that very small suppliers would be at a disadvantage as there are some fixed overhead costs associated with participation in the scheme. They therefore thought that the current size threshold was reasonable (although some wished to see some sort of contribution from the smaller suppliers below the threshold). In addition, one supplier thought that average costs in fact also were increasing with scale, and that smaller targets therefore could lead to lower average costs. However, most suppliers did not think that this was a significant contributor to cost differences between suppliers.

4.2.1.6. Summary: overall cost differences between suppliers

As suppliers' costs are commercially confidential, it has not been possible to assess directly to what extent the costs of EEC compliance differ between suppliers. However, while there are several potential sources of cost heterogeneity in the EEC, there may be little reason to believe that these lead to significant cost differences between suppliers, as most companies have access to the same wide range of measures, regions, and delivery routes. Suppliers acknowledged that they did not know whether the price they paid for compliance was higher or lower than that paid by others. There was some anecdotal evidence for differences: for example, suppliers had sometimes found that competitors were prepared to offer higher subsidies when bidding for participation in individual projects, which could indicate that cost differences exist. There also are some differences in approach, such as the relationship to third parties, the composition of measures undertaken, or the extent to which banking provisions have been used. However, most saw little reason to believe that there were large differences between others' costs and their own under existing arrangements.

¹⁷ Note that this expectation itself can increase the extent to which costs increase in time. If the marginal cost of savings is increasing with the total volume undertaken, then an acceleration of the pace at which savings are undertaken will lead to increased costs for all other participants. In other words, a "first-mover advantage" exists, and the anticipation of this will encourage suppliers to bring forward investment in savings, thus making the expectation in part self-fulfilling—albeit with an accompanying effect that credits produced may be banked for future use.

4.2.2. Sources of uncertainty and risk exposure

Suppliers generally remarked that the penalty for non-compliance with EEC requirements is very severe. As a consequence, options to insure against a future shortfall of savings credits were thought very important.

Participants in the EEC are exposed to several sources of uncertainty. A common concern was the risk that some energy saving measures would become exhausted during EEC 2. For example, many thought that the market for installation of insulation in social housing was decreasing. However, many also felt it was unclear how much was still left to be done, and thought this was a general source of uncertainty about the scheme.

Suppliers were worried about the uncertainty of potential cost increases over the next few years. In some cases, the reasons for this were clearly identifiable, such as the increasing cost of insulation materials, or the installation of insulation in owner-occupier homes rather than social housing. However, most did not feel they had a good idea about the likely extent or pace of the increase in future years.

The total cost of measures also is influenced by willingness of beneficiaries to pay. Suppliers indicated that the pattern varied between different types of measures and delivery routes, but that, in general, the willingness to pay had decreased. One prominent example was the installation of insulation in social housing, where housing providers and local authorities previously had paid a larger share of the cost of installation. More generally, while suppliers expected that the subsidy they paid would increase for several measures over the next few years, they did not know how significant this development would be for overall scheme costs.

Suppliers also felt that they faced uncertainty over whether a particular project would be approved and count towards their target. One supplier thought that this caused a bias towards well-known methods, and a reluctance to use apparently cost-effective measures that were untried for compliance purposes (although there was no general agreement that the innovation uplift was too small). Suppliers also found it hard to predict the level of uptake of marketing campaigns for new types of measures and the corresponding amount of savings that could be expected.

There also was some uncertainty associated with the interaction with third parties. Some suppliers cited situations where schemes had been abandoned half-way because of disagreements. Some also observed that they paid a premium to national firms even though local firms were cheaper, as large firms could guarantee the capacity to carry out measures when and if the supplier needed it. As this highlights, the value to suppliers of a particular measure depends not only on the volume of savings, but also on the certainty and timing of its delivery.

Another source of uncertainty arose because of changes to scheme rules, which most suppliers cited as an important contributor to uncertainty. While many acknowledged that the changes between EEC 1 and EEC 2 were beneficial to suppliers on balance, it was felt that changes were damaging on the whole. Most notably, the change in the eligible savings produced by lighting and appliance schemes in EEC 2 had been detrimental to scheme certainty. One supplier thought it was unlikely that suppliers would return to these types of

measures, as the risk of further changes to their eligibility would make investment (e.g., in third-party contacts) risky.

The uncertainty about future targets also was felt to be a major cause of concern. Most suppliers indicated that there were rumours about very strict future targets, but that it was difficult to take the appropriate action (including current investment) because there was little clear information. While several suppliers indicated that they had some budget to use towards innovation and the exploration of new forms of measures, it was felt that more informed decisions could be taken if future targets were known. Suppliers acknowledged that the uncertainty about future targets might in part be a result of the uncertainty about future costs and the availability of measures.

In sum, EEC contains several sources of uncertainty. Combined with the strict penalties for non-compliance, there therefore could be substantial benefits from mechanisms that would help alleviate risk, including temporal and other flexibility provisions.

4.3. Use of existing trading provisions in the EEC

All of the three main forms of trading – horizontal, vertical, and temporal – are provided for to varying extents within EEC. We discuss each of these in turn.

4.3.1. Horizontal trading

There was very little “horizontal” trading in the EEC 2002-2005. The major exception was a trade (publicly reported) between Dee Valley Group and EDF Energy, in which EDF energy undertook to meet Dee Valley’s entire target. Another instance of horizontal trading was the arrangement under EEC 1 between Telecom Plus and Opus Energy (also publicly reported), who worked together and met their targets through one joint scheme. This is in effect a form of horizontal trading between the two firms, as the efforts of the two firms are pooled for joint compliance.¹⁸

Several suppliers said they had been involved in discussions with other suppliers about the possibility of trading but that, in most cases, this had come to nothing. In one case involving the potential trade of credits, the reasons cited were that there were no established legal procedures and disagreements about the potential liability arising from a trade. In particular, the prospective counterparties found it difficult to agree on whom should be liable if the measures undertaken were not approved by Ofgem at a later date.

In most cases, suppliers considered the benefits from trading would be small, consistent with the observation that differences in cost between different suppliers also appear to be small. Some indicated that horizontal trading could be useful as a tool to adjust compliance position in the event of a shortfall, but that this had not taken place as most suppliers had chosen to over-comply in EEC 2002-2005 once it was clear that savings would be valid for compliance also in EEC 2005-2008. One supplier thought there may be greater use of trading in the 2005-2008 period, depending on the extent to which suppliers face difficulties in locating the

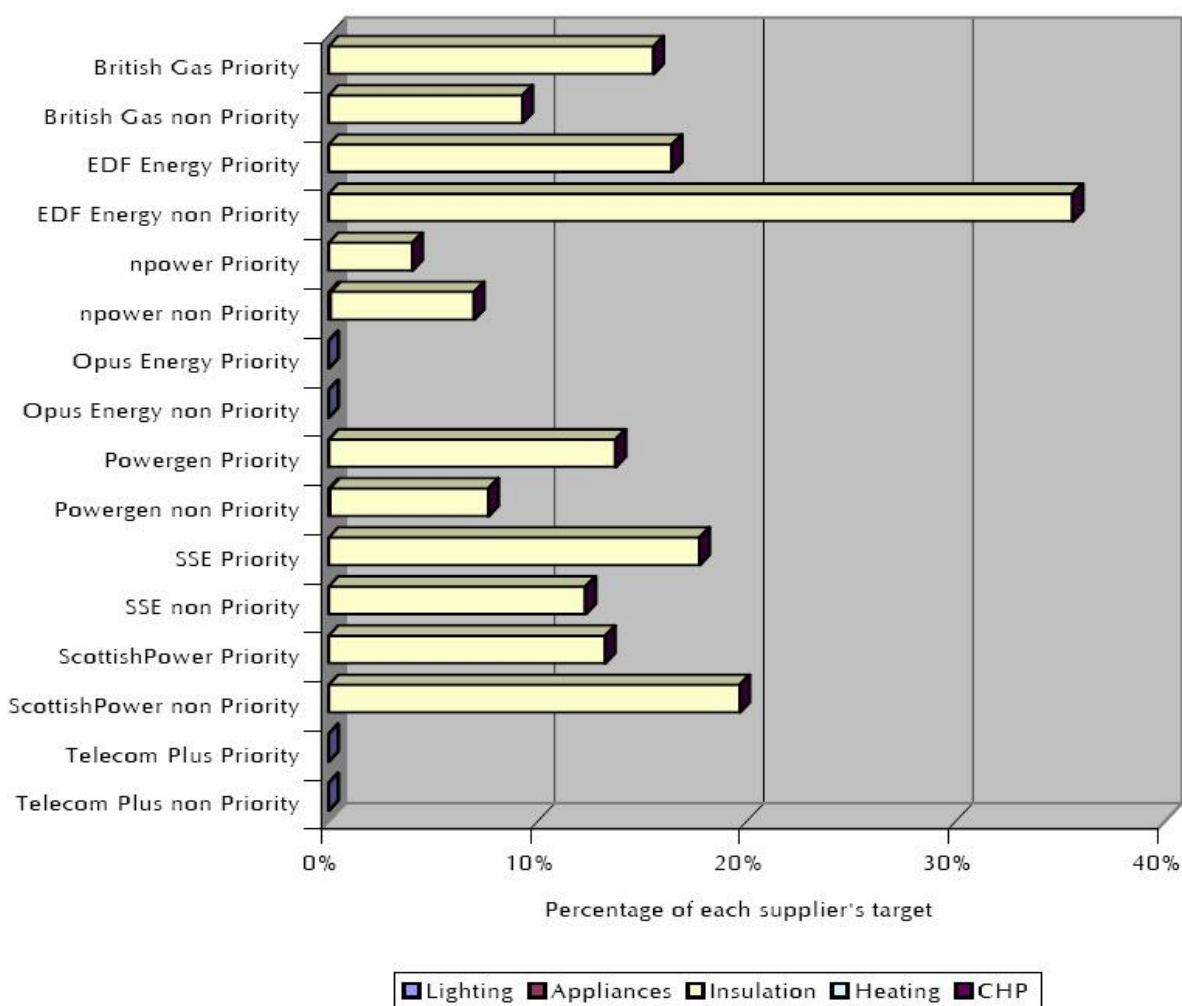
¹⁸ This is comparable in some respects to trading under “averaging” emissions trading schemes, whereby several entities (facilities, firms, etc.) can combine to distribute compliance costs between them in a more efficient way than if each entity had to comply in isolation (sometimes also referred to as a “bubble” arrangement).

required measures in the second and third years of the period. The same supplier thought that trading could be a welcome safety valve in the event that own compliance programmes did not result in the amount of savings projected or required. However, on balance, most suppliers did not think that horizontal trading was an important part of the scheme.

4.3.2. Intertemporal trading

As noted, participants also made heavy use of the banking / carry-over provisions of the scheme. The total carry-over into EEC 2 represented roughly 30% of the EEC 2 compliance target. The amount of banking by each supplier is indicated in Figure 4.3.

Figure 4.3
Carry-over from EEC 1 to EEC 2 by supplier



Source: Reproduced from Ofgem (2005)

Suppliers gave differing reasons for the decisions to carry over. Some compared the opportunity cost of capital against the potential cost savings, under the expectation that costs would increase over time. However, others indicated that risk mitigation was more important, and that the build-up of a bank of approved savings was seen as an insurance mechanism. In one case, the supplier said that banking was used purely as a way of reducing the risk of future targets and that commercial or investment aspects of the decision were secondary. The

main risk cited by suppliers was that of increasing targets and the failure to find sufficient measures to meet them.

4.3.3. Vertical trading

By contrast, all suppliers rely heavily on vertical trading in one form or another. It is useful to distinguish between different levels of trading:

- § *Installation services.* The most common service purchased by suppliers was installation services, whereby suppliers contracted with insulation or boiler installers to carry out measures. This was used by all suppliers. The degree of involvement by the supplier in marketing, identification of measures, communication with the beneficiary, and management of documentation and reporting varied but in several cases substantial appeared to be substantial.
- § *Marketing and search services.* Suppliers also relied on third parties for the marketing and identification of potential measures. This was particularly used for marketing to the Priority Group, and suppliers mentioned charities, community organisations, and doctors' surgeries among the marketing outlets they had used. Another prominent example was the marketing activity of energy efficient appliances by retailers. In these arrangements, suppliers would pay retailers a subsidy on certain approved product, subject to the retailer conducting and demonstrating the efficacy of a marketing campaign or other activity to increase the sales of energy efficient appliances. Suppliers also relied on third parties to identify local opportunities to carry out measures, in effect helping reduce the search costs associated with measures.
- § *Management services.* In other cases, suppliers paid managing agents to manage the whole chain of identifying and carrying out measures. The managing agent may play the role of aggregating several small local opportunities to a larger scale, or may have valuable local contact to which the supplier does not have direct access. A supplier's role in this context is smaller than in the above examples, as it effectively purchases a whole "package" of services from the managing agent
- § *Consulting services.* Some suppliers also purchased consulting services to help manage their EEC obligation. This included advice on which measures to undertake, the interpretation of scheme rules, and oversight of MRV obligations.
- § *Direct purchases of savings.* There also were what amounted to direct purchases of saving credits by suppliers. The sellers included Warm Front programmes, Local Authorities, and Social Housing Providers. However, there also were examples of associations of installers and/or equipment manufacturers selling credits, with contracts effectively specified in a price per unit of EEC-eligible energy savings. In these cases, the measures were wholly identified and carried out by the third party, but funded in whole or part by energy suppliers in exchange for the right to use the resulting savings for compliance under EEC.

As noted, suppliers differed in the extent to which they relied on third parties. For example, some suppliers did not use managing agents, as they felt they could achieve cost-effective savings without this service. Also, some preferred more direct involvement with programmes as this helped ensure that the quality of the measures undertaken met the standards set.

4.4. Summary

Trading provisions can provide significant benefits to the Scheme, reducing scheme cost and the risk to participants as well as government and consumers. We distinguish between horizontal trading between suppliers; intertemporal trading between compliance periods; and vertical trading between suppliers and various organisations in the supply chain for energy efficiency measures. It is important to recognise that such vertical trading also is a form of trading, involving the payment by suppliers for activities in exchange for the property rights to the resulting credits for compliance.

Both intertemporal and vertical trading take place to a significant extent within EEC, helping reduce cost and mitigate risk to participants. The benefits of horizontal trading are smaller, -- in large part because suppliers have equal access to the vertical trading market -- and the level of horizontal trading consequently also is small.

5. Current Barriers to Cost-Effective Compliance and Trading

This Chapter introduces some potential “barriers” to trading in the current EEC framework.

One way to understand “barriers” to trading is in terms of costs of participating in the market for energy efficiency measures and/or the resulting credits. This may include straightforward expenses associated with the mechanics of trading, such as the fee of engaging a broker or resources devoted to extra administrative procedures. Costs also may be more intangible, such as the risk of disclosing information that there would be an advantage to keep confidential (e.g., ones willingness to pay for energy efficiency measures).

Such costs will become “barriers” that prevent trading from taking place when they outweigh the expected gains from engaging trading. If gains from trading were significant, either in terms of lower compliance costs or smaller risk exposure, then the benefits may outweigh the costs and trading would take place. By contrast, if gains are small even small costs such as settling contractual matters or search costs to find a trading partner may be large enough that trading is not worthwhile.

We discuss barriers to horizontal, vertical, and inter-temporal trading in turn.

5.1. Barriers to horizontal trading

The analysis in Chapter 4 suggested that, in most cases, suppliers face very similar costs and risks in complying with their EEC target and that the gains to trading therefore are likely to be small. It therefore seems likely that even small barriers would dissuade suppliers from trading, and many of the barriers identified may be relatively minor compared to the overall costs of undertaking measures.

5.1.1. Commercial sensitivity

Suppliers indicated that expenditure on EEC was a very significant part of their overall costs. Some indicated that it was the third largest cost item after purchases of wholesale gas/electricity and salaries, and that information about cost-effectiveness was regarded as commercially sensitive. One supplier considered this a barrier to trading, as indication of the willingness to sell or buy savings at a particular price would reveal information about suppliers’ cost-effectiveness.

In many markets this problem is overcome by the use of brokers or other intermediaries that help make trades anonymous. A potential solution to the problem therefore exists, but only if the market becomes (or has the potential to become) more liquid than at present and also at some cost in the form of broker’s fees.

5.1.2. Expectation of increasing future costs

As noted above, suppliers thought there were many reasons why the costs of effecting savings were likely to rise and said that this made carry-over more attractive than horizontal trading. Analogously, some thought that there would be more horizontal trading if the carry-over provisions were not in place.

The presence of the carry-over provisions means that suppliers weigh the value of current savings in relation to the expected future costs of achieving savings. With increasing expected costs the current value of savings increases, as the value of those savings at a later date will be higher. As a consequence, suppliers will only find it attractive to sell credits in horizontal trades if they can obtain a price at least as high as the expected value of savings in the future, appropriately discounted.

However, it is not clear that this should be understood as a “barrier” to other forms of trading. Suppliers would be expected to optimise their choice to trade either horizontally or inter-temporally, based on their understanding of their compliance costs relative to other suppliers and their own future compliance costs. A preference for inter-temporal trading may simply reflect the fact that expected cost increases over time are more significant than current cost differences between suppliers (although as noted above, there also may be other reasons why this preference arises). If this is the case, the use of carry-over provisions instead of horizontal trading is consistent with cost-minimisation. Rather than a “failure” of trading in EEC it is a cost-effective use of one flexibility provision in place of another. Penalty structure and risk exposure

The penalty structure of EEC also is likely to contribute to the preference for intertemporal trading over cross-sectional trading that has characterised the EEC to date. As noted above, penalties are severe, and several suppliers stated that they were very unwilling to part with any savings until they could be certain to have met their own obligations. One supplier stated that they had initially looked at the possibility of trading but decided that the benefits were small compared to the risk of non-compliance.

This is consistent with the observation that inter-temporal trading has a value as an “insurance” mechanism. The use of that mechanism depends not only on the size of the penalty, but also on the risk of non-compliance. Anything that increases this risk makes inter-temporal trading more attractive. Concretely, suppliers may choose not to engage in horizontal trading at all, or alternatively demand a risk premium on any credits that they offer to sell.

As noted above, there are many potential sources of uncertainty, including uncertainty about future costs. One risk mentioned by several suppliers is uncertainty about future targets. When future liabilities are unclear the (opportunity) cost associated with selling allowances in the present instead of banking them also is uncertain.

5.1.3. Verification procedures

Another potential barrier to horizontal trading is the fact that final verification of energy benefit credits is done only at the point of reconciliation at the end of the period. This means that suppliers are uncertain about their own positions vis-à-vis their targets, and therefore that selling credits carries extra risk. One risk is that documentation is insufficient for Ofgem to approve projects. Another is the general unpredictability of the amount of credits generated from a particular project. The significance of this risk would depend on the probability that credits ultimately are not approved upon verification. No supplier indicated that this affected a large proportion of their total compliance credits, but some found that this issue nonetheless formed a barrier to trading as credits or target could not be safely “ring-fenced” for trading before final reconciliation.

These problems could be alleviated if credits were verified on a rolling basis (e.g., annually) instead of at the end of the compliance period. With such a system, suppliers could be sure of the status of a particular set of credits. Ofgem and some suppliers thought this would be costlier, as—like shorter compliance periods—it would increase the administrative burden.

5.1.4. Transaction costs

The uncertainty about crediting is closely related to the absence of standardised contract arrangements, which increases transaction costs. As noted above, one supplier stated that discussions to trade had fallen through because of disagreement about contractual arrangements for the liability for credits in the event of non-approval of measures upon verification. In principle, buyer and seller could share the risk in differing proportions, but a risk premium might be demanded as a consequence. The presence of the uncertainty and potential concomitant liability is likely to make negotiations of contracts difficult. Internal company procedures also may not allow the entry into contracts which potentially are exposed to very large liabilities (e.g., if the trading counterparty were to fail to meet their EEC obligation because a particular trade did not go through).

More generally, the absence of standardised contract templates and agreements for trading may mean that each trade entails higher bargaining and other transaction costs than it otherwise would. In emissions trading markets with large volumes of trades standard agreements have emerged that reduce such costs and provide certainty to buyer and seller of the terms of a transaction.¹⁹

Potential traders also would incur transaction costs. One such cost that is potentially significant is the requirement in the Energy Efficiency Order that trades be first pre-notified and then approved in writing by Ofgem. These procedures are more cumbersome than the ones typically found in well-functioning emissions trading markets, where electronic registries are used to make transfers between accounts. Ofgem remarked that these procedures may be unnecessarily unwieldy, but it is hard to assess in how far they have prevented any trading. The issue was not raised by suppliers as one of significance.

Ofgem remarked that the approval requirements also have some benefits. In particular, they help prevent a situation where a supplier that has gone into administration sells its EEC compliance credits to other suppliers but does not also transfer its target obligation to another supplier. As Ofgem typically would be unable to enforce the obligation of a company in administration or administrative receivership, such sales would lead to a smaller amount of savings under the scheme. This would increase the extent of under-compliance.

5.1.5. Priority group requirement

Many suppliers said that they were unwilling to trade because they were concerned about their ability to meet their Priority Group requirement. It is unclear that this is a “barrier” to

¹⁹ For example, in the case of the European Union Emissions Trading Scheme a number of standardised agreements have been used, including the International Emissions Trading Association (IETA) Master Agreement for the EU Scheme, the European Federation of Energy Traders Allowance Appendix, and version of the International Swaps and Derivatives Association Master Agreement. (Baker & McKenzie “Comparison of EU Allowance Trading Agreements”, November 2004),

trading in a sense distinct from the other reasons mentioned above that might make trading less attractive. However, as the costs of measures in the Priority Group are higher than those in the non-Priority Group, such measures would trade at a higher price, reflecting their higher value to suppliers.

In effect, the PG requirement splits the market for energy savings into two distinct commodities, as non-PG savings are not a substitute for PG savings, and also have a lower value. As trading is very limited in EEC this may be of limited importance, but as discussed below it could have important implications for a system based on tradable certificates. Both the “depth” and liquidity of the market for certificates could be affected by the segmentation of the market into several non-interchangeable commodities.

5.2. Barriers to intertemporal trading

As noted, there has been extensive use of the carry-over provisions in EEC, suggesting that no significant administrative or other barriers to intertemporal trading exist. However, it is possible that the amount of carry-over would be less (more) than optimal if suppliers’ expectation of the future value of banked savings was too low (high).

One potential mechanism that could cause this to occur would be a change in the rules regarding the savings attributed to particular technological measures. This could mean that the amount of banked savings from particular measures could be greater or less than expected when the measures were first undertaken. Such changes were made between EEC 1 and EEC 2, and it is possible that the amount of banking of credits from particular measures could have been different if the EEC 2 rules had been in place during EEC 1. For example, if the savings attributed to a particular measure are greater (smaller) in EEC 2 than in EEC 1, the number of those measures undertaken during EEC one may be less (more) than was optimal. The significance of this potential inefficiency depends on the precise changes to the rules governing individual measures.

5.3. Barriers to vertical trading

Barriers to the effective functioning of the vertical market for energy efficiency measures could have a very detrimental impact on the EEC. As this is the main route through which measures are contracted and traded, its functioning is fundamental to the cost-effectiveness of the scheme.

5.3.1. Search costs

A potential barrier to vertical trading arises if potential buyers (suppliers) and sellers of energy efficiency measures (project developers) have difficulties or incur costs identifying each other.

In EEC, several mechanisms are used to assist the matching of sellers and buyers. These include marketing both by suppliers and project developers. There also has been extensive use of intermediaries, including Local Authorities, managing agents, Warm Front and other

government programmes, and others with pre-existing contact networks among contractors for energy efficiency measures. Some organisations, notably social housing providers and other landlords, operate tendering systems whereby energy suppliers are invited to bid to help fund energy efficiency improvements in a particular set of households, against the right to claim credits for the resulting savings under EEC. Conversely, suppliers operate tenders among potential contractors for work to carry out services including market services, identification of properties, and installation of measures. There also were instances of contacts with organisations outside of the immediate supply chain for energy efficiency services, such as supermarkets, doctors' surgeries or charities, especially where these would be able to help identify additional opportunities for projects in the Priority Group.

It is hard to assess to what extent these mechanisms are successful in identifying mutually advantageous trades between suppliers and contractors. Most suppliers as well as project developers consulted felt that the market was working well, and that there would be few barriers for a project developer to undertake a cost-effective project. There was some anecdotal evidence that installers had attempted to contact suppliers directly but not managed to establish contact (it was thought this was because of failure to identify the right person). However, this was not thought to be widespread. One stakeholder stressed that relatively small projects were being undertaken and that this indicated that the market was efficiently finding opportunities for energy savings. The use of managing agents is likely to help alleviate some search costs as such agents typically have access to a large network of contacts.

Overall, while opinion differed on whether there is untapped potential for eligible energy savings that is not currently undertaken under EEC, many suppliers thought this was not the case. Several pointed to insulation as the most cost-effective measure available, and one for which the supply chain is clearly established and actors well known, making it unlikely that potential actors would not be able to participate if they had cost-effective project opportunities. Some nonetheless thought that there may be potential additional sources of eligible measures that were currently not undertaken through EEC, but could not say what these might be.

5.3.2. Minimum economic scale of measures

Another barrier to vertical trading may arise if there is a minimum economic scale of energy efficiency measures. Carrying out projects for compliance under EEC normally involves some fixed costs, such as search and administration costs. There therefore is likely to be a size threshold below which measures are not cost-effective for the purposes of EEC compliance, even though the cost of the physical measure itself (e.g., installation of insulation) may be low for the amount of savings achieved. This is a general issue for project-based schemes and is a more significant problem if the size of individual projects is small and the associated administrative costs are high. Both of these are characteristics of the EEC.

Suppliers indicated that a key requirement for cost-effectiveness was the ability of measures to be delivered in a standardised manner and on a large scale. Some argued that this was another factor contributing to the preference for insulation measures. Some suppliers considered that there may be measures which were cost-effective in particular local circumstances, but which could not necessarily be replicated on a large scale and therefore could not usefully be incorporated into their own programmes.

One partial solution to this is for suppliers to rely on managing agents and other third parties who are aware of local opportunities and can aggregate several small schemes to a point where it becomes feasible for the suppliers to contract with them. Both suppliers and managing agents indicated that this was already happening in EEC.

There also have been instances where smaller installers and manufacturers of energy efficiency goods have formed larger and vertically integrated entities for the purposes of carrying out work under EEC. This has helped centralise administration, marketing, and interaction with suppliers. As a result, relatively small suppliers who otherwise would find it difficult to get access to EEC funding are able to participate in the market.

It is difficult to assess the extent to which the minimum size threshold is a cause of concern. To some extent this can be viewed as another factor determining the “merit order” of measures undertaken; other things being equal, large-scale measures will be more cost-effective than small-scale measures. However, as the cost of measures increases, smaller-scale measures will start to become more attractive. One supplier supported this, stating that the size of measures undertaken now were smaller than they have been in the past. The current “bias” towards larger measures therefore may not be much different from the current emphasis on certain low-cost measures over other higher-cost ones. One stakeholder thought that small measures were already being undertaken, partly because projects in conjunction with social housing providers were becoming more expensive and less common.

It may be helpful to distinguish between scale effects that arise because of the particular provisions of EEC and those that would be part of any programme to subsidise energy efficiency measures. For example, the cost of installing of measures is smaller where the properties affected are near each other or owned by the same authority, decreasing travel costs and the time required. On the other hand, there also are costs that arise because of the structure of EEC, the most important of which may be the documentation and audit requirements that are in place to ensure that measures are “additional”. Several suppliers indicated that part of the attraction of working with social housing partners was that documentation was made simpler.

5.3.3. Availability and reliability of project capacity

The market also could face barriers if the capacity to undertake energy efficiency measures were limited or unreliable. Again, it is important to distinguish between factors that would be common to any subsidy mechanisms (e.g., investment lead times), and ones that are induced by the design of EEC.

One supplier indicated a preference for working with larger partners as these could provide guaranteed capacity to carry out work to the desired timetable. However, this was tempered by higher prices associated with these partners, and is not necessarily related to the workings of EEC. It could be an issue if it were thought that EEC rules meant that reliability became particularly important; for example, if the time required to complete projects was long compared to compliance deadlines. However, no supplier indicated that this was currently the case.

Another issue mentioned was that the EEC induced a “stop-start” cycle in the demand for energy efficiency measures, as suppliers stopped demanding measures once they reached

their EEC target. This could potentially make it difficult for small companies to remain in business. To some extent, this may be offset by the demand for additional measures to produce over-achievement for banking. Also, varying demand is common to many markets, and it is difficult to gauge whether it arises with particular severity in those markets supported by the EEC obligation. Several stakeholders argued that this was the case, and that the insulation market, in particular, was vulnerable to variations in demand by suppliers. If this is correct, the programme may be made more efficient by a mechanism that served to sustain a more even level of demand over time.

5.3.4. Market power

Another potential barrier to a cost-effective market would be the extent of market power in either the energy supply market or the market for energy efficiency services. Allegations about possible imperfections in the market were made in both directions—that is, claims were made suggesting that there might be market power in both the procurement of measures and in their supply.

One energy supplier stated that different project developers charged different prices for the same type of energy efficiency measure, and that one of the potential drawbacks (for the supplier) of a white certificate system would be that suppliers would not be able to pay lower prices to lower-cost developers. Different prices for the same good or service typically do not occur in competitive markets, and thus may be a sign of market power or market inefficiency of some sort. The main result of such price differentiation in the market for energy efficiency measures is that energy suppliers would be able to extract more of the surplus created in the market, to the detriment of project developers. One effect of such a situation could be to blunt incentives to decrease costs among project developers, as some of the gains from doing so could accrue to suppliers and not to themselves.

Market power by project *developers* could have a larger and more direct impact on the cost-effectiveness of the scheme. If project developers were able to increase prices through monopoly, oligopoly or cartel market power, then the total price paid by suppliers to fulfil the EEC obligations would be higher, with likely higher costs to electricity consumers and potentially to the beneficiaries of measures. One stakeholder thought that, while there currently are a large number of installers, it was likely that there would be significant consolidation over the next few years, and that prices could increase as a result. Another stakeholder cited the increase in insulation costs (including insulation materials) over the past few years as a possible indication that market power currently exists at some point in the supply chain. However, the price increases may also be the result of increased demand, and we have not investigated this issue further.

5.3.5. Scheme rules and additionality concerns

Scheme rules put some limits on allowable trading. Energy suppliers are required to notify Ofgem in advance of any energy efficiency measures they wish to count as eligible towards their EEC targets. All trading with third parties therefore needs to be preceded by an agreement and partial documentation prior to undertaking the actual energy efficiency activity (for example, under EEC 1 suppliers could buy credits from Warm Front projects that had already been undertaken, but EEC 2 rules require that all such trades be notified in advance). This adds to the burden of administration and documentation, and also limits the

extent to which project developers can undertake measures independently of (prior) detailed agreements with suppliers. Eliminating or relaxing this requirement therefore may improve the functioning of the vertical trading market. On the other hand, the pre-notification requirement helps ensure that activity is additional and other monitoring mechanisms therefore may be required if the pre-notification rules are changed.

5.4. Summary

Suppliers generally thought that the current arrangements were likely to be effective in identifying and providing incentives for the undertaking of low-cost energy efficiency measures.

Suppliers identified several different reasons that they did not undertake horizontal trading. However, most of these appear to be surmountable at reasonable cost, and some may not strictly speaking be “barriers”, but rather an indication of strong incentives to carry out other forms of trading, notably banking. The most significant barrier arguably is that verification procedures prevent trades in verified credits from taking place except towards the end of the compliance period.

Overall, no information available from stakeholders indicated that the vertical market for energy efficiency contracting had significant problems. Relatively small measures are being undertaken (as well as large ones), and most stakeholders take the view that the current mix of measures (including the heavy emphasis on insulation) is reflective of their relative cost-effectiveness, rather than any market failure. While some participants thought that there might be additional measures or approaches that were not being undertaken, no stakeholder was able to identify such measures.

6. Options for Trading: White Certificates Approach

This Chapter explores the possibility of changing the EEC framework into a tradable white certificate scheme.

The main difference between a system based on TWCs and the current approach in EEC would be to formalise the denomination of savings into a standardised and quantified “certificate” of activity valid for compliance under EEC. In effect, anyone would be able to undertake such activity and have certificates issued in return. The effect of this is to create a certificate commodity that can be exchanged separately from the measures being undertaken. In theory, project developers could undertake energy efficiency activities to obtain certificates independently from suppliers or other obligated parties, making their own assessment of the cost-effectiveness of a particular project given the price obtained for the resulting certificates. Conversely, suppliers theoretically can obtain certificates without any direct involvement in the measures being undertaken or the associated administration. In effect, suppliers would be “consumers” of certificates and (given a competitive and liquid market) would have no need to look beyond the certificate market to discharge their obligation.

The result of this arrangement would be to separate “measures” from “savings credits”. In theory, this should help decentralise the decision to undertake measures to the parties that have most information about their cost-effectiveness. In the presence of asymmetries of information this decentralisation may result in more cost-effective measures being identified and undertaken. Another potential result would be to ensure competition between project developers bidding to supply certificates. Again, the hope would be that this would ensure that the most cost-effective measures are undertaken

The benefits in practice of changing to such a system depend on the extent to which the structure of the market for energy efficiency changes as a result of the certificate provisions. The relevant factors to consider include:

- § the effects of a TWC scheme on the energy efficiency measures undertaken,
- § the costs to different types of participants, and
- § the risks faced by stakeholders and regulators.

We first discuss the design elements of a TWC scheme, and then analyse each of the above three factors in turn.

6.1. Design parameters of a TWC scheme

This section describes some of the possible changes to EEC that would make it more consistent with a TWC approach. This may require some revisions to the basic design of the scheme, and possibly to its legal basis.

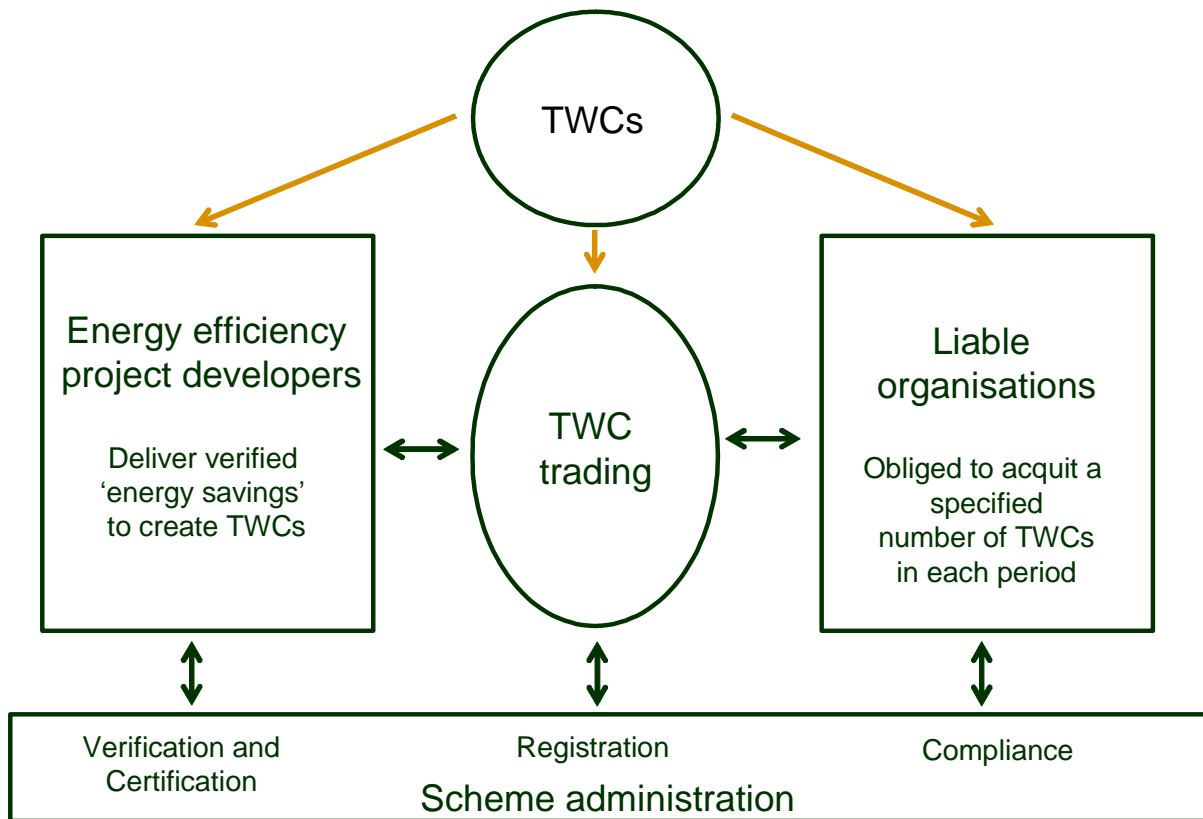
We consider the following design parameters:

- § Denomination of targets,
- § Location of obligation,

- § Definition and certification of eligible measures,
- § Monitoring and verification,
- § Compliance and enforcement, and
- § Market design and mechanisms.

Figure 6.1 outlines the basic elements of a TWC scheme. The EEC framework already contains most of these elements and the institutional changes required therefore could be relatively small. As in the EEC, TWC scheme administration would require the verification of activities by project developers and the registration of the resulting credits / certificates as the property of the appropriate party. In contrast to the current EEC arrangements, however, parties other than suppliers would be able to hold certificates. Compliance procedures also would be different, as a supplier's obligation would be to acquit a specified number of TWCs in each period, but not necessarily to participate in the generation of these certificates. Finally, TWCs would formalise and (potentially) substantially reduce the arrangements whereby liable organisations pay project developers to undertake energy efficiency activities. Whereas currently this is done through contracting, with a requirement that the supplier specifies the details of the project to the scheme regulator, in a TWC scheme the arrangement between a supplier and its TWC provider could be limited to the exchange of certificates, independently of any monitoring, reporting, and verification of the underlying energy efficiency activities. As discussed below, however, it is not clear that such full separation of TWCs from the underlying projects would be a likely outcome of moving towards a TWC structure.

Figure 6.1
Basic elements of a tradable white certificate scheme



Source: NERA (2005)

This structure entails several differences from the current EEC arrangements, and there consequently is likely to be need for additional legislation as well as revision of institutional arrangements. In particular, the Energy Efficiency Order that forms the basis for EEC places an obligation on *suppliers* to undertake actions that lead to improvements in energy efficiency. It is unlikely that a TWC awarded for activity undertaken independently of suppliers would qualify as such an action under current legislation. Consequently suppliers' EEC targets could not be achieved by acquiring and surrendering independently generated TWCs. Depending on legal interpretation, the transition to a TWC scheme therefore may require new primary legislation.

6.1.1. Denomination of targets and certificates

The denomination of the target under a TWC scheme could be similar to that currently under EEC. As noted above, one complication arises because the current EEC target effectively is split into two separate requirements—one for PG households and one for non-PG households—since savings achieved in either of these two groups cannot substitute for savings in the other. One aim of a TWC scheme, to create a standardised “currency” for energy savings, therefore would be somewhat at odds with the current form of the target and with the scheme objectives reflected in the PG requirement. One option would be to create two parallel TWC schemes, under which any TWC would have to indicate to which group of consumers they pertained. This would mean that the separation of measures from savings

credits present in an “ideal” TWC scheme would be incomplete. This in turn could have implications for the liquidity and depth of the market.

Another issue is whether more certificates should be provided for certain activities than others. Current EEC targets are specified in terms of “energy benefits”, which are weighted for the CO₂ intensity of the fuel and also by a number of “uplift” provisions (e.g., extra credits for energy services or innovation activities²⁰). Such differential weighting of energy saved could continue under a TWC scheme—certain types of measures would simply receive more TWCs than a direct calculation of benefits would imply.

However, linking the TWC scheme to other trading schemes may pose additional constraints on the denomination of targets. For example, to be compatible with the widest range of other climate policy measures, it may be necessary to offer a denomination in CO₂e instead of “energy benefits” or energy efficiency. Fungibility between different commodities is likely to be restricted if the denomination is not similar, with limited scope for linking as a result. These issues are discussed in more detail in Chapter 8.

6.1.2. Target group and location of obligation

In a DSM scheme without TWCs, the obligation commonly has been placed on energy suppliers on the grounds that they have direct contact with energy customers and therefore can use their existing marketing channels and other knowledge of the market to identify cost-effective opportunities for energy efficiency activities. With a TWC scheme this may be less important, as (in theory) the obligation and demand for certificates can be unrelated to the activities undertaken to generate certificates.

The more important consideration in determining the appropriate location of the obligation in a TWC scheme therefore may be the extent to which the obligated party is able to either bear or recoup the cost of purchasing certificates. As noted, in traditional DSM schemes obligations were placed on vertically integrated utilities, and mechanism for cost recovery were accounted for within a framework of price regulation. Similar mechanisms would be required if an obligation were placed on transmission or distribution companies in a TWC scheme, adding the complication of handling cost recovery within the prevailing regulatory regime. It also is theoretically possible to place the obligation on entities altogether outside the electricity supply chain, such as electricity consumers or a government agency.²⁰

6.1.3. Definition and certification of eligible energy efficiency activities

The main change in a transition to a TWC scheme would be to the certification of measures. Instead of the current arrangements, whereby suppliers are responsible for the reporting of measures to Ofgem, the organisations actually carrying out energy efficiency measures would report activities and be issued certificates.

²⁰ There is some precedence for this in other certificate schemes. For example, the Swedish green certificate scheme placed the obligation on consumers. In practice, however, this led to obligations being managed by suppliers on consumers’ behalf, and for reasons of administrative ease and price transparency the obligation is being commuted to an obligation on suppliers instead.

This raises the question of how to assign property rights to certificates. Currently a supplier's right to count savings towards its targets is obtained by pre-notifying Ofgem of a particular project and then supplying adequate documentation of the measures taken. The current vertical market includes a variety of different arrangements for managing the documentation of measures as well as their verification. While suppliers ultimately are responsible, many make use of intermediaries that collate and organise the information.. To some extent, the decentralisation of documentation and other administrative requirements is already occurring under the current EEC arrangements.

Some additional complications would arise under a TWC scheme, however. The TWC would have a value to anybody holding it, as they would be able to sell it to a supplier. Under a TWC scheme, if a social housing provider or local authority were to issue contracts to improve the energy efficiency of their housing stock, there might then be a question as to whether the certificates should be issued to the social housing provider or to the contractors / installers of the individual measures? It is likely that there are returns to scale in centralising reporting of TWC measures, but either the housing provider or a building contractor could be of sufficient scale to manage the administrative burdens. If the housing provider took on the responsibility, they in turn would have to come to a sub-contracting agreement with installers and others. It therefore is not clear that such an arrangement would be significantly different from current arrangements (albeit the sub-contracting would occur at a lower point in the supply chain).

It also needs to be decided whether there should be any restriction on the parties that are eligible to generate certificates. In general, cost-effectiveness is best encouraged by imposing as few restrictions as possible on the eligible organisation and measures. There nonetheless may be reasons to exclude some organisations, for example, to minimise administrative costs, or to safeguard the integrity of the savings carried out. For similar reasons, it has been suggested in the context of the French TWC scheme that a size threshold on organisations and/or projects should be imposed.

Another consideration is to restrict eligibility of measures to avoid double counting or double crediting, so that Government can be sure that each certificate represents *additional* energy savings. This issue already arises in EEC: for example, suppliers are only able to use activities from Warm Front or other government programmes for EEC compliance if they can demonstrate that these are additional to the activity that would otherwise have been carried out. Insofar as a TWC scheme leads to a larger number of organisations undertaking measures and having them certified, ensuring additionality may become more important—and more difficult.

6.1.4. Monitoring and verification of eligible energy efficiency activities

The choice of monitoring, reporting, and verification (“MRV”) regime depends upon the relative weight given to the risk of certifying energy savings that are not additional compared to the risk of not certifying energy savings that are genuine. A TWC scheme may lead to the participation of a larger and more diverse group of project developers, including smaller organisations. This could increase administrative costs, as the scheme regulator could be required to interact with a larger and more diverse set of organisations in the MRV process.

Costs also may increase because a TWC scheme would require more frequent verification of certificates. Under current arrangements verification is concentrated at the end of the compliance period, but it may not be desirable to do so under a TWC arrangement, as savings activity would carry on continuously. Lags between activity and crediting would expose project developers to significant uncertainty and delays before they would see any return to their investment.

It also needs to be considered whether a TWC scheme would require a more stringent MRV regime. Under current arrangements the responsibility for documentation of measures is concentrated with suppliers. In a TWC scheme, this would no longer necessarily be the case, and a mechanism would be required to ensure that TWCs are not claimed twice for the same measures, e.g., both by the SHP landlord and the installer in the previous example.

6.1.5. Compliance and enforcement mechanisms

Compliance under a TWC scheme is likely to be demonstrated through the surrender of certificates to Ofgem, in a manner similar to the Renewables Obligation. This is likely to require some form of tracking of certificates to ensure that retired certificates are withdrawn from circulation. As noted, electronic registries are the infrastructure most commonly used in emissions trading programmes for the practical implementation of this.

It also would be necessary to consider whether the current enforcement mechanisms are appropriate and whether any change to the non-compliance penalty would be required. Trading mechanisms differ in their use of penalties; in some a buyout provision is an integral part of scheme design, notably in the “hybrid tax-trading” mechanism used in the UK Renewables Obligation (Roberts and Spence, 1976). Other schemes, including current and proposed green certificate schemes in various countries, also have fixed penalties per “missing” certificate. Finally, some cap-and-trade schemes have penalties designed to make the option of non-compliance costlier than compliance. For example, in the EU ETS non-compliance leads to a fixed fine *in addition* to the continuing obligation to retire any shortfall of allowances. In addition, the non-compliance of a UK participant in the EU ETS could lead to the withdrawal of the permission to emit CO₂ altogether, effectively requiring the facility to shut down.

6.1.6. Market design and mechanisms

A TWC scheme’s ability to provide benefits in addition to those under the current EEC would depend on the nature of the market for white certificates. This in turn would depend on a number of parameters defining the nature of TWCs as a commodity.

In addition to specifying who is able to generate certificates, it may be necessary to establish who would be allowed to hold and exchange TWCs. Allowing all persons to do so without restriction may help establish a more liquid market. It also would be necessary to translate the current arrangements for carry-over into a certificate validity period, including a decision on whether only suppliers or also other participants would be allowed to bank certificates from one period to the next. Concretely, the current trading procedures (written notification to Ofgem) would likely need to be replaced by a registry system through which certificates can be issued, transferred, and withdrawn from circulation.

Also, the creation of a more clearly defined commodity opens up the possibility for increased fungibility with other trading schemes. As noted above, this may be limited by the need to differentiate certificates to achieve particular policy objectives (e.g., restrict validity to the UK, have special Priority Group TWCs, etc.). This is discussed in more detail in Chapter 8 of this report, where the implications of “linking” various schemes are analysed.

There also are a number of specific potential issues that may arise with the implementation of a TWC scheme but that do not arise in EEC. For example, there is the possibility of using a price floor to provide a guaranteed value for certificates, or a price ceiling or buy-out (which may or may not be considered a penalty for non-compliance).

6.1.7. Summary of design parameters

Table 6.1 summarises some of the major design issues and potential changes in the transition from the current EEC arrangements to a TWC scheme.

Table 6.1
Summary of potential changes in the transition from EEC to a TWC scheme

Design parameters	Potential Changes
Denomination of targets and certificates	A TWC scheme would not require any changes from the current denomination. However, if the aim were to create certificates fungible with other trading schemes harmonisation of denominations would be required.
Location of obligation	It may be less important that the target group has direct contact with customers in a TWC scheme than in EEC. However, the difference arguably is slight as much of activity under EEC also is sub-contracted.
Definition and certification of eligible measures	Decisions would be required about the property rights of certificates, including the level in the supply chain of energy efficiency measures. Additional efforts to avoid double counting may be required. In general, it would be desirable to pose as few restrictions as possible on the parties eligible to generate certificates.
Monitoring and verification	Monitoring is likely to become more complex with the participation of a larger and more diverse group of project developers. Costs also may increase because a TWC scheme would require more frequent verification of certificates. A more stringent regime may be required to handle additional risk of double-counting.
Compliance and enforcement	Compliance would be demonstrated by surrendering certificates. The arguments for different types of non-compliance fines are similar to those under EEC
Market design and mechanisms	Rules are required to establish who is eligible to generate, hold, and transfer certificates. Trading infrastructure in the form of a registry would be required. New considerations also include the use of price floor, and the possible fungibility of certificates with other trading schemes.

6.2. Effects on energy efficiency measures undertaken

The main potential benefit from a TWC scheme is the possibility that additional cost-effective measures could be incentivised and undertaken.

6.2.1. Effects on overall incentives to undertake efficiency measures

The value of certificates would depend on the demand by suppliers and on the availability of measures to meet this level of demand. Demand is created through the obligation on suppliers (or some other target group) and this could be the same under a TWC scheme as under the current implementation of EEC.

A liquid certificate market could make the existing incentives under EEC more “visible”, by providing a more transparent price signal to potential participants. This could make it easier for a particular project developer that did not have access to a supplier or EEC “broker” to determine whether it is likely to benefit from participation—both whether there is likely to be demand for its services, and what the potential reward would be. The corresponding signals in the current EEC are more informal, relying on direct contact with suppliers or brokers (such as managing agents), although publications such as Ofgem's quarterly “EEC Update” reports provides some information about the state of the energy efficiency market. The ability of the TWC scheme to improve the transparency of the possible return to energy efficiency projects for potential project developers depends critically on the assumption that there would be a liquid and well-functioning market through which TWCs were traded. Without such a market it would not be the case that the price was easily accessible to anyone who might be interested—and instead it might still require less formal networks with suppliers and brokers.

In addition, the incentives could be different if either the certificate market in a TWC scheme or the market for energy efficiency projects in the current EEC did not function competitively. This possibility is discussed in more detail below.

6.2.2. Effects on composition of measures

A TWC scheme could change the opportunities faced by individual participants to undertake energy efficiency projects. Whether or not this occurs depends on the extent to which there are barriers that impede the identification and implementation of cost-effective measures, and on the extent to which a TWC scheme would be more successful at overcoming these barriers. In particular, information obstacles could prevent suppliers from identifying particular potential project developers, and also mean that potential project developers do not have access to suppliers or are not aware of the possibility under EEC. In addition, there may be reasons why the relative cost-effectiveness of measures would differ under a TWC scheme. We discuss each of these in turn.

6.2.2.1. Identification of measures

One of the theoretical benefits of the use of market mechanisms is that they have the potential to make efficient use of information. With a liquid market in place, participants can respond to a price signal based on the information they hold about their own possibilities to undertake energy efficiency measures. Using this information, potential project developers would be able to judge how their own opportunities for energy efficiency activity compared to the price they could obtain for certificates.

As discussed in detail above, there are of course already incentives in current EEC arrangements for suppliers to maximise the information available to them about potential measures. The volume of savings to be achieved by each supplier is fixed and, suppliers face a strong incentive to minimise costs by adopting the most cost-effective measures available. A corresponding incentive exists for potential project developers to make their services available to suppliers. EEC funding offers access to a market that otherwise would not be available, and project developers have an incentive to make suppliers aware of what they can offer. Also, if the market for contracting with suppliers is competitive, project developers have an incentive to minimise costs when preparing their bids.

Most stakeholders generally consider that these incentives are working well. This suggests that a TWC scheme would not necessarily be more efficient in identifying cost-effective measures. In particular, stakeholders did not think that project developers would be more likely to be aware of the possibility to generate certificates than they were currently aware of the benefits of undertaking EEC-financed work through contracting with suppliers. Also, suppliers said they were willing to contact new partners and consider new delivery options and thought that potential contractors were likely to know this. Some also said that a substantial proportion of energy efficiency activity now is funded through EEC, and that few insulation installers, in particular, were likely to remain unaware of supplier funding.

Some stakeholders held the opposite view, and thought that a certificate system might help bring about projects that were not being undertaken because suppliers did not know about them, or potential project developers were not aware of the possibility of EEC funding. This proposition is by its very nature very difficult to evaluate. However, the fact that no stakeholder was able to identify the *mechanisms* whereby this would occur makes it seem unlikely. There were no concrete suggestions for types of measures or delivery mechanisms that would be eligible under EEC rules but that are not currently being used. None of this can be stated categorically, however, and there remains a possibility that co-ordination difficulties between suppliers and potential project developers form a barrier to some measures that potentially could improve overall Scheme cost effectiveness. A more detailed assessment of this aspect of the market for energy efficiency measures may be a suitable topic for future research.

Note that a functioning vertical market does not necessarily mean that EEC currently is providing incentives for all cost-effective methods of achieving energy efficiency. As noted, several suppliers thought that EEC was unnecessarily restrictive in its eligibility criteria, and some doubted the efficacy of the project-based approach of EEC in effecting large-scale reductions in energy consumption. However, most suppliers holding this view did not think that a certificate approach would be any more successful, as the perceived problem was one of MRV requirements and certification rules (which would persist under a TWC scheme), not the absence of a functioning market (whether vertical or horizontal) in energy efficiency activities.

6.2.2.2. Cost of measures

Another way in which the composition of measures could change under a TWC scheme would be if the relative cost of measures changed. This is discussed in more detail below, but in general it can be said that there are reasons why costs might be either higher or lower under a TWC arrangement. For example, there may be economies of scale in MRV that are beneficial under the current system, making measures less cost-effective under a decentralised TWC system. Against this, MRV may be more costly under the current system because it requires the intercession of suppliers between Ofgem and the project developers. In general, without reference to specific measures and scheme rules, assessments of how costs may differ under a TWC system are very uncertain.

6.2.3. Effect on delivery routes

In addition to affecting the measures undertaken, changes to scheme design (including TWC) provisions could have the potential to change the delivery routes for measures. Current delivery routes typically are characterised by partnership (whether long-standing or one-off

and specific for each project) between different participants. As discussed in previous Chapters, the most significant categories of partnerships were between suppliers and retailers, social housing providers, and other government programmes. At a lower level, partnerships often include many other actors; e.g., Local Authorities entering into agreement with energy suppliers and local project developers to improve the energy efficiency of housing stock under their management; managing agents brokering arrangements between owner-occupier households and suppliers and so on. Under current regulation, the participation of energy suppliers is required at some stage in order for activities to count towards suppliers' EEC obligation (typically early on in project development, and usually throughout).

These partnerships arise for a number of different reasons. The supplier itself needs to report to Ofgem, and also has monitoring and verification requirements. At a minimum, the supplier and the contractor installing a particular measure may need to work together to generate documentation and monitor outcomes that qualify with the requirements under the EEC. Under a TWC scheme, this may no longer be necessary. In theory, under a system of TWCs it may be possible for individual contractors to generate certificates directly without the involvement of suppliers or other third parties.

However, this is limited by the fact that partnerships fulfil a valuable co-ordination function and lower the transaction costs associated with EEC compliance. Many types of measures require the matching of different parties, such as managers of housing stock (e.g., social housing providers, local authorities, other landlords, etc.), contractors (e.g., installers of boilers or insulation, retailers, etc.), intermediaries (e.g., financial brokers, managing agents, consultants, energy service companies, etc.), and other interested parties (e.g., charities). This reflects the fact that the measures eligible under EEC (most of which are small-scale) typically require the co-ordination of a range of functions, such as: identifying opportunities; raising awareness among potential beneficiaries; obtaining finance; installing the measures; maintaining a documentation and audit trail; and reporting to Ofgem. Different parties are able to perform these different roles more or less effectively, and partnerships can be seen as a solution to the widely different tasks involved. Very similar functions would need to be fulfilled under a TWC scheme, and partnerships therefore may continue to be an important part of how measures are delivered.

Installation of energy efficiency measures through partnerships also allows suppliers to retain a higher degree of control over project outcomes. As noted, suppliers currently differ in the extent to which they enter into long-term partnerships, but all acknowledged the need under current arrangements to monitor outcomes carefully and on an ongoing basis, and to ensure the quality of the energy efficiency measures installed. (This latter concern may become less important with a TWC scheme, if suppliers become less directly involved in the installation of measures and therefore do not associate their brand with particular projects.)

Whether this need would continue under a TWC scheme depends to a large extent on whether a reliable spot market model of delivery developed. In theory, project developers could undertake measures speculatively and in the expectation of selling the resulting certificates to suppliers. As discussed below, this delivery model increases the risk to project developers, and may pose a particular problem to small organisations.

Without a liquid spot market, suppliers may prefer to continue to procure certificates through partnerships in order to retain control over the cost, timing and certainty of savings, and

where the provision of certificates is backed by contractual guarantees. If this were to occur, the introduction of a TWC system may not result in a significant change in the way energy efficiency measures are delivered, as there would be no real separation of certificates from the underlying measures. In this case, there is no reason to think the nature or cost of the measures undertaken would be significantly different from those under current arrangements.

6.2.4. Effects on innovation and energy services

The EEO makes specific provisions for the encouragement of innovation and energy services provisions under EEC. A TWC scheme should pose no difficulties for the preservation of the “uplift” associated with innovation and energy services, although this may affect the acceptance of certificates in linked programmes, as discussed below

There may be other ways in which a TWC scheme affects innovation. The introduction of a new measure under EEC typically would require an initial investment, both in developing a concept for implementation and in working with Ofgem to bring out new procedures for certification and MRV requirements associated with the new approach. The return to such an investment is uncertain, depending in large part on the eventual methodology agreed upon as well as the availability of opportunities to carry out the measure. It is unclear whether the current arrangements are likely to be better or worse at encouraging innovation than would be a TWC scheme. The current arrangement may benefit from the financing available to suppliers, whose size may make it easier to invest in innovation. On the other hand, insofar as suppliers’ approval is required and may hold back new initiatives, a TWC scheme may be better able to encourage innovation by allowing potential entrepreneurs to liaise with Ofgem or another regulator directly.

A TWC scheme also could have consequences for the emergence of an “energy services” approach to energy supply. Suppliers of energy could be less directly involved with energy efficiency customers under a TWC scheme, which may make such a business model less attractive. For example, there would be less impetus for suppliers to monitor the quality of the energy efficiency measures if their brand was not directly associated with the projects. However, based on the information from stakeholders, the main reason that an energy services approach is not more common is that customers have not been sufficiently interested to make the provision of such services profitable. This is separate from the use of a certificate system and is unlikely to be affected by a transition to a TWC scheme alone.

6.2.5. Summary of effects on energy efficiency measures

Information asymmetries between suppliers and potential project developers are likely to give rise to barriers to the identification and implementation of cost-effective measures in all project-based energy efficiency schemes. It is unclear whether a TWC scheme would be significantly better at overcoming these barriers than current EEC arrangements. Most stakeholders did not believe that this was the case, but thought that the current incentives for suppliers to identify cost-effective measures performed well. As noted, the question whether significant additional measures exist is inherently very difficult to answer.

An important aspect of the measures available is the route through which they are implemented. Whereas current regulation requires the participation of energy suppliers at some stage, a TWC scheme could, in theory, enable participants to undertake measures

independently of suppliers. However, there may be other reasons than supplier “bottlenecks” for the current structure of the market. The current vertical market is characterised by relatively large organisations, often in the form of partnerships between different organisations. These help aggregate and coordinate functions such as marketing, financing, and MRV requirements to an economically efficient scale. These needs are likely to persist under a TWC scheme, and it therefore is not clear that that delivery routes would change significantly .

Finally, a TWC scheme would be fully compatible with the use of innovation and energy service uplifts that currently are used to influence the composition of measures. The impact of a TWC scheme on these is not clear and depends on whether the involvement of large organisations or a decentralised supply chain is more important for the promotion of these particular types of measures.

6.3. Effects on scheme costs

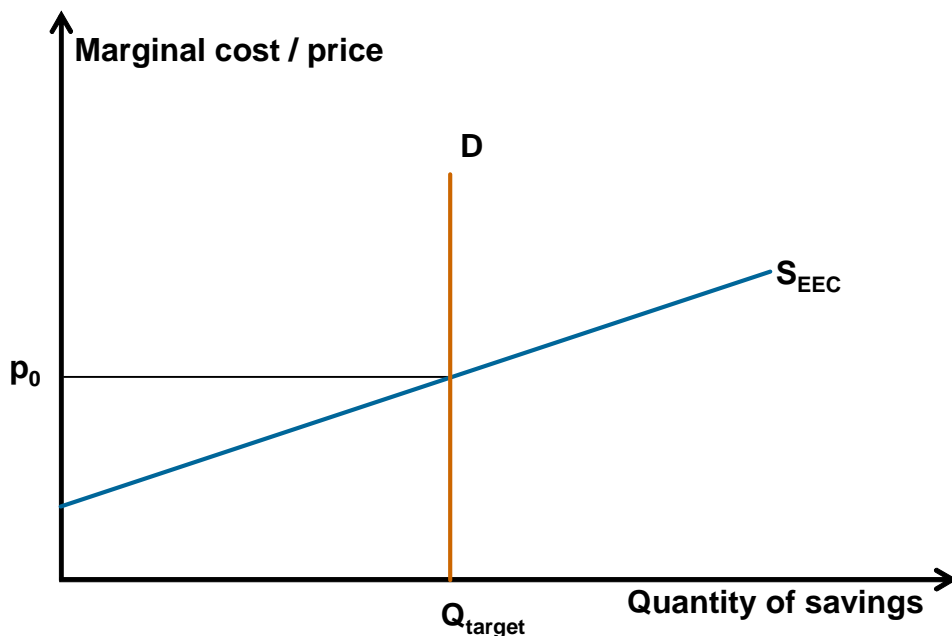
One important reason for moving from the current approach towards a TWC scheme would be if such a change were expected to foster more cost-effective energy efficiency activities. In this subsection we discuss the impact of a TWC scheme on different categories of cost (installation, administration, transaction), as well as the overall distribution of costs.

6.3.1. Costs of energy efficiency measures

A TWC scheme would lower the costs of the energy efficiency improvements if it were more successful at providing incentives for low-cost measures than the current approach.

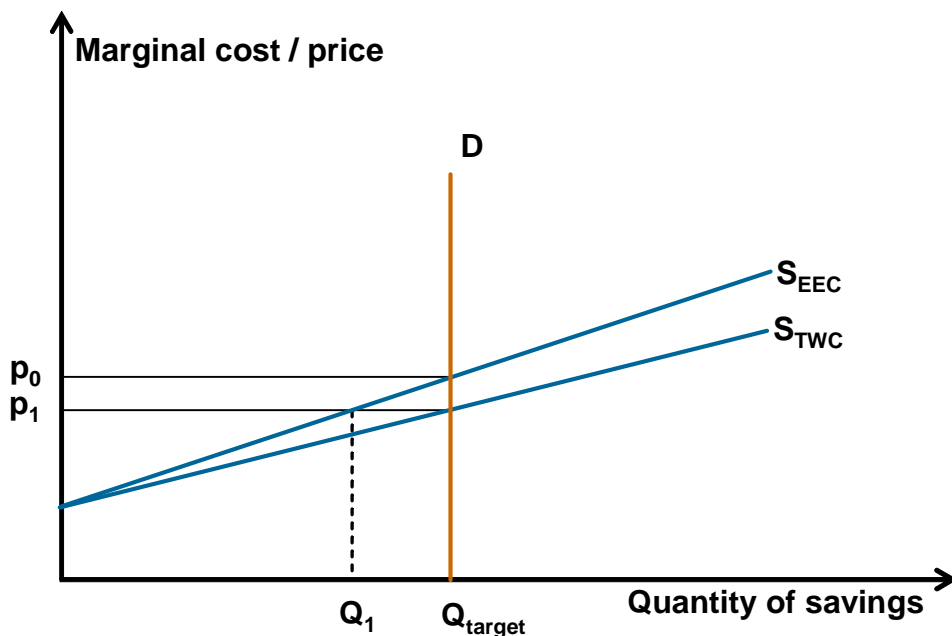
Figure 6.2 illustrates a stylised model of how prices are formed in the market for energy efficiency measures. The Schedule D shows the demand for measures, which is fixed by the quantity of savings demanded through the obligation on suppliers, Q_{target} . Under current arrangements, supply is provided in the vertical market for energy efficiency measures, where suppliers contract with project developers. Although, no “certificates” or “credits” are issued, the schedule is implied by the amount paid by suppliers to contractors, where a price per unit savings is implied. This is indicated by schedule S_{EEC} , which is upward-sloping to reflect the fact that progressively more expensive measures have to be undertaken in order to achieve a greater amount of savings. The price p_0 is the price of savings paid by energy suppliers in this market. If the market functions well, all suppliers would pay a similar price, as they would have access to the same set of potential energy measures, as embodied in supply schedule S_{EEC} . Also, for the time being we assume that this market functions in a competitive way, such that all suppliers of energy efficiency measures obtain the same price per unit savings. We return to the possibility of price discrimination, i.e., the payment of different prices for the same good, in a later section.

Figure 6.2
Price formation in the energy efficiency market



The possibility that a TWC would alter the supply of measures is illustrated in Figure 6.3. This has an impact on the supply schedule, which shifts to S_{TWC} , reflecting the availability of new measures. At target Q_{target} the price of savings is p_1 , which also is the price of white certificates. Put differently, the TWC scheme has made available a quantity ($Q_{target} - Q_1$) of previously unavailable measures, i.e., the difference between the amount of cost-effective measures available at the new price p_1 under the TWC and EEC scheme, respectively. (Alternatively, this can be conceptualised as the “same” measures, but implemented at a different cost.)

Figure 6.3
Effect of new measures made available through a TWC scheme



This possibility would be the main motivation for the transition to a TWC scheme. However, as noted above, the significance of the change in delivery routes and measures undertaken is uncertain; in terms of the figure, it is not certain that S_{TWC} is substantially different from S_{EEC} and hence not clear that the price p_1 would be significantly lower than p_0 .

This representation clearly is highly stylised but illustrates the basic principle of how the price paid by suppliers for energy measures is formed. There are several complexities that are not illustrated in this framework. For example, the supply schedules are likely to change with external circumstances such as fuel prices; if the composition of measures contained in each supply schedule is different, they may react differently to such changes. More directly, there is no distinction between PG and non-PG measures, and it is possible that the TWC scheme would have a differential impact on the supply of these two categories of measure.

6.3.2. Administrative and MRV costs

The significance of MRV costs in EEC as well as TWC schemes arises for a number of reasons. First, the project-based policy framework generally requires complex administrative procedures to establish additionality, requiring certificates to embody a comparison against a counterfactual baseline scenario that is inherently uncertain. Second, compared to many other certificate schemes such as those for renewable energy, the size of individual potential projects is relatively small in relation to their financial value. Third, a comparatively large number of project developers is required to install measures, making the number of (direct or indirect) participants in the scheme very large and the average size of participants small. Taken together, these considerations mean that MRV costs potentially constitute a more significant factor in energy efficiency certificate schemes than in other programmes in which the principle of tradable certificates has been implemented. (For comparison, in the certificate programmes for electricity generation from renewable energy sources the additionality issue does not arise once the eligibility of technologies has been established, the projects are normally large investments in generation capacity, and the number of participants much smaller than in an energy efficiency scheme.)

One immediate change with a TWC approach is that MRV costs may be incurred directly by project developers as well as energy suppliers. For developers to recoup these costs, the price for certificates under a TWC scheme will need to include these costs, as well as the costs of installing a particular energy efficiency measure.

It is not clear that the change from current practice would be large. Like in the current scheme, participants generating certificates in a TWC scheme would need to invest time and resources in learning about scheme rules, track changes to requirements, carry out audits, follow the white certificate market, contact trading counterparties, obtaining IT systems, submit data to the scheme regulator, undertake verification activities, etc. Much of this is likely to be beyond the capacity of small organisations, even if administrative requirements were relaxed (at the price of a higher risk that non-additional measures were certified). These requirements effectively create a size threshold for participants, since smaller companies could find them too high for participation to be viable.

In the current vertical market for energy efficiency measures these functions typically are carried out through consortia, managing agents, consultants, or other parties (as well as the suppliers themselves). This is likely to continue in a TWC scheme, provided scheme rules

allowed for group reporting and verification of projects in which several small participants could delegate some of their reporting and other requirements to a third party, who in turn could maintain the necessary direct contact with the scheme regulator. Such “pooling” arrangements of reporting have been used in other schemes involving trading mechanisms, including the UK Emissions Trading Scheme. The effect on total MRV costs is uncertain. If the number of organisations engaging in MRV were to increase the total cost could increase, although this could be offset by lower cost of implementing measures. On the other hand, there may be little change, as much of MRV requirements already are decentralised through sub-contracting.

In addition, energy suppliers would need to continue to devote some resources to participation. These costs would be significantly decreased compared to current arrangements, as certificates would be certified by others, but suppliers still would need to monitor progress towards target and assess their risks. If, as is a possibility, this is done by procuring certificates in a way similar to current contracting procedures, suppliers also could end up providing the “pooling” services referred to above, and thus continue to incur some of the cost of MRV. Again, this would mean that the demand (by suppliers) and supply (by project developers) of certificates would not be fully separated, blurring the practical distinction between a TWC scheme and current arrangements.

6.3.3. Transaction costs

Many of the potential attractions of a TWC scheme arise because of the potential to reduce transaction costs. If the scheme is able to sustain a liquid market, there are immediate efficiency gains from the alleviation of costs for search and co-ordination, price discovery, bargaining, etc. For example, for a homogenous goods such as TWCs, the existence of a “market price” helps inform potential sellers of whether they would have a competitive product to offer, and therefore whether it is worth attempting to market the good to potentially buyers. Also, sellers and buyers also require substantially less information about each other as it in principle would be irrelevant to the energy supplier purchasing the certificate how it was first generated. However, if most certificates were traded not through a liquid spot market but through long-term contracts, the change from current arrangements may not be large.

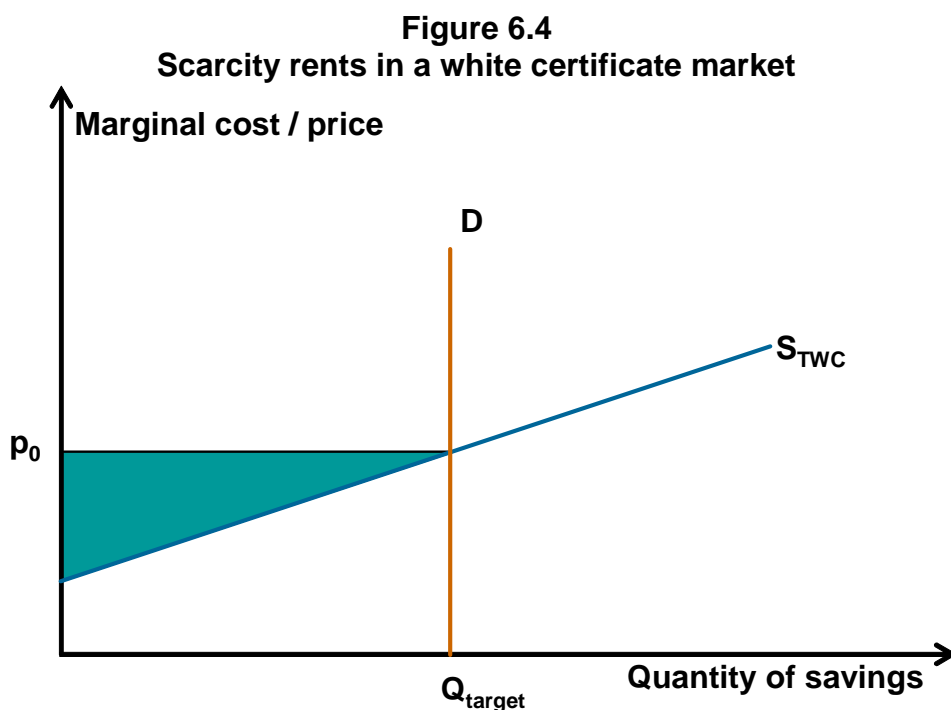
Market participation can give rise to some new transaction costs, such as fees payable to brokers and other intermediaries to facilitate trades. The participation of such players may help alleviate one of the concerns expressed by stakeholders, *viz.* that horizontal trading currently would risk disclosing commercially sensitive information. With anonymous trades and large trading volumes this consideration would not arise.

6.3.4. Distribution of costs

A major concern expressed by some suppliers was that a change to a TWC scheme could lead to increased costs to them, even if total costs were lower. In other words, there was a fear that the distribution of costs would be such that suppliers (and therefore potentially also consumers) would be worse off than they are under the current arrangements.

The issue of cost distribution is an important aspect of policy evaluation—and indeed explains the inclusion of the PG requirement in the EEC. One important aspect of

distributional impacts in the context of a certificate market is the so-called “*surplus*” that potentially accrues to the suppliers of the tradable commodity. This is illustrated in Figure 6.4. All developers of certificates obtain the same price, p_0 in this market, but many developers have costs that are substantially lower. For each measure undertaken, these developers thus earn a net margin. One energy supplier was concerned that this could lead to substantial gains for the insulation industry, as they would receive certificate prices that were substantially above their own cost and that reflected instead the costs of other, more expensive measures.



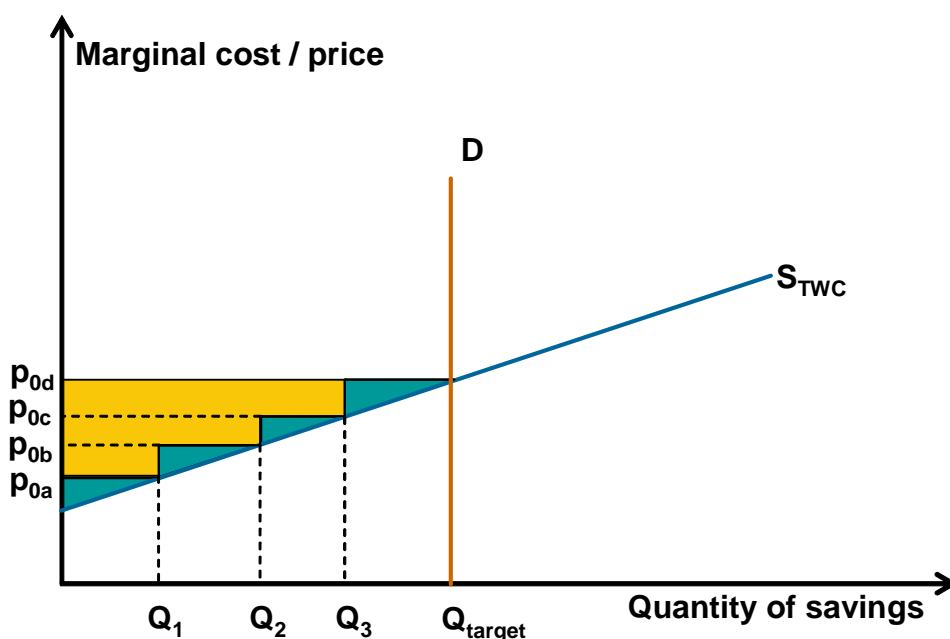
It should be emphasised that this is a normal feature of a competitive market, occurring wherever production or other supply costs are heterogeneous. For example, costs of one industrial facility may be lower than those of another producing an identical good because one uses newer and therefore better technology, or because it has lower cost raw material, labour or financing costs, etc. As long as both facilities are producing and meeting demand in the same market, the (single) market price will have to at least cover the marginal cost of the more expensive facility, leading to a margin or producer surplus on each unit produced by the less expensive facility. (The potential to earn this margin in turn is a major motivating factor for cutting costs, undertaking new investment, and innovation).

It also is important to recognise that, while the existence of such surplus results in a transfer from energy suppliers / energy consumers to developers of energy efficiency measures, it does not necessarily increase the overall costs of the scheme, i.e., the sum of the net cost to all scheme participants. Nonetheless, the issue potentially is politically sensitive, as the surplus is created by obligations imposed through regulation. Also, the size of the total transfer depends in part on which eligible measures are included; if additionality is not entirely enforced, then some “unnecessary” subsidies are likely to be paid to suppliers of energy efficiency measures.

This reasoning is not only a feature of a TWC market, but can also be applied to the vertical market in energy efficiency measures in the existing EEC scheme. If suppliers are prepared to pay a particular price per unit energy savings to, say, a retailer of energy efficient appliances, then economic theory tells us that, in a competitive market, the same price should be available to insulation installers. In other words, if the market functions in a competitive way, there will be a “market price” that is obtainable by all providers of “identical” savings measures (whether actual certificates are issued or not).

The fact that suppliers are concerned that their overall expenditure may increase with a TWC scheme suggests that the current EEC arrangements allow them to *price discriminate* (i.e., pay different prices to different project developers). For example, contracts for insulation measures may be entered into at a lower cost than those of other measures, reflecting the lower cost of insulation. This situation is illustrated in Figure 6.5. In this example, suppliers are able to divide the market for energy efficiency measures into four segments, indicated by Q_1 , Q_2 , Q_3 , and Q_{target} . For example, each segment may represent a distinct delivery route or measure, in which energy suppliers are somehow able to negotiate a price based on that particular segment’s costs, rather than the costs of the market as a whole. Each segment thus has a different price, indicated by $p_{0a} - p_{0d}$, where p_{0d} corresponds to the price payable in the absence of price discrimination. The net result of this market segmentation is that suppliers pay less in total, with the total surplus or rent obtainable by energy efficiency providers reduced (indicated by the four smaller shaded triangles in the figure).

Figure 6.5
Example of price discrimination



In this situation, suppliers would be worse off by a switch to a system that establishes a single market price for measures, as embodied in white certificates.

It has not been possible to ascertain the whether price discrimination in fact occurs to a significant extent in the current market for energy efficiency. While some suppliers expressed concerns about increased costs that implied there might be price discrimination,

others did not share these concerns and were positive to the idea of certificates. Also, price discrimination can arise for various reasons—it can be an indication of market power, but it may also indicate that products are in fact not identical; for example, measures delivered promptly and reliably may fetch a premium over measures delivered unreliably. Anecdotal evidence of differences in prices also needs to be treated with caution, as there may be reasons for fluctuations in prices that are unrelated to price discrimination; for example, changes in the compliance position of suppliers at different points during the compliance period.

Concerns about the distribution of costs and benefits also may arise because of the differences between beneficiaries and non-beneficiaries of energy efficiency measures. Other things being equal, DSM schemes financed through energy bills (including EEC and TWC schemes) result in costs to *all* consumers, whereas the benefits accrue only to those who have measures installed in their homes. However, this issue arises equally in the case of EEC and a TWC scheme, and thus is separate from the transition to a certificates system.

6.3.5. Summary of effects on costs

The overall costs and benefits of a switch to a TWC system depend on a range of different factors, especially the extent to which incentives for new, cost-effective measures can be provided by the approach. As noted, no stakeholder was able to identify what these sources would be, but the possibility of some cost savings cannot be excluded. Overall administrative costs are likely to be higher in a TWC scheme where smaller participants have their activities directly certified by the scheme regulator, but this may be alleviated by relying on “pooling” methods of MRV similar to those in the current scheme. The overall impact on administrative costs (for the regulator as well as participants) would depend on the exact parameters of scheme design, and especially the verification requirements of the scheme. The impact on transaction costs depends in large part on whether a liquid market for certificates is established. Finally, the distribution of costs may depend on the competitive operation of the market for energy efficiency measures, whether through vertical contracting or horizontal trade in certificates.

6.4. Effects on scheme uncertainty and risk

The change from the current EEC arrangements to a TWC system could also lead to changes in risks faced by different participants. We discuss the risks faced by suppliers, project developers, government, and consumers in turn.

6.4.1. Risks to suppliers

Suppliers indicated that the risk of non-compliance was a paramount consideration in EEC. As discussed above, this is closely related to the penalty mechanisms in EEC. Participants stated that the large downside to non-compliance meant that they were reluctant to rely on the horizontal market for certificates for compliance purposes. Some also said that they paid a premium for measures that would minimise this risk, for example, by using more expensive but reliable national contractors rather than local ones.

This illustrates that the demand for energy savings by suppliers includes not only the *volume* of savings, but also the *certainty* of delivery at a point of time, to a given quality standard, and at a known price. These concerns would remain in a TWC scheme, as the same

considerations would apply to the purchase of certificates. Assuming the existence of a liquid spot market, this theoretically could be achieved purely through horizontal trading. However, if the market lacks liquidity and “depth”, this may not be sufficient, and suppliers thus could face significant price risk. Price spikes have arisen in some previous emissions trading programmes, suggesting that this may be a significant concern, although experience also suggests that the presence of banking or carry-over provisions help alleviate this potential problem.

One way to alleviate the risk under a TWC scheme would be for suppliers to enter into forward contracts, i.e., contracts that specify a right to buy certificates at an agreed price at a future point in time, and an obligation of the contract developer (or other party) to sell. As noted above, this type of market may mean that suppliers face lower transaction costs, as, in theory, they do not have to gather information on the type of energy efficiency measures being undertaken. If developers were willing to enter into contracts that committed them to a guarantee of delivery of certificates, this could indemnify suppliers against the costs of default on the contract by the developer. The implications of such arrangements for developers is discussed in the next sub-section.

By contrast, under current arrangements suppliers generally monitor the status of individual projects with a high frequency (normally on a monthly basis) in order to have greater certainty about their overall compliance position and distance to target. It is likely that this need would remain in a TWC scheme if the consequences of non-compliance were similar to those in the current arrangements. One possible outcome therefore is that suppliers continue to enter into direct contracts with project developers undertaking specific activities, against a guarantee of the right to purchase the resulting white certificates. As noted, this would result in a market structure very similar to the current contracting market, having a strong vertical element with an association of certificates with the underlying activity (rather than the theoretical separation of the two envisaged by a theoretical TWC scheme). With a different penalty structure, it may be less likely that such contracts would be considered necessary.

6.4.2. Risks to project developers

In a spot market for TWCs, project developers would undertake activity in anticipation of being able to sell certificates, but without certainty about the price. This essentially amounts to a risky investment, whereby an initial payment is made against an uncertain future return. For example, an insulation installer could undertake work in the anticipation that the certificates issued upon final verification by the regulator would have a value large enough to more than offset the initial outlay.

Most suppliers of energy efficiency measures consulted in the course of this study did not think they would be able to bear this level of risk. While the sample is limited, this is likely to illustrate a general problem for small participants. Current arrangements typically allow contractors to invoice for credits gained with high frequency (e.g., weekly) in order to manage their own cash-flows and expenditure. By contrast, this may be difficult to achieve in a certificate spot market, as there could very easily be a lag between measures, verification, and trading activity. In theory this difficulty could be overcome via bridging loans or by developing a sufficiently large portfolio of projects that were completed on a rolling basis to provide sufficient cash flows to finance them. However, in practice such an arrangement would be difficult to engineer, and even the largest and most sophisticated project installers

that we have interviewed indicated that they would have difficulty operating under such arrangements. This contributes to the likelihood that energy efficiency measures will be undertaken against some form of forward contract under a TWC scheme, reaching a similar outcome to current EEC arrangement, where payments generally are agreed prior to the work being undertaken.

Another source of uncertainty is that it is difficult to know what amount of savings will be available from a particular project. Several energy suppliers stated that there often was a mismatch between the initial estimates and eventual delivery. For a small project developer, this uncertainty could make it difficult to enter into a firm forward contract to deliver a fixed number of certificates—particularly if they were held liable for the damages a supplier incurred as a result of non-fulfilment. Such considerations raise the possibility that agreements will be made to deliver an estimated but unspecified number of certificates arising from a particular project, either against a lump-sum payment or a payment per certificate. Again, this would serve to link certificates to specific projects, resembling the current vertical market for energy efficiency measures.

6.4.3. Risks to Government

The main risk that would be faced by government if there were a shift to a TWC scheme is that changes to scheme arrangements would jeopardise scheme objectives to achieve cost-effective *additional* improvements in energy efficiency. As discussed, the project-based approach that underlies both the current EEC framework and a TWC scheme poses a trade-off between the risk of certifying non-additional measures and the risk of excluding genuine and cost-effective measures. Provided penalties for non-compliance were similar, there is no inherent reason to think that there would be a greater risk of non-compliance by suppliers under a TWC scheme than under the current EEC arrangements. Instead, the issue is largely one of the MRV requirements in place, and whether any changes would be required in order to make a transition to a TWC scheme.

As noted above, it may be more difficult to strike the appropriate balance for MRV stringency under a TWC scheme. On the one hand, the effective participation of small players in a TWC market may require a less stringent regime (although this change could be made independently of a transition to a TWC scheme); on the other hand, there may be additional challenges to eliminate double-counting or non-certification of genuine additional measures. To a large extent, however, these problems are inherent in the project-based approach to energy efficiency obligations, and a TWC scheme may not be much different from the current situation, unless deliberate changes were made to the MRV regime for other reasons.

A related issue is whether a TWC scheme could preserve all current scheme objectives. In particular, continued separation of PG and non-PG requirements would require two different “currencies” of certificates that were not exchangeable. As discussed above, this potentially would partition the certificate market and could be an impediment to the development of a liquid market.

One way to avoid this problem would be to abandon the PG requirement and attempt to address the social component of EEC through another policy. Another would be to have a single certificate denomination but give a different weighting to non-PG and PG activities,

similar to the “uplift” provision in the current EEC. This would facilitate the operation of a single certificate market, but the price would be reduced certainty about the proportion of measures undertaken in PG households. The balance of measures undertaken would depend in large part on how the relative cost of PG and non-PG measures compared to the relative weighting of the certificates awarded, and it would be difficult to arrive at the exact weighting that gave the desired result that half of measures are undertaken in the PG (once a weighting has been said it would be desirable not to alter it, in order to provide certainty to market participants).

The existence of different weightings for PG and non-PG households also would make the mapping between energy saved and avoided CO₂ emissions less clear-cut, making it more difficult to link the TWC scheme to other trading schemes, such as the EU ETS or TWC schemes in other countries. It arguably also would make the rules more complicated.

6.4.4. Risks to beneficiaries / end-users of energy

It is unclear that a TWC scheme would entail additional risk for the beneficiaries of energy savings. A (small) potential issue in this regard may be the quality of projects. Some suppliers stated that one reason for their direct involvement in energy efficiency project was to monitor the quality of the outcome of any project where their own brand was used. With a TWC scheme this may become less common, but other actors in the market would be likely to have similar concerns about maintaining their reputation for EEC measures for which they are responsible. Overall, it seems unlikely that beneficiaries would run a higher risk under a TWC scheme. If it were found to be the case, the Government could require more rigorous quality inspection as a component of the general MRV regime.

6.4.5. Summary of effects on risks

A White Certificate system would change the distribution of risk within a system with energy efficiency obligations. Notably, project developers would not have any guaranteed level of payment if transactions were carried out purely in a spot market. In addition, there would be a lag between undertaking the measure and receiving payment from the buyers of the certificate which even fairly large organisations may find difficult to bear.

The solution to these concerns may be the use of a forward market for certificates or sub-contracting agreements to undertake energy efficiency activities to generate certificates. Such arrangements are likely to limit the extent to which a TWC scheme results in a market structure significantly different from the current vertical market for energy efficiency measures.

6.5. The possibility of a “hybrid” EEC and TWC scheme

One option that has been proposed would be to allow a TWC scheme to develop alongside the EEC in a complementary fashion. Such a “hybrid” arrangement would allow the current institutional arrangements of EEC to be retained, but participants also would have the possibility of using a TWC model for compliance. One benefit of a hybrid scheme would be

to test the viability of the TWC approach and allow scheme participants to try out its features. Another motivation could be to provide safeguards in case there were unanticipated problems with the implementation of a TWC approach, e.g., difficult administrative procedures or insufficient generation of certificates to meet demand.

The TWC component of a hybrid scheme would require consideration of the various design issues arising for TWC schemes in general, as discussed in detail in section 6.1 above. In particular, new institutional arrangements for the monitoring, reporting, verification, and the issuing of certificates would be required. There also would need to be a registry for certificates. This raises the question of which authority would be best placed to regulate the TWC part of the hybrid scheme. One reason for Ofgem's involvement in the EEC has been the close involvement of energy suppliers, which are licensed and regulated by Ofgem. With a greater number of participants requiring verification of activities another authority may be better placed to regulate the TWC aspect of a hybrid scheme. However, it may be disadvantageous to have two distinct regulators for the EEC and TWC components, both because total administrative costs could increase, and because it would be difficult to ensure consistency of treatment across regulators. This in turn could give rise to gaming by project developers, choosing to register their projects under the EEC or the TWC part of the scheme depending on which regulator was perceived to offer the more advantageous interpretation of regulations. Running two parallel procedures also would lead to higher administration costs for the regulator.

An additional potential concern would be that the market for certificates would be smaller and less liquid in a partial TWC scheme. If suppliers (perhaps out of inertia) chose to carry out most measures in arrangements similar to those currently operating there may be little demand for TWCs. The risk faced by a potential project developer therefore would be higher. Thus the partition of the energy efficiency market into an EEC and TWC component under a hybrid scheme could amplify the factors that may be obstacles to the development of a well-functioning TWC market.

It also would need to be clarified who would be eligible to generate TWCs. Unless there were strong reasons to the contrary, the preferred option is likely to be to allow any party able to submit documentation of an eligible project and fulfil associated MRV requirements (including information necessary to avoid double-counting) to be issued certificates. This would include TWCs generated through sub-contracting, as there may be clear efficiency gains from centralising documentation and other aspects of implementation, and it may be difficult for small participants such as individual installers to learn about and comply with scheme requirements.

With such arrangements suppliers also would arguably be able to generate TWCs for the type of activity they currently undertake, and the distinction between the "EEC" part and the "TWC" part of the scheme therefore would not be clear-cut. The distinction may be limited to one of nomenclature for the credits / certificates issued. On the positive side, allowing TWCs under a hybrid arrangement could potentially encourage the uptake of hitherto untapped sources of efficiency measures.

6.6. Summary

A transition to a TWC scheme would require new institutional arrangements and some new legislation, including primary legislation. Various design parameters would have to be considered, with the most significant changes to MRV rules, certification procedures, and market arrangements such as a certificate registry.

The effect on the composition of measures undertaken would depend on whether there currently are significant barriers to the uptake of eligible measures, and the extent to which a TWC design would be able to overcome these. In theory, the more decentralised nature of a TWC scheme may be more successful in overcoming information asymmetries that give rise to such barriers. However, no stakeholder was able to identify the specific mechanisms through which a TWC would lead to significant changes in measures, and the existence of significant untapped opportunities among eligible measures remains moot. In addition, there is reason to think that some aspects of current partnership arrangements would persist under any project-based energy efficiency scheme. Changes to the supply chain therefore may be constrained by considerations unrelated to a change to whether the scheme uses a TWC or a vertical contracting approach to demonstrate compliance. For both these reasons, the change in the composition of measures and delivery routes occasioned by a TWC scheme may be limited.

This also means that the impact on scheme cost may not be large. Also, insofar as new measures did become available, the average expenditure necessary to reach a given target may decrease, although the significance of this effect is unclear, as discussed. Transaction costs are likely to decrease, as there would be fewer requirements for the involvement of suppliers in energy efficiency projects. Against this, administrative costs are likely to increase with the involvement of a larger and more diverse set of participants in the monitoring, reporting, and verification process.

A TWC approach also may affect scheme risk and uncertainty. The use of a certificate spot market may be unlikely, as project developers require both certainty and a higher frequency of payment. Conversely, several suppliers indicated their preference for the involvement and monitoring of projects in order to reduce their risk of non-compliance. Both these considerations point to the likely use of forward contracts for certificates or direct sub-contracting for measures. This would be very similar to the arrangements in the current vertical market for energy efficiency measures, and a TWC scheme therefore may have little practical impact on the composition of measures and scheme costs.

Finally, a “hybrid” scheme retaining the current institutional arrangements of EEC but allowing participants the possibility of using a TWC model for compliance may offer some elements of TWC schemes without some of the risks that changes to the EEC may entail. The benefits of such an approach may be limited, however, as similar benefits arguably could be obtained under a TWC scheme in which suppliers were allowed to generate certificates from subcontracted activity.

7. Options for Trading: Cap-and-Trade Approach

This Chapter discusses issues that would arise in applying a cap-and-trade framework to the aim of encouraging household energy efficiency. Both the current EEC and a potential TWC

scheme are based on a project-based approach in which credits are generated for selected approved activities. The obligated parties thus are required to hold credits or certificates demonstrating estimated improvements against a counterfactual baseline, providing an indirect measure of energy savings and/or CO₂ reductions. By contrast, a cap-and-trade approach would place restrictions directly on the quantity which the policy seeks to limit, either CO₂ emissions or (more controversially) energy consumption.

This approach has been favoured in several other trading schemes, notably the EU ETS, for its potential advantages in terms of administrative simplicity and certainty about achieving policy goals. However, the application to energy efficiency is largely untested, and would pose significant challenges, especially in setting an appropriate and feasible overall cap.

The chapter is organised in the same structure as the previous chapter on white certificates, discussing design parameters, the effect on energy efficiency measures, the implications for scheme cost, and the issue of risk and uncertainty in turn.

7.1. Design parameters of an energy/CO₂ cap-and-trade scheme

A cap-and-trade scheme would entail a completely new approach to energy efficiency policy, and as such would need to supersede the current EEC framework, rather than be developed alongside it. Obligations and institutional arrangements would have to be revised, and new primary legislation would be required.

In light of this, this section does not describe a transition from the current EEC framework to a new cap-and-trade framework, but rather outlines the basic design parameters that would have to be considered in a new trading scheme.

7.1.1. Denomination of targets

As noted above, the main difference between a cap-and-trade and a project-based scheme is the denomination of the target and obligations on participants. In a project-based scheme, a minimum target level of activity is set for participants, and certificates are issued for verified qualifying activity. The target thus is denominated in terms of the *desired* activity, e.g., the production of electricity from renewable energy sources, the achievement of emissions reductions, the delivery of energy efficiency projects, etc.

By contrast, under a cap-and-trade scheme the regulator imposes a limit on something that is determined to be undesirable. Participants are required to hold a permit (an “allowance”) in order to undertake a certain activity. For example, in the EU ETS covered installations are required to hold a permit / allowance for each tonne of CO₂ emitted. As the regulator has control over the total number of allowances issued, it also has control over the total amount of activity undertaken (e.g., total CO₂ emissions) provided scheme rules are enforced.

The denomination of targets and the cap would depend on the objectives of the scheme. We consider briefly here the possibility of a CO₂ cap and a cap on energy use.

7.1.1.1. Cap on CO₂ emissions

One possibility would be to cap the CO₂ emissions associated with household energy use. This would require that an emissions factor were associated with each type of energy covered by the scheme to reflect the CO₂ associated with its use.

In determining the emissions factor to be applied to electricity use, one issue to consider is whether CO₂ emissions from electricity should be differentiated by supplier to reflect the CO₂ emissions actually produced by the generation sourced by those suppliers (rather than, for example, grid-average CO₂ emissions).²¹ This would mean that the total cost to the end-user of electricity from high-emitting sources / suppliers would be higher than electricity from low-emitting sources, as it would require a larger number of allowances. Overall, the effect would be to increase the value (and therefore price) of electricity from low-emitting generation compared to electricity from high-emitting sources. It also would mean that participants could cut their energy-related CO₂ emissions by methods other than reducing total energy consumption, including switching to a lower-emitting supplier. Suppliers in turn could reduce their average emissions intensity by sourcing their electricity from low-CO₂ sources, which thus would be able to earn a premium in the wholesale electricity market.

Table 7.1 shows the fuel mix and emissions intensity of six major UK energy suppliers along with the UK average figures, in the period 1 April 2004 to 31 March 2005. For example, Powergen sourced a relatively high proportion of electricity supplied from coal-fired generation, and its overall fuel mix results in an emissions intensity of 0.64 tCO₂/MWh supplied. By contrast, the emissions intensity of electricity supplied by British Gas is 0.37 tCO₂/MWh. Overall, there is substantial variation in emissions intensity across different suppliers. (In addition to those shown below, there are also smaller suppliers, some of whom focus exclusively on renewable electricity.)

Table 7.1
Fuel Mix and Emissions Intensity of Major UK Electricity Suppliers

Supplier	Coal (%)	Natural Gas (%)	Nuclear (%)	Renewables (%)	Other (%)	CO ₂ emissions (g/kWh)
British Gas	14	62	16	5	3	0.37
EDF Energy	46	33	14	3	4	0.56
npower/RWE	46	35	13	3	3	0.56
Powergen	56	33	8	1	2	0.64
SSE	30	57	4	8	2	0.48
ScottishPower	48	41	4	6	1	0.59
UK average	33	39	21	4	3	0.46

Source: www.energyinfo.org

These numbers are annual supplier averages, but it is not clear that this would be a satisfactory basis on which to base emissions factors for the scheme. It would likely be necessary to use the previous year's average in order to arrive at a reliable figure, and the

²¹ This discussion draws on the discussion of denomination in the report on a new emissions trading scheme for the public and small business sectors, written by NERA Economic Consulting and Enviro Consulting, and accompanying this report.

time lag would mean that the current CO₂ intensity of suppliers would not be accurately reflected. Suppliers might develop products for their customers that had a certain CO₂ intensity, but this could run the risk of being a shell-game, with “low-CO₂ sources” being tagged for use by households and high-CO₂ sources “diverted” to other (business) markets.

Also, the CO₂ intensity of a particular supplier is to a large extent the result of historical circumstances unrelated to climate policy, so differentiation therefore could be perceived as an unfair reward or penalty for these circumstances. For example, a supplier with low CO₂ intensity may find itself price competitive even if it does not take any action to reduce the CO₂ emissions produced by the electricity it produces. From this perspective, it therefore may be worth considering differentiation not by the level of emissions, but the *change* in the emissions rate over time. Unfortunately this would make it more difficult to do a straightforward accounting of the “carbon content” of electricity, but could be better able to provide incentives to purchase and generate power from lower-carbon sources.

A related concern is that many but not all suppliers have vertically integrated power generation and supply divisions. Under differentiation it may be possible for a supplier with generation assets to earmark the low-emitting electricity for own use, selling only high-emitting electricity to competitors. The effect may be a distortion of competition in the electricity market, with a disadvantage for suppliers without generation assets.

It also is not clear to what extent it is desirable to attempt to encourage low-emitting generation (as opposed to low electricity consumption) through a new cap-and-trade scheme as this may overlap with other policies, with risk for double-counting or “double-crediting”. The Renewables Obligation already provides support for eligible generation from renewables, and providing support for their low-CO₂ characteristics via a new cap-and-trade scheme could serve simply to reduce the support required from the RO, so that ROC prices would fall, especially in the long run. Similarly, as all CO₂ emissions from grid-connected electricity generation is covered by the EU ETS, CO₂ emissions already are accounted for, and the environmental benefits of further differentiation by fuel are not obvious.²²

7.1.1.2. Cap on energy use

Denomination in terms of CO₂ may not accurately reflect the non-environmental objectives of current energy efficiency policy. For example, a CO₂ cap with supplier-specific emissions factors could be met partly through fuel switching instead of energy efficiency measures. There therefore may be a case for a cap on energy use rather than CO₂, to reflect the benefits of energy efficiency that are not strictly related to environmental goals—for example, security of energy supply.

This is closely linked to the view that energy is not best understood as a good in itself, but as an input into “energy services” such as heating, lighting, and white good functionality. According to this view, an energy cap therefore would not lead to a cap on a good that in itself contributed to consumer welfare, as the same amount of energy could produce different

²² For extensive discussion of the interactions between various types of climate policy environmental instruments, see NERA (2005)

levels of energy services depending on parameters such as the housing stock, the energy efficiency of appliances, and end-user behaviour.

The validity of this analysis would depend on a number of parameters. An important consideration is the extent to which parties subject to the cap (e.g., energy suppliers) would be able to influence the quantity capped, an issue discussed further in section 7.4 below. Suppliers traditionally have not had substantial control over their domestic customers' energy use. One possibility that potentially would be encouraged by a shift to a cap on energy use would be for energy supply companies to transform their business model from one in which they supply energy to one in which a given service involving energy is supplied (e.g., domestic heating). This service could be delivered with different combinations of input energy and energy efficiency measures (e.g., insulation). Prices would be set per unit of energy *service* rather than per unit energy. This is a very different business model from that currently operated by energy supply companies, and thus would require a major restructuring of the UK energy supply market. It also is largely untested in a household setting, and it is unclear to what extent consumers would successfully respond to such a redefinition of their contract terms.

Even if an energy services approach were deemed feasible, it still would have to be determined whether it would be desirable. Rationing energy would raise fundamental questions about the rationing of goods and consumer welfare. It would be important that the introduction of an energy cap were preceded by a rigorous analysis of welfare consequences, including different options for analysing consumer preferences and welfare in this context.

7.1.1.3. Absolute vs. relative cap

A related consideration is whether the cap should be expressed in absolute terms or in terms of an emissions or energy rate per consumer. Often the latter type of rate-based or per-capita trading schemes are known as averaging programmes. In general, an absolute cap may give greater certainty about the level of emissions / energy consumed. In this case, however, the uncertainty about the total level may be very small as the number of domestic consumers can be estimated with a good degree of certainty, and a close-to-absolute cap could be maintained for any desired quantity, even taking into account population growth. One advantage of a rate-based cap would be that if consumers switched from one supplier to another, the allocation would stay with the consumer, rather than with the supplier. Suppliers would have incentives to try to attract low-consuming customers, because these would make it easier for them to stay within their capped allotments. If suppliers could not attract sufficient low-consuming customers or were unable to reduce their customers' demand sufficiently, they would be able to purchase allowances from other suppliers.

7.1.2. Target group and allocation of obligation

7.1.2.1. Target group

The choice of target group would depend on the coverage and objectives of the scheme. At the most basic level, it is useful to distinguish between a *downstream* scheme, in which energy users surrender allowances for emissions associated with their energy use, and an *upstream* scheme, in which fossil fuel producers (or suppliers) surrender allowances for the carbon content of the fuel they sell.

Each option has pros and cons and each has different implications for incentives and abatement options. A comprehensive upstream scheme ensures an economy-wide cap on fossil fuel emissions and a single price for carbon throughout the economy. This scores well on breadth of coverage and economic efficiency, but can be politically unpopular since it resembles a carbon tax from the perspective of energy consumers. In contrast, a downstream scheme is confined to a subset of emission sources and may lead to carbon being priced differently between sectors and fuels. But while a downstream scheme scores less well on coverage, administrative costs and economic efficiency, it offers greater political feasibility and, arguably, stronger incentives to downstream participants.

In the context of energy use by households, an upstream trading scheme is likely to be the more feasible option. Households are unlikely to engage in trading, and administration and allocation to a large number of small participants would be a hugely complicated undertaking.²³ By contrast, upstream trading would involve a relatively small number of participants. These could either be producers—including oil refineries, oil and gas importers, coal mines and coal preparation plants—or suppliers of fuels (and potentially other energy sources) to households. Keeping the obligation on suppliers rather than producers is likely to be more effective, because suppliers' direct relationships with customers should make it more likely that they would be able to affect behavioural changes. In either case, the relatively small number of companies involved in the upstream supply chain should help to keep administrative costs low compared to downstream trading schemes.

A related issue is whether to cover emissions that are already regulated by other measures, and especially the EU ETS. Note that, in the context of CO₂ trading, “downstream” refers to the activity that gives rise to CO₂ emissions rather than the use of “energy” *per se*. The EU ETS therefore is an example of a *downstream* scheme, in which electricity generators are consumers of fuel. The fuel used and CO₂ produced in electricity generation thus already are accounted for within a cap-and-trade scheme. The inclusion of electricity generators in another cap-and-trade scheme thus would lead to double-counting and double-regulation. As discussed in detail in Chapter 8, the inclusion of electricity generation in a household cap-and-trade scheme thus would *not* lead to any additional environmental benefits for a given EU ETS cap, as total emissions from covered sources in the EU would not be affected. (It may, however, lead to lower emissions from the UK.)

7.1.2.2. Price / cap level

The overall level of the cap has very important implications for the cost of the scheme. At the most basic level, it is the interaction of the total cap and the emissions abatement / energy reduction potential of market participants that determines the price of allowances. In particular, depending on the sensitivity of the price to the overall cap on allowances, imprecision in setting the cap may result in very high allowance prices with significant consequences for the price of energy (see section 7.4.1 below).

Setting the cap can be conceptualised in two steps. First, it is necessary to determine a “business as usual” (“BAU”) scenario, i.e., the level of emissions / energy consumption that

²³ Such proposals are similar to proposals for “Domestic Tradable Quotas”, extending the cap-and-trade principle to individual consumers.

would obtain in the absence of the scheme or other policy measures with similar aims. Second, the additional reductions in emissions / energy consumption required from participants would be defined. Subtracting this from the BAU level would give the total number of allowances to be allocated to scheme participants. Alternatively, one advantage of a cap-and-trade scheme is that it allows a cap to be set without reference to any counterfactual “BAU” scenario.

The starting point for setting the cap could be recent historic data on energy supplied from covered sources. Much of this may already be available to a precision acceptable to an upstream trading scheme, as it would not be necessary to produce disaggregated data necessary for allocations to end-users. It nonetheless may be necessary to gather additional data before the initial cap can be set. Moreover, it may be desirable to adjust the cap relative to historical data to reflect any changes to consumption that may arise if the new cap-and-trade scheme replaces an existing policy. Because energy use can vary significantly year-to-year based on annual weather conditions, it may be desirable to allow for some flexibility, at least early-on. This is discussed in more detail in section 7.1.4

Finally, the level at which the cap is set ought to reflect the emissions abatement / energy reduction potential. A starting point may be the information from EEC and other energy efficiency programmes, although as discussed below there may be reason to think that a cap-and-trade scheme would be able to incorporate a greater range of energy efficiency measures and therefore achieve the same level of energy savings at a lower cost.

These factors all are all subject to significant uncertainty, and would require detailed study before they were implemented.

7.1.2.3. Allowance allocation

Once the level of the cap were established, it will be necessary to determine how allowances should be allocated between participants.²⁴ The method of allocation has important distributional implications, and also may influence the incentives faced by scheme participants.

The most basic choice may be whether to distribute allowances for free or to sell them. In the first case, allowances could be distributed on the basis of historic data; for example, a certain allocation per customer in a recent base year. Allocations could also be updated, as in the case mentioned above where allowances are transferred from one supplier to another with the customer. The other basic option is to distribute allowances through an auction. As discussed below, the choice of allocation methodology has important distributional implications.

It generally would be desirable to determine allocations (per customer or in absolute terms) for as long a time period as is deemed feasible given the constraints on setting the cap noted above. Long-term certainty helps participants make informed choices about the most appropriate investments to make in energy efficiency or other abatement / energy reduction measures.

²⁴ For a detailed discussion of allocation options in the EU ETS, see Harrison and Radov (2003).

7.1.3. Monitoring and verification

A significant advantage of a cap-and-trade scheme would be the simplification of administrative for monitoring and verification. In contrast to a project-based trading scheme, it would not be necessary to assess the individual measures taken by suppliers or other obligated parties against a counterfactual baseline to ensure their “additionality”. The trend in emissions trading policy appears to be one that has moved away from credit-based schemes and towards cap-and-trade schemes because of the administrative difficulties associated with the latter, although this trend is by no means universal. (Ellerman, Joskow, and Harrison, 2003)

More generally, under a cap-and-trade scheme there would be less uncertainty about the additionality of reductions in energy use. The main remaining source of such uncertainty would be related to whether the cap was genuinely below BAU levels of emissions / energy use. However, this may not be a significant concern as it may be less important whether emissions (or energy) are reduced as a result of the scheme than to know that total emissions levels are below a target limit.

Depending on the emissions / energy sources covered, monitoring and verification thus could be a relatively limited administrative exercise. However, an upstream trading scheme would require that the regulator could track the energy and fuels supplied to households and distinguish these fuels from those consumed by sources not covered by the scheme, such as businesses and the public sector. This may be relatively easy for energy or fuels supplied and metered through networks (electricity and gas) but more complicated for coal, heating oil, and other fuels sold through standard retail channels. If the scheme aimed not to include fuels already covered by the EU ETS additional requirements would be required. The details of such arrangements would be an important topic for further research if the implementation of a cap-and-trade scheme were to be pursued.

7.1.4. Market design and mechanisms

For various reasons, it may be unlikely that there would be large amounts of trading under an upstream trading scheme (see below). It nonetheless would be necessary to establish a registry system for the tracking of allowances and allowance holdings, as well as various other trading provisions.

7.1.4.1. Buy-out / safety-valve

Some trading schemes provide a “safety-valve” for participants that essentially caps prices in the event that unforeseen scarcity drives them higher than desired or anticipated. The safety valve could be in the form of a “buy-out” price that participants could pay in lieu of purchasing allowances (or other certificate), or it could be in the form of a link to another trading scheme (such as the EU ETS), where the price in the linked market would serve as a ceiling above which the UK ETS price would not rise. Equivalently, a buy-out price could be cast in terms of a fixed penalty per unit CO₂ / energy for which an obligated party failed surrender an allowance.

As discussed above, there would be many sources of uncertainty in setting the overall cap for household CO₂ emissions / energy use. In the event that energy use were significantly higher

than expected (for example, during an exceptionally cold winter), the obligated parties would have a fixed supply of allowances and potentially limited opportunity for efficiency improvements beyond what they have already planned for the year. Because the higher energy demand would affect most participants in the scheme, it is likely that under such circumstances there would be an aggregate shortfall in allowances. This could lead to major price spikes in the allowance market, which probably would not be desirable. Over time (and particularly if banking were allowed), organisations could learn to plan for such contingencies by building up some surplus allowances. However, it would also be desirable to have a safety valve to ensure that the market stayed within reasonable bounds.

7.1.4.2. Allowance fungibility and linking with other schemes

The principle of a safety-valve “gateway” to other emissions trading schemes could be extended to more widespread – and potentially two-way – fungibility of allowances / certificates. This would help to ensure cost-effectiveness across schemes (by equalising marginal costs by participants in different schemes) and also would be consistent with the environmental aim to reduce global CO₂ emissions. However, it may not be consistent with all the non-environmental objectives of energy efficiency policy; for example, local benefits may be lost if energy savings in the UK were substituted for energy efficiency activity or emissions reductions elsewhere. We discuss these issues in more detail in Chapter 8.

7.1.4.3. Banking of allowances

The benefits of allowing intertemporal trading or “banking” have been discussed in detail in section 4.1. In addition to reducing the cost and risk to participants, it would bring forward energy efficiency activities and also reduce the likelihood that the price would drop very low, because market participants would know that they could always sell their allowances to be used during the next period if current period demand were lower than expected.

7.2. Effects on energy efficiency measures undertaken

The main motivation for a cap-and-trade scheme would be its ability to achieve a greater range of energy efficiency measures.

7.2.1. Effect on overall incentives to undertake energy efficiency measures

In a project-based energy efficiency scheme, suppliers have direct incentives to undertake energy efficiency measures, ultimately provided by the penalties for failure to do so. By contrast, cap-and-trade schemes provide incentives that are somewhat less direct. Incentives are provided indirectly through the overall cap and individual penalties for non-compliance. On an overall level, a supplier would be subject to penalties if its customers consumed more energy than the supplier held allowances. Faced with this prospect, suppliers can comply either by purchasing allowances, or by undertaking measures to ensure that the households they supply do not exceed that level of energy consumption or associated emissions. To achieve this, suppliers will need to offer households sufficient incentives (financial and other) to reduce their energy consumption.

One important issue for suppliers is likely to be the fact that under a liberalised retail energy market consumers are able to switch supplier relatively easily. This presents suppliers with a potentially serious difficulty—if they are required to reduce the average energy consumption of their customers, they may need to make investments in these customers and their housing stock. Suppliers may have concerns that they would not reap any benefits of such investments if their customers switch to a different supplier before the capital costs have been fully recovered. One way of doing this would be to allow suppliers and customers to agree to longer term service contracts. This issue will require careful consideration, however, because Ofgem has considered the ability to switch supplier without impediment an important element of an open and competitive retail energy market.

7.2.2. Effect on composition of measures

One of the main potential attractions of a cap-and-trade scheme would be the ability to provide incentives for additional types of measures that are difficult to incentivise within a project-based framework. One example of such measures that was mentioned by many suppliers was changes in consumer behaviour. It may be possible for suppliers to affect consumers via information campaigns and other educational measures, but the impact on energy use in any one particular case typically is difficult to establish, making it difficult to incorporate this type of measure among those eligible in a project-based scheme. More generally, suppliers would be free to undertake any measure whether or not it were on the list of EEC-approved measures, using whatever information available to the supplier. In this sense, a cap-and-trade scheme would be one step further removed from a “command-and-control” approach to energy efficiency, leaving decisions on energy efficiency measures entirely to the obligated party.

A cap-and-trade approach also could provide incentives for reductions in energy use throughout the supply chain, rather than just at the level of the end-user. This extent to which this occurs depends to a large extent on the level at which the supplier’s obligation is defined. For example, small-scale renewable energy sources could lower total household use of CO₂-emitting energy but would be incentivised only if the supplier’s target included all energy entering the household from distribution systems. Similarly, suppliers may wish to pay a distribution company to optimise the voltage on distribution circuits to lower the waste of energy, but only provided the supplier’s target included electricity prior to its entering this stage of the supply chain.

Other things being equal, the ability to undertake a larger set of measures should ensure that energy efficiency improvements are undertaken at a lower cost. As noted, however, it is difficult to assess the extent of such additional cost-effectiveness, and there may be reasons why some of the limitations on measures that currently operate in EEC may persist in a cap-and-trade scheme. First, it may be the case that the measures that are not amenable to formal crediting under a project-based scheme also are ones that are inherently difficult to monitor. For example, the impact of measures to encourage changes to consumers’ behaviour may be difficult to establish *in general* as well as in the context of a specific project. If this is the case, suppliers will face the same the risk of approving/undertaking measures as does the regulator in a project-based scheme, and will not be able to arrive at a robust analysis of the cost-effectiveness of such measures. Put differently, some of the focus on actions whose energy savings impact is well-known and easily measured may remain in a cap-and-trade scheme simply because they offer a more certain return to suppliers’ investment.

Second, there may be limitations to the extent to which suppliers can translate the overall cap on emissions / energy use into effective incentives for households to undertake energy efficiency measures. One of the rationales for not using a price-based mechanism for energy efficiency is that energy demand is very inelastic even in the long-run. In other words, consumers do not adjust their consumption levels to a great extent even when prices change significantly. More generally, suppliers may have little influence over the decisions made by households, even though they would carry the liability for their decisions.

A final consideration relevant to the types of measures that would be undertaken under a cap-and-trade scheme is that under such a scheme suppliers would only benefit from measures installed *on behalf of their own customers*. Suppliers would not benefit from measures installed for other customers, because their own total or per-capita energy supplied (or associated emissions) would not be reduced unless they were applied to their own customers. This could have the potential to reduce the types of measures and broader initiatives that suppliers would undertake. For example, suppliers would be less interested in blanket subsidies on the sale of energy-efficient consumer goods by major retailers, since they would only benefit if their own customers purchased the goods. Suppliers might still be interested in providing discount “coupons” to their own customers.

7.2.3. Effect on innovation and energy services

As noted above, one aim of capping the energy supplied (rather than CO₂ emissions) could be to change the business model of energy supply to an “energy services model”. In its simplest version, the aim would be to link suppliers’ profits not simply to their supply of energy only, but of energy services, i.e., the benefits that customers derive from using energy.

This model has been investigated in some details in the business sector, where energy can be seen as one of the inputs into production. In this context, energy service contracts can help reduce operating costs, transfer risk and concentrate attention on core activities. However, as energy services contracting effectively is a form of outsourcing, it also carries transaction costs, and will only be chosen where the expected reduction in the production cost of supplying energy services can more than offset the transaction cost of negotiating and managing the relationship with the energy service provider.²⁵

While this framework has been used with some (limited) success in industry, its application to the household sector is largely untested. Energy suppliers we interviewed were interested in the concept and as noted above, some were actively pursuing the idea, but none thought that there currently is a commercially viable business model for domestic energy services, notwithstanding the “uplift” provisions in the EEC and unusually high energy prices.

The successful application of an energy services model of energy supply arguably is a key question in assessing the viability of a cap-and-trade scheme for domestic CO₂ emissions or energy use. If such a model were not viable suppliers’ influence over energy use may be very limited compared to other factors influencing energy consumption. This would make the application of a cap-and-trade approach risky—both to suppliers and to government’s ability

²⁵ For a detailed analysis, see Sorrell (2005).

to achieve the targets set—or potentially even infeasible, and would be an important topic for further research.

7.3. Effects on scheme costs

The main motivation for a cap-and-trade approach to household CO₂ emissions or energy use would be to achieve large-scale reductions in a cost-effective and equitable way. Cost-effectiveness largely is a function on the composition of measures undertaken, but also is influenced by the administrative and transaction costs faced by participants.

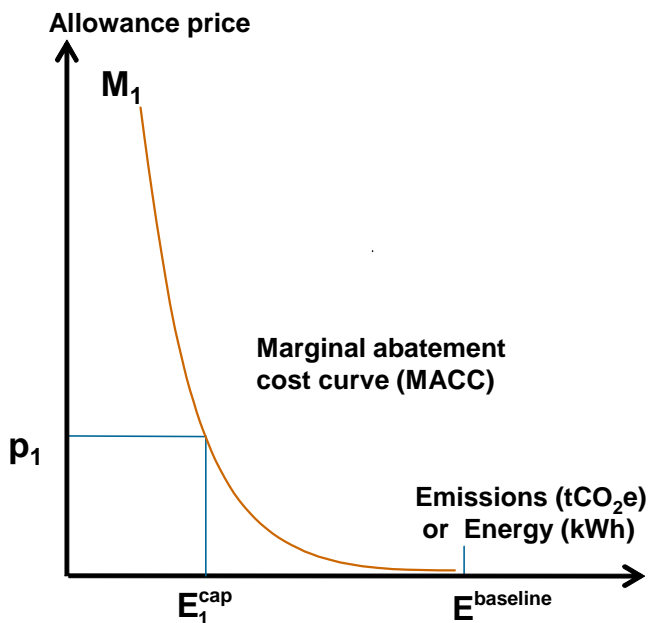
7.3.1. Cost of measures

As in a project-based scheme, costs to scheme participants will depend to a large extent on the cost of the available measures to reduce energy consumption in households. As noted above, the introduction of a cap-and-trade scheme would seek to include additional cost-effective measures, and to the extent this were possible could allow a given amount of energy savings to be achieved a lower cost.

7.3.1.1. Costs to suppliers

The costs of the scheme to various parties also depends on the price of allowances. Figure 7.1 shows a simple model of how allowance prices are formed in a cap-and-trade scheme. The horizontal axis shows the quantity subject to the cap, either CO₂ emissions or energy, while the vertical axis shows the price of allowances. The baseline emissions / energy is indicated by E^{baseline} while the desired cap is indicated by E_1^{cap} . In a competitive allowance market, the price will reflect the *marginal cost of abatement*, i.e., the cost of reducing emissions / energy use by one additional unit. The aggregate relationship between the amount of emissions / energy use and the price is given by the marginal abatement cost curve (“MACC”), shown in the figure as schedule M_1 . In this framework, the allowance price is given as p_1 for cap E_1^{cap} .

Figure 7.1
Allowance price formation in a cap-and-trade scheme



While the precise MACC relationship would need to be established empirically, the figure illustrates some of the patterns that typically have been observed in previous trading schemes. The slope of the MACC indicates that marginal cost increases with a more stringent cap, a reflection of the fact that increasingly expensive measures need to be undertaken to reduce emissions / energy. In addition, as illustrated in the figure marginal cost increases at an increasing *rate* as quantity of emissions / energy decreases, showing a very slow increase near the baseline level, and increasing rapidly as the level approaches zero. The cap thus is determined by the regulator, but the resulting market price for allowances depends on the available abatement opportunities as embodied in the MACC.

The market for allowances created by the trading scheme results in a market price for CO₂ emissions / energy that will affect the cost of supplying energy. Suppliers thus will react to the market for emissions / energy by undertaking efforts to reduce the energy supplied, for example, by increasing household energy efficiency. An individual supplier will undertake these measures as long as their own marginal abatement cost is less than the allowance price. These control costs (e.g., installing insulation, switching to smart metering) will increase the cost of production. In addition, suppliers will incur costs for the residual CO₂ emissions / energy that remain after the cost-effective control options are exhausted. Indeed, even if producers receive sufficient allocations for free to cover their residual emissions, every tonne of CO₂ emitted results in a cost (an “opportunity cost”) because the allowance used to cover the CO₂ tonne emitted / energy supplied could otherwise be sold at the market price.

7.3.1.2. Costs to end-users and distribution of total costs

The costs to consumers depend, in turn, on the extent to which suppliers’ costs are passed on to end-users of energy in the form of higher energy prices. This depends chiefly on the competitive conditions of the market. Under (restrictive) assumptions of perfect competition

full pass-through of costs would be expected, while less than full pass-through could result under other conditions.²⁶

Note that the degree of pass-through generally would *not* depend on the method of allocation. In a competitive product market, the full *opportunity cost* of allowances would be expected in the electricity price even if all allowances were provided for free. The choice between free allocation and auctioning thus mainly is a matter of distributional concern. The free allocation of allowances to energy suppliers represents a grant of the value of allowances to suppliers, whereas an auction of allowances would mean this value was transferred elsewhere.

As in a project-based scheme, the costs also would differ between groups of consumers. Beneficiaries of energy efficiency measures subsidised by suppliers potentially would be better off, while those not improving their energy efficiency would pay higher energy prices without such benefits. Of course, if an energy services model were to emerge, suppliers would look to find ways to incentivise customers to pay for the opportunity to reduce their energy consumption but otherwise enjoy energy services—so the benefit would be the normal benefit that both buyer and seller enjoy from a commercial exchange.

In addition, an auction would make available revenue to the government that could be used to compensate electricity consumers for the higher electricity prices arising from the scheme. This could include the possibility of using revenue to promote auxiliary policy objectives of energy efficiency policy, such as the reduction of fuel poverty, which would not otherwise be easily incorporated into a cap-and-trade scheme. The political acceptability of this may be constrained, however, as the scheme would have an effect on consumers similar to a tax on energy.

7.3.2. Administrative and transaction costs

As noted, the administrative and MRV costs of cap-and-trade scheme generally is lower than those of a project-based schemes achieving a similar scale of reductions in emissions. In the case of a household-only cap-and-trade scheme, an additional cost would be associated with the tracking of fuel supplies to distinguish energy supplied to households from that supplied to non-households. The feasibility of doing this at reasonable cost would be an important area for further investigation prior to the introduction of a scheme.

While the cost to the regulator would be lower, it is difficult to assess to what extent the costs associated with a project-based scheme of project documentation, reporting, and monitoring would be transferred to the need for corresponding administrative procedures *within* supply companies. At a minimum, ensuring that cost-effective measures were undertaken would mean that suppliers would need to monitor the impacts of specific measures and work to develop new offerings. Thus the total costs of the scheme therefore may not be as much lower as suggested by a simple comparison of the regulatory requirements under a project-based and cap-and-trade scheme.

Transaction costs would depend in large part on the amount of trading, and there are reasons to think this may be rather limited. First, if allowances are allocated through an auction there

²⁶ For a fuller discussion of the pass-through of cost in the context of the EU ETS see NERA. (2005)

would be little need for suppliers to carry out additional trading, except to make small adjustments to meet compliance requirements or respond to changes in the market. Secondly, costs between suppliers may be small, implying that gains from trade would be small. The differences between suppliers' abatement costs nonetheless may be larger than under EEC, as suppliers' actions would be confined to their own customer groups, which may have different characteristics.

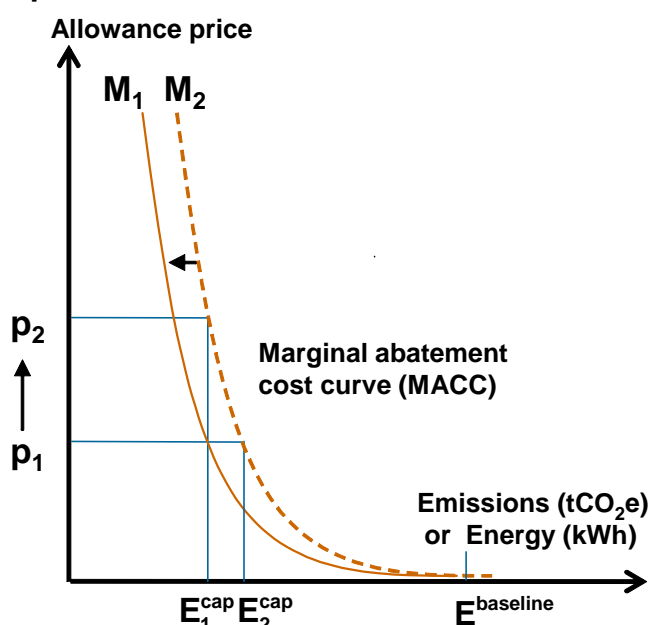
7.4. Effects on scheme uncertainty and risk

7.4.1. Risk arising from the level of cap

One of the main disadvantages of a cap-and-trade scheme may be the risk to which it would expose scheme participants as well as energy consumers. As noted above, the price of allowances would depend on the level of the cap and on the abatement options available to suppliers. Misjudging the abatement options may lead the scheme regulator to set a level of the cap that would entail a very high cost of allowances.

This is illustrated in Figure 7.2, where two alternative MACCs are illustrated. If the cap is set at level E_1^{cap} and the MACC is M_1 , then the price of allowances would be p_1 . However, if the true MACC is in fact slightly to the right of M_1 , illustrated by M_2 , the significantly higher price p_2 would obtain instead. The consequences of a particular cap therefore may be very uncertain. Put differently if the MACC is M_2 , the difference between the two caps E_1^{cap} and E_2^{cap} may lead to very different allowance prices.

Figure 7.2
Allowance prices with different MACCs and levels of the cap



The uncertainty about the *position* of the MACC (i.e., whether the true MACC is M_1 or M_2) partly is a function of the fact that relationship illustrated is a very simple static one for a given set of circumstances. That is, the MACC may be accurately represented by M_1 for one time period but shift to M_2 as external circumstances change. For example, if demand for energy were to increase for reasons unrelated to the trading scheme (e.g., cold weather), then

the MACC would shift right in the figure, making it more expensive to reduce emissions to the level of the cap and pushing up the price of allowances. Conversely, anything that caused demand to decrease (e.g., higher energy prices) would shift the MACC to the left, causing the market price to drop. If these fluctuations are large in relation to the reductions being undertaken under the scheme, then there could be significant price volatility, with a risk of price spikes if suppliers were unable to find cost-effective measures to compensate for the variations in energy demand.

7.4.2. Risk arising from demand fluctuations

The figure also shows how the degree of uncertainty about price depends on the *shape* of the MACC. The reason for the large difference between p_1 and p_2 is that the MACC is very steep (the marginal cost of abatement increases very rapidly with a more stringent cap) in the area around the level of the cap. As noted, the actual relationship is an empirical question. One relevant consideration is the extent to which the marginal cost of abatement may differ with different time horizons. Some measures may be unavailable in the very short run (e.g., because installation capacity is unavailable), or may be more costly to implement quickly (e.g., because it takes time to identify the most cost-effective opportunities). In this case, the MACC will differ with the time scale, and it may be more expensive to respond to sudden changes in demand resulting from unpredictable factors.

There is a possibility uncertainties may be significant, in which case setting of the cap would entail significant risk. As noted, energy demand is influenced by a range of factors, and the ability of energy suppliers to influence demand – particularly in the short term – may be small compared to the influence of weather, fuel prices, demographic changes, changes in the economic cycle, economic growth, etc. This would be an important area for further investigation, as it has direct bearing of the viability of a cap-and-trade approach for the household sector.

7.4.3. Options for risk mitigation

Given the potentially high risk associated with a cap-and-trade scheme it would be important to consider design options that would mitigate risk. As discussed in sections 4.1 and 4.2, a key benefit of trading provisions is that they help to spread risk between participants and across time. In the context of a cap-and-trade scheme applied to suppliers, the most important forms of trading are likely to be intertemporal trading, helping smooth fluctuations over time. In the absence of borrowing provisions, however, this is only effective once participants have had the opportunity to build up a bank of allowances that they can draw down if demand were to increase temporarily.

Trading with other schemes also could help spread risk. For example, the ability to use EU ETS credits for compliance would reduce volatility to the level of EU ETS allowance prices. However, the use of such provisions has to be set against the risk that they would compromise scheme objectives. Notably, if EU ETS prices were lower than those of the UK cap-and-trade scheme, then the ability to use EU ETS allowances could mean that less energy efficiency activity is undertaken in the UK. This arguably would be cost-effective from the

point of view of achieving the environmental objective of reduced global CO₂ emissions, but it would not lead to the benefits of energy efficiency improvements in the UK.²⁷

7.5. Summary

The chief attraction of a cap-and-trade scheme would be the possibility that a wider range of cost-effective energy efficiency measures could be implemented. By removing the restriction of an “approved list” of measures that is necessary in a project-based scheme, scheme participants would face fewer restrictions and scheme costs potentially be reduced.

However, the implementation of a cap-and-trade scheme for household energy efficiency would be a challenging undertaking. Capping energy also would represent a new departure in the application of the cap-and-trade principle, as the quantity capped would not be that directly leading to negative externalities, but a good that (currently) is traded in a standard product market. It would be important to analyse the welfare consequences of such a cap in detail.

One possibility is that a cap-and-trade scheme would make possible the emergence of a new business model for energy supply, in which suppliers and customers entered into contracts for “energy services” such as heating, lighting, or white good functionality. The inspiration for this idea comes from the industry sector, where such outsourcing of services has had some (limited) success. However, the successful application of this model to the household sector is largely untested, and would be an important issue for further investigation prior to the introduction of a cap-and-trade scheme.

The viability of a cap-and-trade scheme also would depend on extent to which the obligated parties would be able to influence levels of the capped quantity (whether CO₂ emissions or energy supplied). If this influence is limited the reductions achievable could be small compared to other influences on energy demand. Moreover, to the extent other such other influences (such as weather and fuel prices) fluctuate it may not be possible to set a cap to which the obligated parties could realistically adhere. The use of “safety-valve” provisions, such as linking to other trading scheme or a buy-out price, could mitigate such problems, but may compromise the aim of ensuring improvements in energy efficiency in the UK.

8. Linking and interaction with other trading schemes²⁸

This chapter considers how a UK trading scheme for energy efficiency may interact with other environmental trading schemes, and especially the EU ETS. We first discuss generic issues that arise for energy efficiency policy in the presence of the EU ETS, including the impact on environmental benefits

²⁷ Various other arrangements could be considered, including the possibility of allowing the use of EU ETS credits only at a minimum price. This option is discussed further in the companion report on options for implementing a cap-and-trade scheme for small businesses and the public sector.

²⁸ This section draws on EC Green

8.1. Generic issues concerning policy interaction with the EU ETS

The presence of the EU ETS has important implications for other policies aimed at reducing emissions of CO₂, including energy efficiency schemes. This section reviews generic issues concerning policy interaction of energy efficiency schemes with the EU ETS under the following headings:

- § types of policy interaction;
- § policy interaction under a cap; and
- § implications for the environmental benefits of energy efficiency schemes.

The discussion is based on NERA (2005), where a more comprehensive treatment of these issues is provided, and also draws on Sorrell and Sijm (2003), Sorrell (2003).

8.1.1. Types of policy interaction

In exploring policy interaction, it is useful to distinguish between *directly* and *indirectly* affected target groups. The directly affected target group has obligations and incentives imposed upon it immediately by a policy, while the indirectly affected target group is influenced in some way by the behavioural changes that are made by a directly affected target group. Indirect effects permeate throughout the economy and ultimately require analysis within a general equilibrium framework. But for present purposes, the indirect impact of the EU ETS and other policy instruments on electricity consumers is of particular interest.

The distinction between directly and indirectly affected target groups leads naturally to a distinction between *direct* and *indirect* policy interaction. In addition, there is the additional possibility of *trading* interaction. These are introduced below:

- § *Direct interaction* is where the target groups directly affected by the two policies overlap in some way. For example, participants in the EU ETS may already be subject to a CO₂ tax on fuel use.
- § *Indirect interaction* occurs when a target group is indirectly affected by one policy and either directly or indirectly affected by a second. For example, there is indirect interaction between the EU ETS and a tax on electricity consumption, since electricity consumers are indirectly affected by the former and directly affected by the latter.²⁹
- § *Trading interaction*, or *linking*, is where two policies influence one another by the exchange of an environmental trading commodity. For example, there are plans to make CO₂ allowances from a trading scheme in Norway exchangeable for allowances in the EU ETS. Such links need to be governed by transfer and exchange rules, which in combination define the *fungibility* of the commodities. Linking between the EU ETS and other tradable GHG currencies established under the Kyoto Protocol has attracted much attention and has been embodied in the Article 25 of the Emissions Trading Directive and in the Linking Directive.

²⁹ Similarly, electricity generators are indirectly affected by the tax and directly affected by the EU ETS.

The interactions between the EU ETS and an energy efficiency scheme may take each of these forms.

8.1.2. Policy interaction under an EU ETS emissions cap

A defining feature of a cap-and-trade scheme such as the EU ETS is that, assuming adequate enforcement and full compliance, there is certainty that total emissions will be less than or equal to the aggregate cap. A second feature is that, under a standard set of assumptions regarding the competitive operation of the allowance market, the scheme will allow the emissions target to be met at least cost. In equilibrium, marginal abatement costs will be equalised across sources and equal to the allowance price.

These (somewhat idealised) features of the EU ETS have important implications for its interaction with other policies. Coupled with comparable assumptions regarding the idealised operation of product markets, they imply that *policies affecting CO₂ emissions from facilities participating in the EU ETS will have no immediate CO₂ reduction benefits*. Furthermore, such policies will increase the overall costs of meeting the emissions cap (Sorrell and Sijm, 2003). It is important to acknowledge, however, that one of the rationales for energy efficiency policies in the first place is the belief that there may be market failures in the adoption of energy efficiency measures. In the presence of such market failure, it is possible that stimulating the uptake of energy efficiency measures could actually reduce the cost of meeting a given EU ETS target—although it still would not have any immediate effect on CO₂ emissions.

This result applies to instruments that *directly* affect CO₂ emissions from EU ETS participants, such as a CO₂ tax on fuel use, as well as those that *indirectly* affect those emissions, such as a domestic energy efficiency scheme covering electricity use. Such policies may either increase or reduce the abatement costs of individual EU ETS participants, but in all cases the aggregate costs of meeting the cap will be increased and participant emissions will continue to be less than or equal to the cap. Hence, these instruments will contribute nothing to the effectiveness of CO₂ abatement (i.e., meeting the overall cap) and may potentially undermine the efficiency of abatement (i.e., achieving that cap at least cost) (Sijm 2003). (Again, the presence of market failure may alter the conclusion about cost.)

To illustrate this, assume that the second instrument is a CO₂ tax on the energy use of a number of EU ETS participants. As a consequence of this tax, the affected participants are likely to reduce fuel use (and hence emissions) further than they would under the EU ETS alone, which means that they are likely to either sell more allowances or purchase fewer allowances. The consequent reduction in allowance prices will make it easier for other EU ETS participants that are not affected by the tax to comply with their EU ETS targets. Aggregate emissions will not have changed, since other participants will use any “freed-up” allowances to cover increases in emissions (or reduced emissions abatement). But aggregate abatement costs will have increased, since the distribution of abatement actions across participants will have departed from the cost minimising optimum. Also, the participants subject to the tax will effectively be subsidising competitor participants that are not.³⁰

³⁰ This only applies to those competitors which are buyers of allowances. If they are sellers, the value of their sales will be reduced.

This has some further potential implications:

- § If *all EU ETS participants* were subject to the same tax on energy use, the primary effect would be to increase overall abatement costs and lower the allowance price;
- § If *all of the EU electricity sector* were subject to the same tax, costs to the electricity sector would increase but costs to non-electricity participants would decrease because of lower allowance prices. The overall cost would increase.
- § If *the tax were sufficiently stringent*, aggregate emissions would be reduced below the cap, making the EU ETS redundant, and reducing the price of allowances to zero. The cost of achieving the emissions reductions would, however, be higher than in the case of using the trading scheme to accomplish the same reductions.

8.1.3. Implications for the environmental benefits of energy efficiency schemes

Very similar conclusions apply to the effects of energy efficiency schemes on CO₂ emissions. If the energy efficiency scheme covers electricity use it will reduce overall electricity demand, leading to lower production by electricity generators. This and any other emissions reduction stimulated by the energy efficiency scheme will be adopted by generators in lieu of other (on average cheaper) abatement measures or the purchase of allowances from sources outside the electricity sector. At the same time, the overall emissions from EU ETS participants will be unchanged, as the total number of allowances available to participants will be unaffected by the energy efficiency scheme. The scheme therefore would raise the cost of meeting the EU ETS cap without delivering any additional emission reductions at the EU (or global) level. However, emissions from the UK may decrease, if at least some of the “freed-up” allowances are used by sources outside the UK.

It is important to note that the same conclusion does not follow where the energy efficiency scheme does not interact, either directly or indirectly, with the EU ETS. Such a scheme will contribute emission reductions independently of and in addition to the EU ETS. Notably, the EU ETS does not cover emissions from household fuel consumption, but it does (indirectly) cover those from household electricity consumption. Since policies that affect household fuel consumption *would not* interact with the EU ETS, they will contribute to additional reductions in CO₂ emissions.

The above argument assumes that the ETS cap is fixed. In practice, it is likely that the overall cap (i.e., the sum of all National Allocation Plans) will be tightened for Phase 2 and for subsequent compliance periods, as countries endeavour to meet their Kyoto targets. The effect of national supplementary instruments, including energy efficiency policy, on the process of negotiating and establishing these caps must then be considered.

In Phase 1, national allocation plans were based in part on emissions forecasts. In principle, these forecasts should have taken into account the emission reductions expected from instruments such as energy efficiency policies in general that were anticipated to be in operation during Phase 1. Therefore, the emission reductions expected from these schemes should have been reflected in a more stringent Phase 1 cap. It also is possible that the absence of such schemes would have led to a less stringent Phase 1 cap. If so, these schemes would have contributed to aggregate emission reductions during Phase 1 by helping to ensure

a more stringent overall cap. Conversely, it is possible that the absence of these schemes would have made no difference to the stringency of the Phase 1 cap. If so, these schemes would not have contributed to any additional emission reductions.

Climate policies that interact with the EU ETS and which are introduced subsequent to the negotiation of the Phase 1 cap will not contribute to any additional emission reductions during Phase 1 for the reasons discussed above. But these policies may reduce *national* CO₂ emissions. If the national allocation plans in Phase 2 are again based on national emission forecasts, the existence of such policies may contribute to the negotiation of a more stringent Phase 2 cap (and possibly to more stringent caps in subsequent compliance periods). If so, these policies would have contributed to aggregate emission reductions during Phase 2 (and subsequently) by tightening the overall cap.

In summary, while policies that interact with the EU ETS will not contribute to additional international emission reductions during the current compliance period, they may contribute to the negotiation of more stringent emission caps in subsequent climate periods. By this process, such instruments may contribute to additional emission reductions in the longer term compared to a counterfactual scenario in which they are not introduced. In all cases, however, once a cap is established for a given period, that cap may be achieved most cost effectively through the use of the EU ETS alone, rather than in combination with other instruments.

8.2. Implications of linking the EU ETS to energy efficiency schemes

The linking of trading schemes is a topical policy issue. The EU ETS has been linked to Joint Implementation and Clean Development Mechanism projects through the Linking Directive and it may subsequently be linked to CO₂ trading schemes in other countries. At present, however, there are no proposals for allowing trading between the EU ETS and energy efficiency schemes. This may be feasible, however, and has been proposed by a number of authors. Since certificates in a project-based or allowances in a cap-and-trade energy efficiency scheme represent avoided CO₂ emissions, they could potentially be converted to CO₂ allowances using a suitable conversion factor and traded into the EU ETS.

However, where schemes cover the same sources, linking the EU ETS to a national scheme could lead to problems of *double counting* of CO₂ emissions. There are two related concerns (Zapfel and Vainio, 2001):

- § *double coverage*: where two separate CO₂ allowances are surrendered for a one-tonne increase in physical emissions;³¹ and
- § *double crediting*: where two separate CO₂ allowances are generated from a one-tonne decrease in physical emissions.

³¹ A cross-border example of double coverage would be the export of electricity from country A, which has an emissions trading scheme where electricity generators surrender allowances, to country B, which has an emissions trading scheme where electricity consumers surrender allowances. Both the seller of the electricity (generators) in country A and the purchaser of the electricity (consumers) in country B would need to surrender allowances to cover the emissions associated with this electricity, which means the emissions would be covered twice by two separate trading schemes. A primary motivation for introducing a harmonised ETS throughout the EU was to avoid such problems.

For example, CO₂ allowances created through over-compliance with energy efficiency targets and sold into the EU ETS will lead to double crediting. First, the displaced fossil fuel generation will free up EU ETS allowances that will be used to cover emissions elsewhere. Second, an approximate equivalent volume of new allowances will enter the EU ETS via the conversion of energy efficiency credits into EU ETS allowances. Since this double crediting will not be offset by double coverage, the prior cap in the EU ETS is exceeded.

In addition to double counting, linking raises some practical problems of CO₂ accounting. First, the use of a fixed emissions factor for conversion creates problems of discrepancy between the actual and claimed emissions reductions. The quantity of emissions displaced through energy efficiency measures will depend on the time of day, week and year the energy is generated/saved and possibly on the location of the investment. A fixed factor based on the average fuel mix, as is common in energy efficiency schemes, will become increasingly inaccurate over time, unless it is regularly updated. Second, the monitoring and verification of CO₂ savings through the certificate schemes may not meet the required standards of the EU ETS. In the case of project-based schemes, there is the additional complication that the savings are estimated rather than monitored and the accuracy of these estimates may be open to question.

In summary, linking certificate schemes to the EU ETS creates a range of practical difficulties and may potentially threaten the environmental integrity of the EU ETS through problems of double counting.

8.3. Implications of linking an energy efficiency scheme of linking to other schemes

While the above arguments suggest that it may be difficult to gain acceptance for the use of energy efficiency credits / allowances in the EU ETS, it may be possible to create a one-way link between a UK energy efficiency scheme and other trading schemes, including the EU ETS. If prices in another scheme are lower than those in a UK scheme such a link could reduce the compliance costs of participants in the UK scheme. Also, as discussed above, allowances or certificates from other schemes could provide a safety-valve mechanism, helping protect UK suppliers and consumers either from high prices or volatility.

A difficulty with this proposition is that the objectives of the EU ETS differ from those of the EEC. There are two related properties that distinguish current energy efficiency policy from the policy aims of the EU ETS:

- § First, there are qualities embodied in EEC credits that are wholly *unrelated* to CO₂ emissions. This includes differentiation by social groups and the types of measures (e.g., innovative or energy services “uplifts”). More generally, aspects such as UK security of supply or technology policy are not captured by the EU ETS. .
- § Second, many of the benefits embodied by EEC credits are *local*. This includes the gain to the individual (UK) beneficiary of the underlying EEC energy efficiency measures, but also local environmental objectives such as decreases in local air pollution from UK power stations or contribution to national emissions targets unrelated to the EU ETS.

These considerations have led to proposals to separate the CO₂ and non-CO₂ “values” of energy efficiency certificates and trade them independently in separate markets. Suppliers would be required to purchase a certain quantity of both to meet their obligation. The difficulty with this proposition is similar to the concerns outlined above, *viz.* that the CO₂ value of the certificates is already reflected in the EU ETS allowances “freed up” by the displaced fossil fuel emissions. Indeed, creating a separate CO₂ value and trading this into the EU ETS would lead to two allowances being created for *all* the emissions displaced by the energy efficiency scheme, rather than just from over-compliance. Such a “splitting” of energy efficiency certificates / allowances may therefore not be advisable in the presence of the EU ETS.

The local and diverse objectives of energy efficiency policy may mean that it also would be difficult to achieve fungibility with other energy efficiency schemes. One reason for this is that the denomination of certificates in existing and proposed TWC schemes often is different from current UK arrangements. Factors such as the scope of coverage; lifetime vs. average savings; the definition of eligible measures; the treatment of additionality; the accounting for “comfort taking”; etc. may all differ to varying degrees. This means that even if the unit of account is similar (e.g., kWh saved) there may be no clear correspondence of definitions of “energy efficiency”. A system with interchangeable trading commodities would likely require substantial standardisation of programmes.³²

While these difficulties arguably could be overcome through the harmonisation of programmes, they do not address the more fundamental fact that some of the intended benefits of energy efficiency policy are local. One option is to try to separate those benefits of energy efficiency that are local from those that are not by having separate programmes. One such possibility was mentioned in the discussion of a cap-and-trade scheme for energy efficiency, where auction revenue from the sale of pure CO₂ allowances (which would not account for local benefits) could be used to finance other energy efficiency objectives such as fuel poverty.

8.4. Summary

Energy efficiency policy in the UK potentially interacts with the EU ETS. In particular, as electricity generation is covered by the EU ETS, policies to reduce household use of electricity will result of “double-regulation” of the same emissions. As emissions from EU ETS sources are capped, additional policies to affect these do not affect total emissions. From the point of view of the environmental aims of energy efficiency policy, there therefore may be a case for focussing household energy efficiency policies on non-electricity use. This does not affect non-environmental aims of policy. Also, in the presence of market failures preventing the uptake of energy efficiency measures, additional policy covering EU ETS sources could be cost-effective.

³² Similar problems have arisen with efforts to create an international standard for trading in renewable energy, where Renewable Energy Certificates (“RECs”) have met with mixed success. In particular, most national schemes with a renewables obligation or target do not accept RECs for compliance purposes, chiefly because they do not embody national energy policy goals. The difficulty arguably would be even larger in the context of energy efficiency, which is less clearly defined and standardised than energy from renewable energy sources, the unit of account for RECs.

There also is the possibility of making explicit provisions for interactions by making the allowances or certificates of one scheme available to the other. Linking into the EU ETS would be difficult to achieve and, moreover, would not be desirable, as it would raise problems of double counting of emissions reductions and thus undermine the EU ETS cap. It also would be practically difficult to account for the CO₂ reductions embodied in certificates or allowances issued in an energy efficiency scheme.

The same problems would not necessarily arise if EU ETS credits were allowable for compliance with obligations in a UK energy efficiency scheme. Indeed, this may be an attractive option for a “safety valve” provision, putting an upper limit on the price of compliance. The drawback of such arrangements is that EU ETS allowances (or credits generated in energy efficiency schemes in other countries) would not contribute to the local and non-environmental objectives of UK energy efficiency policy. This includes the objective of energy supply security, social objectives to reduce fuel poverty, and the benefit to UK consumers of improvements to energy efficiency.

9. Conclusions and Recommendations

9.1. Conclusions

The following are conclusions from this study:

9.1.1. Current Operation of the EEC

- § ***Trading is an important element of the EEC.*** EEC compliance is accomplished through vertical trading. Almost all energy efficiency activity involves exchange between suppliers and a third party providing energy efficiency measures. This is appropriately understood as a form of trading,
- § ***The vertical market appears to be working well.*** A diverse set of third-party organisations participate in EEC through the vertical trading market. A large number of activities are outsourced by suppliers, including the identification of opportunities, marketing, documentation, monitoring, and installation of measures. Most EEC participants interviewed believe that the current trading arrangements are working well, and that there are few barriers to cost-saving trading.
- § ***Inter-temporal trading also is an important part of the EEC.*** All participants banked energy savings credits from EEC 1 to EEC 2. This helps promote cost-effectiveness by optimising costs over time, mitigating risk, and encouraging early action. High levels of banking is not necessarily a sign of undemanding targets.
- § The major trading activity consists of inter-temporal trading (banking of energy saving credits for use in a subsequent period) and vertical trading (purchasing energy saving credits from non-participants).
- § ***In contrast, horizontal trading among participants suppliers is little used.*** Gains from such trading appear to be relatively small, mainly because there are no immediate reasons why costs of compliance should differ systematically between suppliers. There also are some barriers to horizontal trading including commercial sensitivity and transaction costs. Most such barriers could be overcome if the gains to trading were large.
- § Most EEC participants believe that the current trading arrangements are working well, and that there are few barriers to cost-saving trading.

9.1.2. Potential change to a TWC scheme

- § ***A TWC scheme would require new institutions and legislation.*** New primary legislation is likely to be required.
- § ***Transaction and administrative costs could either increase or decrease in a TWC scheme.*** Transaction costs are likely to decrease, as there would be fewer requirements for the involvement of suppliers in energy efficiency projects. However, administrative costs to the regulator are likely to increase with the involvement of a larger and more diverse set of participants in the monitoring, reporting, and verification process. Also, administrative costs to participants may increase if the current centralised arrangements represent efficient pooling of MRV activities.

- § ***The impact of a TWC system on the market for energy efficiency measures may be limited.*** The current market relies on partnership arrangements that help reduce the risks faced by participants, help manage cash flow and budgeting, provide certainty to suppliers, and provide for “pooling” of MRV requirements. Similar benefits of partnerships or long-term contracts would persist under a TWC scheme, and the emergence of a certificate spot market may be unlikely. A TWC scheme therefore may have little practical impact on the composition of measures and scheme costs, assuming similar MRV rules were retained.
- § ***There may be relatively few cost-saving gains from switching to a formal TWC programme, and a TWC scheme may not lead to significant changes in the composition of measures.*** In theory, the more decentralised nature of a TWC scheme may be more successful in overcoming information asymmetries that prevent the uptake of otherwise cost-effective measures. However, no stakeholder was able to identify the specific mechanisms through which a TWC scheme would lead to significant changes in measures, and the existence of significant untapped opportunities among eligible measures remains uncertain.
- § ***A “hybrid” system may have limited impact.*** Switching to a “hybrid” system (i.e., allowing TWC credits to be created within the current trading system) has the potential to encourage additional energy efficiency measures but its impact is likely limited by the above factors.

9.1.3. Potential change to a cap-and-trade scheme

- § ***A cap-and-trade programme for household energy use (or for CO₂ emissions from household energy use) would represent a major departure from the current programme.*** Such a programme may encourage additional low-cost energy-saving measures if it resulted in a large-scale transformation of the energy supply market. Because of the major changes it would entail, it would also be complicated to establish. Creating a CO₂-based cap-and-trade programme would be more complicated because of the difficulty avoiding the double-counting of emissions already included in the EU ETS.
- § ***A cap-and-trade scheme may make available additional cost-effective energy efficiency measures.*** By removing the restriction of an “approved list” of measures that is necessary in a project-based scheme, scheme participants would face fewer restrictions and the costs of achieving a given level of emissions potentially could be reduced.
- § ***Capping energy also would represent a new departure in the application of the cap-and-trade principle.*** The quantity capped would not be that directly leading to negative externalities, but a good that (currently) is traded in a standard product market. It would be important to analyse the welfare consequences of such a cap in detail. This would not apply if the cap were denominated in CO₂.
- § ***The feasibility of a cap-and-trade scheme would depend in large part on the viability of an “energy services” approach to energy supply.*** The application of this approach to the household sector is largely untested.
- § ***Implementation of a cap-and-trade scheme would be complicated and potentially risky.*** Setting an appropriate cap and determining the potential for suppliers to reduce household

energy use would be key aspects of cap-and-trade implementation. The use of “safety-valve” provisions would likely be necessary but may compromise the aim of ensuring improvements in energy efficiency in the UK.

§ ***Under a cap-and-trade scheme suppliers could have reduced incentives to sponsor efficiency measures that did not apply to their own customers.*** Under a project-based scheme such as the current EEC or a TWC approach, suppliers receive credit for measures that reduce energy consumption (or CO₂ emissions) by any energy consumer. Under a cap-and-trade scheme, suppliers only benefit from measures targeting their own customers (or those that they can persuade to switch to them). This may reduce the incentive for suppliers to participate in certain types of measures—for example, national price incentives for white goods.

9.1.4. Scheme interaction and linking

§ ***Energy efficiency policy in the UK potentially interacts with the EU ETS.*** Electricity generation is covered by the EU ETS, so policies to reduce household use of electricity (and the emissions associated with this use) will result of “double-regulation” of the associated emissions. Because emissions from EU ETS sources are capped, additional policies do not affect total emissions. In the presence of scheme linking, there is risk for “double-counting” of emissions.

§ ***Allowing energy efficiency credits to be sold into the EU ETS would be very complicated and, moreover, would not be desirable.*** Such linking would raise problems of double counting of emissions reductions and thus undermine the EU ETS cap. It also would be difficult to account for emissions in a way that was sufficiently robust to be consistent with stringent EU ETS MRV requirements.

§ ***Linking EEC to international trading schemes would not be consistent with all current scheme objectives but could provide a valuable safety valve.*** Linking potentially would help further the cost-effective attainment of environmental aims and could help provide a safety valve mechanism, particularly in a cap-and-trade framework. However, such provisions are unlikely to be compatible with many of the current aims of the EEC, including social objectives and ones local to the UK or specific to the domestic sector.

9.2. Recommendations for policy and further work

The above analysis has identified a number of areas for potential changes to policy design, many of which are likely to require further analysis outside the scope of the present study.

9.2.1. Potential changes to the current EEC framework

The following are elements of the current EEC framework that have been highlighted through this study as the ones most relevant to the extent of trading within the EEC, and which thus may offer opportunities for changes to scheme design. In most cases, changes to the rules entail a trade-off of scheme objectives.

9.2.1.1. Denomination of targets and certificates

- § **Social objectives.** Several stakeholders pointed to the Priority Group requirement as a potential impediment to the cost-effectiveness of the scheme. However, it is unclear that this referred to the scheme's functioning, as opposed to the average cost of measures. One potential influence is that the PG effectively segments the market for energy efficiency measures; as PG and non-PG credits are not substitutable, different commodities are created. If social objectives could be separated from environmental objectives this could help establish a single environmental trading commodity. Further research would be necessary to investigate ways to do this without compromising the social objectives of the scheme.
- § **Certainty about future targets.** Inter-temporal trading is used by suppliers in large part as a hedge against uncertainty about future liabilities and costs. Early certainty about future targets would help reduce this and also may reduce overall Scheme costs. Against this, Government would forego the opportunity to take into account emerging information in setting EEC targets, although such information could still be incorporated for subsequent periods provided more advance warning were given. One way to reduce the risks associated with the "mis-setting" of targets (either too high or too low) would be to experiment with a buyout option (perhaps initially set relatively high) that could be applied to a fraction of participants' target requirements.

9.2.1.2. Definition and certification of eligible measures

- § **Certainty about the eligibility of measures.** Changes to the eligibility of measures, including the amount of savings arising from particular measures, contribute to scheme uncertainty. Stakeholders indicated that this makes investment in the capability to undertake or procure particular kinds of energy efficiency measures difficult to undertake, as the return is uncertain. By minimising the revisions and announcing revisions early participants can obtain greater certainty. However, this would have to be balanced against the benefits from being able to incorporate new research and information into scheme rules.
- § **Eligibility of measures.** Some participants thought that the current eligibility of measures was too restrictively defined. In general, cost-effectiveness is helped by including as wide a set as possible of measures. The two categories of measure most frequently mentioned in this context were *behavioural measures* and *renewable micro-generation*. It is possible that these types of measures could lead to more cost-effective energy efficiency measures, but it would raise important questions about compatibility with other scheme objectives. In the case of behavioural measures the most important issue may be arriving at a robust calculation of savings attributable to particular measures. In the case of micro-generation, the potential for double-counting with other policy (notably, the Renewable Obligation or specific renewables support schemes such as Clear Skies) would have to be considered. In both cases, more research would be required and is recommended.

9.2.1.3. Monitoring and Verification

- § **Requirement for pre-notification of measures.** Current rules require that measures be pre-notified to Ofgem in order to be eligible towards EEC compliance. This is likely to

contribute to the transaction costs of engaging in vertical trading, and its removal may help encourage some forms of vertical trading that currently are not economical to undertake. Removal of this requirement also may enable project developers to undertake measures more independently of suppliers, which could help bring additional measures into the scheme (though this would be limited by the difficulty of small parties to finance and assume the risk of measures without the prior backing of suppliers, as discussed). Balanced against these considerations, the pre-notification requirement also has benefits, in particular helping to ensure the additionality of measures. Its removal therefore would likely require additional alternative monitoring measures that also entail costs for participants.

§ **Level of verification stringency.** A number of stakeholder raised the possibility that some measures and delivery routes were left untapped because they gave rise to high MRV costs in the current framework. Suppliers therefore may be able to procure energy efficiency measures from a wider set of project developers, measures, and delivery routes if requirements were relaxed. If this is correct, a less complicated MRV regime could help make possible a larger vertical trading market. This has to be assessed against the impact of such changes on the confidence in the additionality of measures.

§ **Timing of verification.** Participants indicated that uncertainty about the eventual status of measures was an impediment to some forms of trading (notably, horizontal trading between suppliers). More frequent verification of measures by Ofgem therefore may help encourage trading. One way to achieve this would be to require that verification takes place within a certain time period after the completion of measures. The drawback of such a requirement would be reduced flexibility for participants; in effect, it would force them to undertake verification on a pattern that currently is an option they do not take. This could be costly if the current concentration of MRV activities to the end of the compliance period is a reflection of economies of scale.

9.2.1.4. Compliance enforcement mechanisms

§ **Length of compliance periods.** It is unlikely that a change to the length of compliance period would lead to cost-savings through additional trading. The shorter the period the less the inter-temporal flexibility available to participants. However, longer compliance periods may also have disadvantages—by increasing uncertainty and exacerbating the “start-stop” nature of the market for energy efficiency measures.

§ **Penalty structure.** The prospect of very severe penalties (and uncertainty about their levels) was mentioned by many stakeholders as an impediment to horizontal trading and a contributor to increased inter-temporal trading. A different form of penalty, such as a buy-out price, may decrease this perceived risk. Against this, a penalty that is not fully dissuasive may compromise the attainment of scheme objectives.

9.2.1.5. Market design and mechanisms

§ **Banking provisions.** Restrictions on banking provisions may lead to additional horizontal and vertical trading. However, rather than a way to encourage vertical and horizontal trading, this would be a restriction on the choices available to participants. Banking this is an important part of participants’ compliance strategy and a key tool for Scheme risk mitigation.

9.2.2. Potential change to a TWC scheme

A conclusion of this study is that there may be relatively few cost-saving gains from switching to a formal TWC programme, and these gains do not appear to outweigh the potential additional administrative costs. This could be further explored by further research. Potential topics for such research include:

- § ***The availability of additional measures.*** The survey carried out for this project indicated that it was unlikely that significant additional energy efficiency measures or delivery routes would be made available simply through a change in the trading rules of the scheme (as opposed to, say, a change in the eligibility of measures). However, this conclusion is limited both by the inherent difficulty of addressing the question of the existence of additional (but unknown) measures, and by the limited scope of the survey. There are two main ways in which the study could be extended. First, a larger number of participants could be consulted. Second, and potentially more importantly, if additional categories of potential new participants could be identified it may be fruitful to carry out additional research on their potential role. From the results of this study, charities and Local Authorities may be two such categories.
- § ***Administrative costs of a TWC scheme.*** This could be put on a more secure footing if administrative costs could be reliably estimated. This would include both costs to the scheme regulator (e.g., a transactions registry) and to participants (e.g., fixed administrative costs for a larger number of small participants, potentially lower search costs, etc.).
- § ***Developments in Italian and French TWC schemes.*** To date there is little international experience with TWC trading, but the Italian and French energy efficiency schemes may offer lessons that are applicable to EEC. If certificate trading for measures in the household sector becomes a significant route for compliance in these schemes it would offer lessons for changes to UK policy. In particular, if TWC schemes give rise to new delivery routes or measures there may be scope to replicate this in the UK.

9.2.3. Potential change to a cap-and-trade scheme

A transition to a cap-and-trade scheme for energy or CO₂ from the household sector would be a major departure and would require careful additional research of a number of topics. Some preliminary recommendations include:

- § ***A relative “cap” is preferable to an absolute cap.*** A per-capita or “averaging” scheme would avoid various difficulties related to the treatment of incumbents and allows all customers to be treated “fairly” by letting their allocation move with them.
- § ***Neither a CO₂- or energy-based scheme is a clear favourite.*** Energy-based schemes present various difficulties associated with rationing of goods and the “energy services” model. CO₂-based schemes would suffer from double-counting of EU ETS emissions, unless they were narrowly limited to non-electricity-based emissions.

The analysis of this report also suggests the following topics as ones likely to be particularly important for further study:

- § ***Scope for an “energy services” approach to energy supply.*** The success of a cap-and-trade approach is likely to depend in large part on the extent to which energy supply companies can derive revenue from providing “energy services” to households, rather than supplying energy itself. A commercially viable model for “energy services” in the household sectors has not yet been demonstrated, although there has been some limited success in industry. An important topic for further work prior to the establishment of a cap-and-trade scheme would be to clarify the potential for such a business model for energy companies in the UK.
- § ***Technical research to establish the range of measures potentially available under a cap-and-trade scheme.*** One of the potential attractions of a cap-and-trade scheme is that it would place no limitations on the measures eligible towards compliance. Further technical research may help identify the extent to which additional cost-effective measures would be used.
- § ***Ability of energy suppliers to translate overall constraints into incentives for households.*** A cap-and-trade scheme would require suppliers to provide incentives for households to reduce their energy use. Methods for doing so may include mechanisms such as smart metering and/or new tariff structures. The cost and viability of such mechanisms would be an important topic for further research.

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Appendix A. Organisations interviewed

- § Alpha Boilers
- § Independent EEC consultant (anonymous)
- § British Gas
- § EDF Energy
- § Energy Savings Trust
- § Halstead Boilers
- § Heating and Hotwater Information Council
- § Instafibre
- § National Insulation Association
- § NPower
- § Ofgem
- § Opus Energy
- § Osborne Energy
- § Powergen
- § Scottish and Southern Energy
- § ScottishPower
- § Solutions4Energy
- § Telecom Plus

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