CARBON TRUST

Making business sense of climate change

Climate change and shareholder value

Preface

Set up in 2001, the Carbon Trust is an independent company, business-led and funded by government, tasked with reducing carbon emissions in business and the public sector. We work directly with UK companies of all sizes to help reduce carbon emissions and develop new low carbon technologies. We also periodically undertake detailed research to improve understanding of climate change issues.

Background to this work

Investors and companies alike are beginning to realise that climate change, and its associated need for constraints on emissions of 'carbon' and other greenhouse gases, has some significant value risk implications for many areas of the economy. Earlier in 2005, Mercer Investment Consulting confirmed that understanding climate change risk should be part of pension funds' investment strategy. However, it is a complicated area — and to date — no comprehensive **quantitative** analysis has been prepared to compare its impact across different sectors and companies.

The impact of carbon emissions trading under the EU Emissions Trading Scheme on the electricity sector is well documented, but the implications of climate change for other exposed sectors has been less widely investigated by the investor community.

Against this background, the Carbon Trust commissioned Cairneagle Associates to work with us to develop a methodology for this analysis, and test it on a range of different companies. This publication provides a summary of this work, together with a discussion of the implications for both corporate senior management and shareholders.

Contents

1 Executive summary

Climate change

Climate change is now recognised as a fact. Consequently there is a need to control and reduce the greenhouse gases that cause climate change. Legally binding regulation has been put in place to begin to control emissions. Following Russian ratification, the Kyoto Protocol entered into force in February 2005, governing developed world emissions in 2008-12.

From 1st January 2005, major sources of industrial carbon dioxide[1] emissions in the EU have been subject to the cap and trade regulation surrounding the EU Emissions Trading Scheme. Carbon dioxide accounts for 80% of the developed world greenhouse gas impact. It is heavily linked to energy consumption, being released wherever fossil fuels are burnt, whether in industry, power stations, domestic households or vehicle exhausts.

Longer term, greenhouse gas reductions of around 50-60% from 1990 levels are thought necessary, and discussions have already begun on post-Kyoto international targets, governing emissions from 2013. High priority is being placed on engaging with countries not currently regulated by the Kyoto Protocol, particularly the USA, India and China.

Even if steps are taken now to dramatically reduce greenhouse gas emissions, climate change will still happen to some extent because greenhouse gases remain in the atmosphere for decades and impacts accumulate for even longer. The forecast impacts include changes to temperature and precipitation (rainfall) patterns, together with a greater frequency of extreme events — such as flooding, storms and drought.

Calculating shareholder value at risk from climate change

During 2005, the Carbon Trust worked with Cairneagle Associates (a strategic management consultancy firm) to develop a methodology for analysing shareholder value at risk from climate change.

Companies across a wide range of sectors are exposed to climate change — both in terms of the physical risks (e.g. asset damage from increasingly frequent extreme weather events, production downtime) and the constraints and cost of carbon dioxide and other greenhouse gases imposed by regulatory (and voluntary) mitigation measures. The challenges also bring new market opportunities in areas such as renewables and energy efficiency. Whilst climate change is seen as a longer term issue, emissions controls such as the EU Emissions Trading Scheme are already in place.

The model developed offers a robust, replicable, top-down approach to analysing such value at risk. In addition to a company's own energy linked ('direct' and electricity-linked 'indirect') carbon emissions, it looks further along the value chain and considers broader potential risk. In calculating the financial impact, the analysis quantifies the potential impact on profits, **using the shape of the business in 2004, but applying a potential 2013 emissions regulatory regime**.

This analysis illustrates what a determined shareholder (or other onlooker) could derive about value at risk from climate change, based upon what companies disclose today.

[1] Carbon dioxide is often referred to as just 'carbon'.

Why use 2013?

2013 was chosen as the first year after the end of the 2008-2012 Kyoto compliance period (which also equates to Phase Two in the EU Emissions Trading Scheme).

Greenhouse gas targets, policy and regulation beyond this 2008-2012 Kyoto compliance period are several years from being agreed. However, in order to meet longer term 'safe' greenhouse gas levels, significant further reductions will be required. We have assumed in Europe a continuation of the EU Emissions Trading Scheme, with its approach of allocating a set (typically decreasing) number of free allowances to each site. We have assumed that the sectoral scope of the EU Emissions Trading Scheme (or similar parallel schemes) is extended to include other corporate sectors and transport-linked emissions.

A major uncertainty is to what extent countries not currently regulated by the Kyoto Protocol (particularly the USA, India and China) will be brought into committed emission reduction targets from 2013. In the case study analysis in Appendix 1, we have considered two scenarios for non-EU emissions: one where they face the same regulatory cost as activities in the EU, and one where they face no regulatory constraints.

2013 therefore represents the earliest year under this uncertain, but likely tougher, regulatory regime. However, although this report focuses on 2013, it needs to be recognised that, for many sectors, financial impacts will be seen significantly before this time.

Ten sector 'case study companies'

Ten 'case study companies' have been studied, from a range of sectors. In some cases, the 'case study company' analysed is strictly linked to a single company within that sector. In others, just a single corporate division has been reviewed, and in others yet again, characteristics from several companies have been combined to produce a more representative example.

In order to enable analysis on a strictly like-for-like basis, the research has been based entirely upon public sources of information. No company interviews were conducted (in order to keep the research to just public sources), although input was sought where appropriate from investment analysts and other third party experts. **This analysis illustrates what a determined shareholder (or other onlooker) could derive about value at risk from climate change, based upon what companies disclose today**.

In most cases, not everything needed to quantify exposure to climate change was disclosed: a large proportion of the project was spent drilling down into corporate and industry body information in order to obtain robust estimates. This in itself is an important finding. In particular, in most cases, estimates were needed for carbon emissions associated with logistics, packaging and key raw materials. With care, and using a broad range of third party sources and approximations, these could be estimated.

Findings

A summary of the analysis for each sector case study is available in Appendix 1, with the analysis for one case study (Bulk Commodity Chemicals) available in more detail in Section 4 of this Report. The findings are summarised in the graph opposite:

- The blue bars show the full carbon emissions exposure, with all associated carbon emissions costed at £20/tCO_2. These figures represent each case study's 'carbon emissions exposure' or 'emissions exposure'.

  Whilst the future of carbon prices is clearly highly uncertain, £20/tCO_2 is in line with longer term carbon price assumptions in recent other Carbon Trust and third party publications (including Trucost/Henderson's Carbon 100 publication[2]). It is also similar to long term estimates for the gas/coal switching price — a key technical price driver for the carbon market.[3]

- The red bars show this emission-linked exposure, once regulatory and market dynamics have been taken into account. These figures represent each case study's 'profit exposure' to emissions regulation.

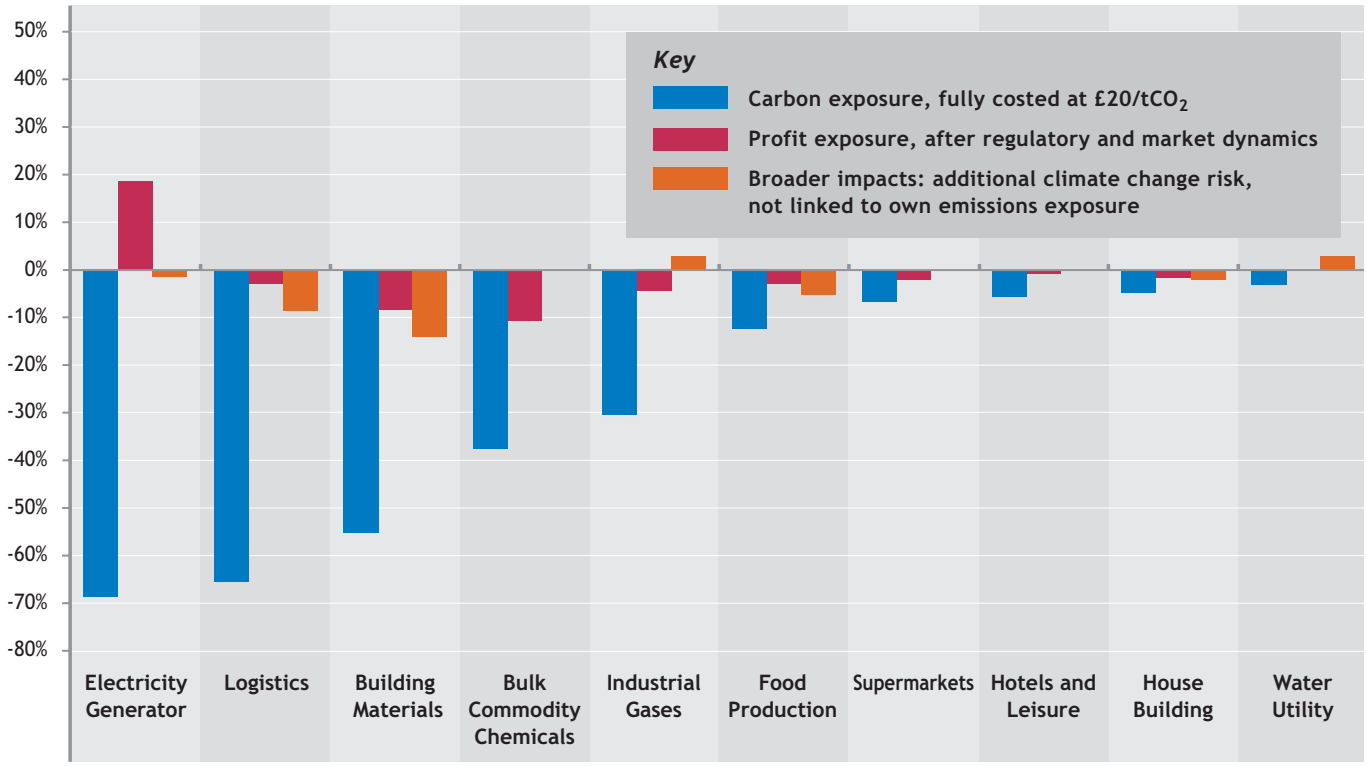
- The orange bars show the additional profit risk or upside from broader climate change impacts, not linked to the case study's own emissions exposure. These calculations are harder to quantify, but are key estimates. In some sectors — such as Logistics, Building Materials, Food Production and House Building — this less quantifiable risk is the more material.

Total value at risk is represented by the red and orange bars combined. Clearly, as the graph illustrates, this is not the same as simple 'emissions exposure'. Different companies and sectors have (a) different carbon emissions regulatory treatment and carbon cost exposure, (b) different carbon emission abatement opportunities, and (c) different abilities to pass costs through to customers. Certain companies also experience significant additional climate change risk, not directly linked to their own emissions profile.

[2] June 2005, *The Carbon 100*, Henderson Global Investors and Trucost. Available through www.trucost.com/henderson.html.

[3] Coal-fired electricity generation emits considerably more CO_2 per MWh than electricity generated from gas. Above a certain price level, inclusion of the marginal cost of CO_2 in the marginal price of electricity generation can cause gas-fired generation to become more competitive (on a marginal cost basis) than coal-fired.

Value at risk from climate change
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: In order to provide a like-for-like comparison, the value at risk analysis above is shown before the EU/Non-EU adjustment, i.e. it compares a 100% EU based supermarket, versus a 100% EU based hotel and leisure group.

What do the results mean?

The analysis has been based around a single regulatory scenario for 2013:[4]

We have assumed a 70% free allowance allocation, versus business as usual. We have assumed a cost of carbon of £20/tCO_2. We have assumed that by 2013 the electricity sector passes through 50% of the marginal cost impact that valuing carbon at £20/tCO_2 would have on the cost of coal fired generation. (Coal fired generation is assumed to be the 'technology at the margin' — i.e. the technology that sets the market price.)

For most of our case studies, the methodology indicates that, under our scenario, climate change is not likely to be that financially material (using the typical investor metric that materiality has a 5% impact on profit or value). Whilst fully costing all associated emissions at £20/t (see the blue bars) can imply a high exposure, this exposure reduces significantly after regulatory treatment and pass through considerations take place.

Under our scenario, only the Building Materials and Bulk Commodity Chemicals case studies potentially have value at risk clearly in excess of 10% of EBIT in 2013. For Building Materials, this risk is primarily linked to the broader risk of weather-linked construction delays, rather than direct emissions regulation. Logistics may also see value at risk of this magnitude, if its long-haul air freight growth rates are hit.

However, a harsher regime, with a higher carbon price or the need to purchase a greater proportion of allowances, could make the impact significantly higher.

The profit exposure and 'broader impacts' risk for other sectors is significantly lower. The Electricity Generator case study sees significant profit upside (as already forecast in commentary surrounding Phase One of the EU ETS), due to the mechanics of marginal cost pricing (see page 11).

New business opportunities and cost effective emissions abatement measures can improve the situation still further.

[4] Appendix 3 includes a summary of regulatory scenarios for two of the case studies.

An issue for both senior management and investors

The results clearly show that companies need to look further than just their own emissions and energy use in order to understand their exposure to climate change. Raw materials which involve significant carbon in their extraction or production, and associated services (such as logistics and packaging) can be key. For some sectors, merely looking at 'direct' and electricity linked 'indirect' carbon emissions overlooks broader more significant business risks.

Large companies — in most cases — represent a portfolio of assets, whether in different product or industry areas, or different geographic locations. Whilst some assets may be significantly exposed to climate change, others may be more protected. Smaller companies, with more restricted operations, may be more affected.

Many companies are already taking actions to reduce energy use which both cuts costs and emissions. Some have also started looking at logistics, again reducing costs as well as emissions. Very few companies, however, are incorporating their full climate change risk exposure into their strategic thinking and it could have a significant impact.

Whilst initially climate change can appear a highly material risk, properly managed, this downside risk can be minimised. For some sectors, the analysis even suggests an uplift in profits. What is critical is that companies need to fully understand the risks and opportunities associated with this complex area, and develop robust plans to address them. There will be large creation and distribution of shareholder value in the transition to a low carbon economy — there will be winners and losers at sector level and within sectors at company level. The winners are more likely to be those businesses that take the time to understand and address this complex area.

- **Senior company management** needs to ensure that emissions regulation is fully understood and integrated into the company's business planning and operations, in addition to the potential weather-related/physical impacts. If the company fully understands the implications of emission constraints, it will know where to focus its lobbying and negotiation attention — whether with government regulators, higher-carbon suppliers, or pricing discussions with customers. For many, emission constraints and the 'cost of carbon' should influence capex and investment plans. Other financial opportunities (such as CDM investments[5], technology developments or new markets) should be seriously explored.
- **Investors**, particularly in those sectors more highly exposed to the issue, should ensure that climate change forms part of their ongoing dialogue with the companies they invest in. From a governance perspective, they will want to ensure risks are being appropriately managed. From a valuation perspective, the companies themselves are best placed to provide information on the financial impacts of regulatory announcements (such as the announcement of 2008-12 National Allocation Plans due in mid-2006, and any ongoing developments on post-2012 regulations) and other drivers.

Accordingly, this document provides **seven questions** that investors could ask companies, and companies should ask themselves. Derived from the financial outputs of this analysis, these questions allow attention to be focused upon those areas of greatest materiality. They are outlined on the opposite page.

The Carbon Trust will continue to lead financial understanding of this issue going forward. This is a moving area, and if you would like to be kept informed as new research is brought out, please contact the Carbon Trust's investor engagement team through investors@carbontrust.co.uk.

For all other enquiries on the Carbon Trust's activities, including its Carbon Management programme working with large corporates, please email info@carbontrust.co.uk.

Tom Delay
Chief Executive
The Carbon Trust

Emma Johnson
Head of Investor Engagement
The Carbon Trust

[5] The Clean Development Mechanism (CDM) is a mechanism linked to the Kyoto Protocol, under which companies and investors can gain tradable emission allowances from investments in greenhouse gas reduction projects in the developing world.

Assessing corporate risk from climate change

1. **What is the company's full exposure to greenhouse gas emissions, including those linked to energy use, transport, logistics and supply chain?**

   Does the company fully understand its exposure to greenhouse gas emissions, including those linked to energy use, transport and logistics, and its supply chain? Which emissions does it disclose? Which emissions are estimated solely for internal purposes? Which emissions are ignored, and how often is that decision (to overlook such emissions) reviewed? Are emissions benchmarked against competitors or industry standards, and — if so — how does the company compare?

2. **What is the company's exposure to emissions regulation cost, and how is this expected to develop?**

   How are the company's emissions currently regulated, and what is the cost incurred? How is this expected to develop going forward, and what are the cost/planning implications? What regulatory and price scenarios are routinely run during business planning?

3. **What other climate change impacts may affect the company?**

   Could demand patterns change as (a) consumer awareness of climate change increases, and (b) lower-carbon products become more competitive? Is the company exposed to extreme weather events? How do such risk factors feed into the planning process?

4. **Are there supply side risks, either with electricity costs or other high carbon raw materials?**

   How exposed is the company to rising energy prices, and to what extent has this been hedged? Are other key bought-in goods (including packaging) linked to high greenhouse gas emissions, and what are the implications?

5. **Are there significant competitiveness implications, and how well placed is the company versus its direct competitors?**

   How much of the incremental cost associated with climate change can be passed on to customers? Does the company face direct competition from non-EU producers, less exposed to emissions regulation? Does the company face competition from lower-carbon substitute products? What scenarios are analysed during business planning? What are their implications? Do competitors have different outsourcing strategies and does this impact positively or negatively their ability to react to carbon issues?

6. **Process Technology: What would be the cost of reducing emissions by 5%, 10% or 20%, and does the company own any proprietary IP in this area?**

   If the company needed to reduce emissions by 5%, 10% or 20%, how could this be achieved, and what would be the cost? Is the company itself involved in development in this area of process emissions efficiency? What is the estimated value of its IP, and what is its strategy for exploiting this?

7. **New Market Technology: Does climate change open up new market opportunities, and how is the company positioned versus competitors in these new areas?**

   Does climate change open up new market opportunities, that the company would be well placed to address? How is the company positioned versus competitors in these new areas? What are the revenue projections, and how much has been invested to date?

2 Introduction to climate change

Climate change

Climate change is caused by emissions of greenhouse gases into the atmosphere — concentrations of which have been increasing since the start of the industrial revolution. Whilst some details of the science remain uncertain, climate change is now fully recognised as a reality, and legally binding regulations to address it have already been put in place.

Carbon dioxide (CO_2) accounts for around 80% of the developed world greenhouse gas impact. It is heavily linked to energy consumption, being released wherever fossil fuels are burnt. Other greenhouse gases include methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), together with various HFCs and CFCs.

Carbon dioxide is often referred to as just 'carbon'.

The Kyoto Protocol and longer term targets

Following Russian ratification, the UN's Kyoto Protocol entered into force in February 2005, restricting developed world emissions of greenhouse gases for 2008-2012. EU-15 countries were allocated a single target of an 8% reduction in 'CO_2 equivalent' versus 1990 levels; within this the UK's target is a 12.5% reduction.[6]

The Kyoto Protocol does not include greenhouse gas emissions targets for emerging countries, including India and China, nor targets for countries that did not ratify the Protocol — most notably the USA and Australia. Early stage discussions have started on post-2012 emissions regulation.

The UK's Energy White Paper confirmed the UK's aim for a 60% reduction in its greenhouse gas emissions by 2050. Other EU member states have similarly tough medium and long term targets.[7]

EU and UK climate change legislation

The European Climate Change Programme (ECCP) covers a broad range of measures to meet the EU's greenhouse gas reduction targets. There are 41 Directives in total — covering topics as diverse as transport policy, energy labelling, non-CO_2 greenhouse gases, the energy performance of buildings, emissions trading, renewables, and combined heat and power (CHP).

A major component of the ECCP is the EU Emissions Trading Scheme (the EU ETS). From January 2005, major sources of industrial carbon emissions have been subject to the 'cap and trade' regulation surrounding this new scheme. As with any limited resource, the EU ETS places a value on each tonne of carbon. Appendix 2 provides a brief overview.

Within the UK, industrial users of energy have been subject to climate change legislation in the form of the Climate Change Levy and Climate Change Levy Agreements since 2001. The Climate Change Levy (CCL) is a tax on industrial energy use, thereby indirectly addressing energy-linked carbon emissions. The Climate Change Levy Agreements (CCLAs) offer an 80% levy reduction for companies who satisfy agreed energy efficiency improvement targets. UK companies with agreed CCLA targets are able to opt out of the EU ETS until 2008. Other UK-specific climate change legislation includes the Renewables Obligation.

EU ETS mechanics and the concept of 'free allowances'

Under the EU ETS, each Member State's National Allocation Plan sets out its allocation of carbon emission allowances (generally referred to as just 'emission allowances') to each site covered by the trading scheme.

These emission allowances are issued for free — meaning that regulated sites only face the cost associated with any shortfall. They do not face a cost on each tonne of carbon emitted.

> Whilst the Kyoto Protocol, and other measures such as the Clean Development Mechanism, address all greenhouse gases, the EU ETS currently only covers carbon emissions.

At the end of each calendar year, each EU ETS regulated site must submit sufficient emission allowances to cover that year's verified carbon emissions. If it does not have sufficient emission allowances, it may purchase them through the EU ETS; if it has an excess, it can be a seller. There are significant penalties in place (see Appendix 2) if these requirements are not met.

Through allocating with a small shortfall, the EU ETS encourages a reduction in carbon emissions to take place, in whichever sites have the lowest cost abatement opportunities.

Appendix 2 provides more details on the EU Emissions Trading Scheme (EU ETS).

[6] The UK has also set itself a tougher domestic target of a 20% reduction versus 1990 levels by 2010.
[7] See *Investor Guide to Climate Change*, The Carbon Trust, January 2005.
[8] For more information on CDM see *Investor Guide to Climate Change*, The Carbon Trust, January 2005. CDM is a mechanism under which companies and governments can meet part of their Kyoto commitment through investing in greenhouse gas emission reductions in the developing world.

What happens in 2005-7 and 2008-12?

Phase One of the EU ETS is already underway, covering carbon emissions from energy intensive industry in the EU for the three year period 2005-7. It regulates around half of the EU's total greenhouse gas emissions. The carbon price on the EU ETS is currently is around €27/tonne CO_2 (mid-February 2006).

Emission allowance allocations for Phase Two (covering 2008-2012 and corresponding to the Kyoto compliance period) are due to be announced in each Member State's Phase Two National Allocation Plan by mid-2006. These will be subject to review by the European Commission, for competitive consistency and alignment with individual Member State's Kyoto compliance strategies.

During Phase Two, the EU ETS may be extended to include other sectors such as aviation, and may be linked into other trading schemes (including potentially Norway, Switzerland, Canada and Japan).

Various chemical, industrial and agricultural processes also emit other greenhouse gases. Whilst not covered by the EU ETS at present (which only covers carbon emissions), they have a potent greenhouse gas effect. These non-CO_2 greenhouse gases are included within the broader Kyoto Protocol regulatory regime — for example, developing world reductions in any of these gases can qualify for Clean Development Mechanism (CDM) credits.[8]

What happens from 2013?

International discussions have started on post-2012 emissions regulation. High priority is being placed on engaging with countries not currently regulated by the Kyoto Protocol — particularly the USA, India and China.

Regardless of progress on international negotiations, the EU ETS is expected to continue post-2012, with tightening controls on carbon emissions and a widening scope.[9] Emissions from transport (including aviation), property and the service sector are likely to receive more attention. The scheme may also be extended to cover emissions from non-CO_2 greenhouse gases.

As constraints on emissions of carbon and other greenhouse gases become tighter, the underlying carbon price (per tonne of CO_2 equivalent) in schemes such as the EU ETS would typically be expected to increase.

The inevitability of at least some weather impacts

Even if steps are taken now to dramatically reduce greenhouse gas emissions, climate change will still happen to some extent because such gases remain in the atmosphere for decades and impacts accumulate for even longer.

The forecast impacts include changes to temperature and precipitation (rainfall) patterns, together with a greater frequency of extreme events — such as flooding, storms and drought.[10]

Broader implications

Climate change is also expected to bring some less tangible effects on business and industries.

Demand patterns are likely to change, both as (a) consumers become more aware of climate change, and (b) low-carbon products and services become relatively more competitive. In 2005, the Carbon Trust published analysis on *Brand Value at Risk from Climate Change*, investigating the value at risk if a company's products are not seen to be as environmentally responsible in the future.[11]

To meet long term emission targets, and regulatory requirements, new technology developments are required: from renewable energy development to energy efficiency and energy management technologies, to more radical product redesign. This potentially opens up new business areas across a range of industries.

There will be large creation and distribution of shareholder value in the transition to a low-carbon economy — there will be winners and losers at sector level and within sectors at company level. The winners are likely to come from those businesses that take the time to understand and address this complex area.

[9] It is worth noting that the EU put in place legally binding legislation surrounding the EU ETS, before the Kyoto Protocol entered into force. From a company perspective, it would be prudent to assume that EU legislation will continue, even if the broader international process is stalled.
[10] For more information on the science of climate change and the anticipated impacts, see *The Climate Change Challenge*, The Carbon Trust, March 2005.
[11] See *Brand Value at Risk from Climate Change*, The Carbon Trust, March 2005.

3 Methodology

During 2005, the Carbon Trust worked with Cairneagle Associates (a strategic management consultancy firm) to develop a methodology for analysing shareholder value at risk from both climate change and its associated carbon emissions regulation.

Companies across a wide range of sectors are exposed to climate change — both in terms of the physical risks (e.g. asset damage from increasingly frequent extreme weather events, production downtime) and the constraints and cost of carbon dioxide and other greenhouse gases imposed by regulatory (and voluntary) mitigation measures. The challenges also bring new market opportunities in areas such as renewables and energy efficiency. Whilst climate change is seen as a longer term issue, emissions controls such as the EU Emissions Trading Scheme are already in place.

The approach

The model developed offers a robust, replicable approach to analysing such value at risk. It follows a four step methodology as outlined on the following page. The model has been tested and developed through the analysis of ten 'case study companies', which are discussed in Appendix 1 on an unnamed basis.

The methodology is by nature a top-down approach. In calculating the financial impact, we have quantified the potential impact on profits, using the shape of the business in 2004, but applying a potential 2013 emissions regulation regime.

Why use 2013?

2013 was chosen as the first year *after* the end of the 2008-2012 Kyoto compliance period (which also equates to Phase Two in the EU ETS).

Greenhouse gas targets, policy and regulation beyond this 2008-2012 Kyoto compliance period are several years from being agreed. However, in order to meet longer term 'safe' greenhouse gas levels, significant further reductions will be required. We have assumed in Europe a continuation of the EU Emissions Trading Scheme, with its approach of allocating a set (typically decreasing) number of free allowances to each site. We have assumed that the sectoral scope of the EU Emissions Trading Scheme (or similar parallel schemes) is extended to include other corporate sectors and transport-linked emissions.

A major uncertainty is to what extent countries not currently regulated by the Kyoto Protocol (particularly the USA, India and China) will be brought into committed emission reduction targets from 2013. In the case study analysis in Appendix 1, we have considered two scenarios for non-EU emissions: one where they face the same regulatory cost as activities in the EU, and one where they face no regulatory constraints.

2013 therefore represents the earliest year under this uncertain, but likely tougher, regulatory regime.

Although this report focuses on 2013, it needs to be recognised that, for many sectors, financial impacts will be seen significantly before this time. Energy intensive industry in the EU has been regulated by the EU ETS since the start of 2005, and free allowance allocations are expected to be reduced in the second phase of trading from 2008. In addition, a much broader range of businesses are also already seeing the early impact of carbon pricing through electricity costs.

The case studies

All of the 'case study companies' have been based on real examples. In some cases, the 'case study company' analysed is strictly linked to a single company within that sector. In others, just a single corporate division has been reviewed, and in others yet again, characteristics from several companies have been combined, to produce a more representative example.

Restriction to just published sources of information

In order to enable analysis on a strictly like-for-like basis, the research has been based entirely upon public sources of information. No company interviews were conducted (in order to keep the research to just public sources), although input was sought where appropriate from investment analysts and other third party experts. **This analysis illustrates what a determined shareholder (or other onlooker) could derive about value at risk from climate change, based upon what companies disclose today**.

In most cases, not everything needed to quantify exposure to climate change was disclosed: a large proportion of the project was spent drilling down into corporate and industry body information in order to obtain robust estimates. This in itself is an important finding. In particular, in most cases, estimates were needed for carbon emissions associated with logistics, packaging and key raw materials. With care, and using a broad range of third party sources and approximations, these could be estimated.

Value at risk methodology

1. Assess value chain and impacts

Begin by assessing the company, its sector and related value chain. For some industries, such as automotive manufacture, even though the company's own carbon emissions are relatively low, carbon emissions elsewhere in the value chain dominate. Is use or disposal of the company's products particularly exposed to climate change? Do key raw materials or suppliers represent high sources of carbon emissions?

2. Quantify carbon emissions — direct and indirect

This needs to include both direct carbon emissions, and those indirect emissions linked to purchased electricity, bought-in goods (including packaging) and distribution. These should be costed at an agreed carbon price — for this report and analysis we have used £20/tCO_2 — for calculation of the company's 'emissions exposure'.

3. How is financial exposure to carbon emissions minimised?

Regulatory:

- How many emissions are allocated for free? This will be influenced by the perceived availability of cost-effective carbon reductions within that sector, and broader competitive and economic considerations.

Competitive dynamics:

- What proportion of additional costs will be passed on by the supply chain?
- What proportion of additional costs will the company be able to pass through to its customers? What implications may this have for market share or revenue?
- How much of business is within the EU, versus elsewhere (where regulatory regimes may be less costly)?

4. Other broader impacts

Implications of broader carbon emission constraints:

- Are there implications (positive or negative) of broader carbon emission constraints on demand for a company's products?
- Will competitive positioning change — by company or sector? Is there a risk of low-carbon substitute products?
- Are there new business opportunities?

Implications of physical impacts of climate change:

- Do changing weather patterns (hotter, drier summers; warmer, wetter winters; more extreme events) have any implications?

Potential impact on customer needs and behaviours:

- Will customers increasingly value 'climate friendly' products?
- Could brand values be affected (positively or negatively)?

In order to obtain a better indication of the likely impact on value, the methodology quantifies the impact on profits using the **shape of the business in 2004, but applying the likely carbon management regime in 2013**. This long term profit impact is used as a proxy for value at risk.

The analysis **focuses on carbon emissions**, as carbon is the only greenhouse gas currently covered by the EU ETS. However, where relevant, non-CO_2 greenhouse gases are also measured and their materiality indicated.

4 A worked example for the chemicals sector

Step 1. Assessing value chain and potential impacts

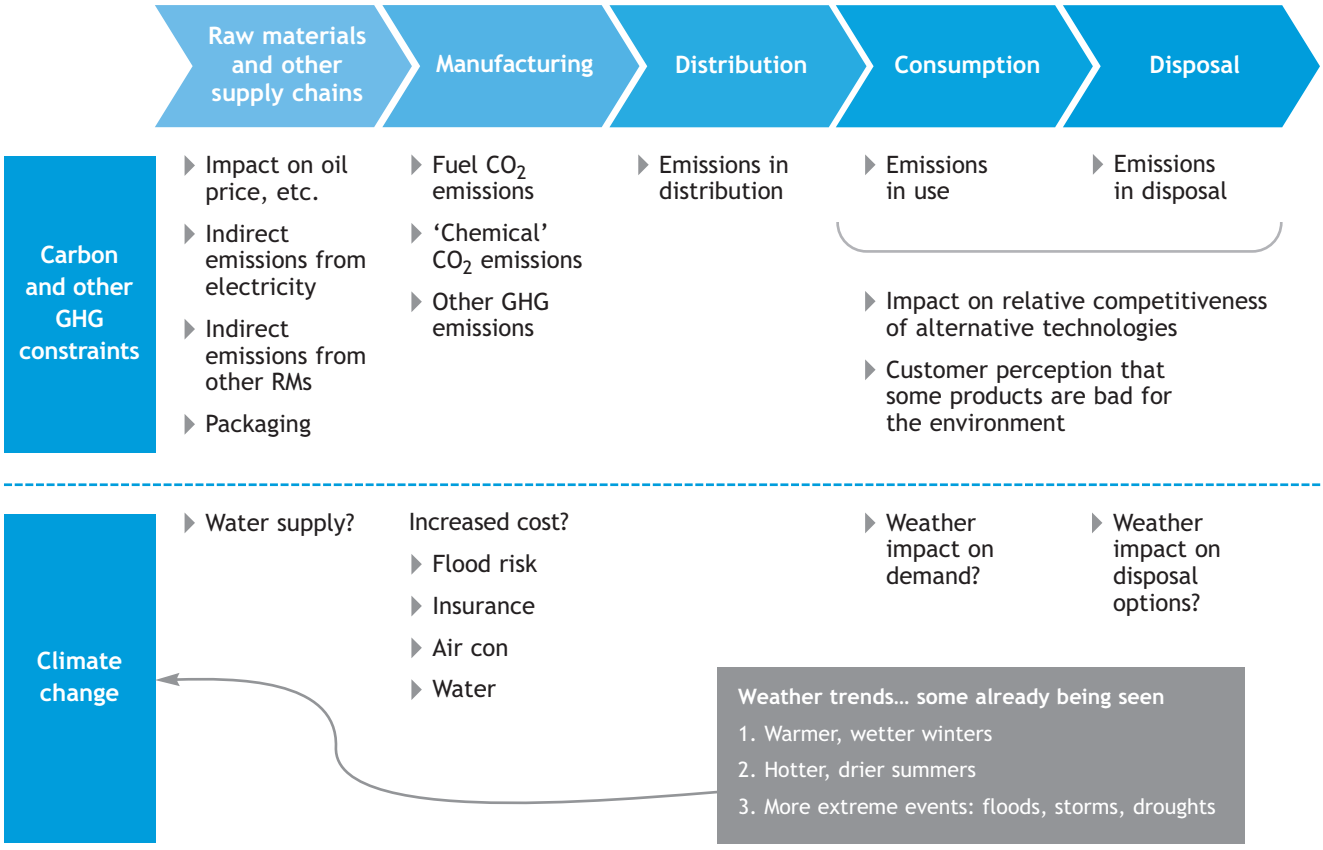
The diagram below outlines the key risk areas for the chemicals sector, from both constraints on carbon emissions (and, as relevant, other non-CO_2 greenhouse gases) and from the expected weather impacts linked to climate change.

As an energy intensive sector, the chemicals sector is clearly exposed to restraints on carbon emissions. The sector may also be impacted by carbon emissions linked to its more energy intensive suppliers, and carbon emitted by its main customer markets. Certain chemical processes also release other non-CO_2 greenhouse gases.

Whilst not specifically named as an EU ETS sector, many chemicals sites are covered by the EU ETS's coverage of thermal combustion units over 20MW. Within the UK, the chemicals sector is covered by the Climate Change Levy and Climate Change Levy Agreements (see page 6). The chemicals sector — including its non-CO_2 greenhouse gas emissions — may well be included in the EU ETS by Phase Three.

Whilst the risk from 'Carbon and other GHG constraints' may be more easily quantified, the sector is also exposed to 'Climate change' weather impacts. Although it will be several decades before most effects of climate change may be seen, some — particularly extreme weather events — are already having greater occurrence as can be seen from recent high rises in insurance premiums and claims. The hurricane disruption to the petrochemical sector seen in the Gulf of Mexico during the second half of 2005 is a good example of the production disruption that can be caused by extreme weather. Water supply may also become an issue in some locations.

***Example** — Potential impact of climate change on the chemicals sector*



Step 2. Quantifying carbon emissions — direct and indirect

Gathering reliable and comparable data on carbon emissions is not straightforward.

The chemical companies reviewed all disclosed their 'direct' and electricity-linked 'indirect' carbon emissions. However, carbon emissions associated with packaging, logistics and 'high carbon' raw materials needed to be estimated in all cases. For the bulk commodity chemicals case study used here, this resulted in an 'emissions exposure' roughly twice that reported.

The carbon emissions were then costed at a carbon price of £20/tCO_2. Whilst the future of prices is clearly highly uncertain, this is in line with longer term carbon price assumptions in recent other Carbon Trust and third party publications (including Trucost/Henderson's Carbon 100 publication[12]). It is also similar to long term estimates for the gas/coal switching price — a key technical price driver for the EU ETS carbon price.[13]

Step 3(a). Impact of free allowances and supply chain pass through

Applying a straight cost of £20/tCO_2 to every tonne of carbon emissions, however, clearly overestimates and oversimplifies the situation. Different companies and sectors can pass through different proportions of increases in operating costs. They also have different regulatory exposure and different potential abatement costs.

Our case study Bulk Commodity Chemicals company was assumed to receive sufficient free allowances to cover 70% of its own direct emissions (those linked to direct fuel, direct chemical emissions and distribution). Free allowances are allocated through each Member State's National Allocation Plan.

A large component of supply chain carbon emissions are from purchased electricity. In this analysis, we have assumed that the electricity sector passes through costs at 50% of the marginal cost impact that valuing carbon at £20/tCO_2 would have on the cost of coal-fired generation — the 'technology at the margin'.

Carbon and electricity costs

The technical mechanics of power pricing mean that the electricity sector has been forecast by many to see increased profits from Phase One of the EU ETS.

Wholesale electricity prices are based on the marginal cost of electricity generation.

Even if emission allowances have been allocated for free, if unused they could be sold at the prevailing EU ETS carbon price. This 'opportunity cost' is therefore included in the pricing calculation. Put another way, the carbon price is reflected in every unit of electricity sold, even for those units where the necessary emission allowance was allocated free of charge.

Longer term, these forecast increased profits may be eroded, potentially through lower allocations of free allowances, or negotiations with major purchasers. **In this analysis, we have assumed that by 2013 the electricity sector passes through 50% of the marginal cost impact that valuing carbon at £20/tCO_2 would have on the cost of coal-fired generation**. Coal-fired electricity generation is assumed to be the 'technology at the margin' — i.e. the technology that sets the market price.

[12] June 2005, *The Carbon 100*, Henderson Global Investors and Trucost. Available through www.trucost.com/henderson.html.

[13] Coal-fired electricity generation emits considerably more carbon per MWh than electricity generated from gas. Above a certain carbon price level, inclusion of the marginal cost of carbon in the marginal price of electricity generation, can cause gas-fired generation to become more competitive (on a marginal cost basis) than coal-fired.

For all other supply chain carbon emissions, we have assumed that the suppliers receive free allowances to cover 70% of their business-as-usual carbon emissions, with simple pass through of these additional costs through to our case study bulk commodity chemicals company.

Step 3(b). Cost pass through to customers

The ability of the chemicals sector to pass additional costs through to its customers varies. Our case study is predominantly a producer of bulk commodity chemicals — the pass through capability in these markets can be very difficult. We have assumed that only 30% of additional costs can be passed through to customers.

Step 3(c). EU/Non-EU weighting

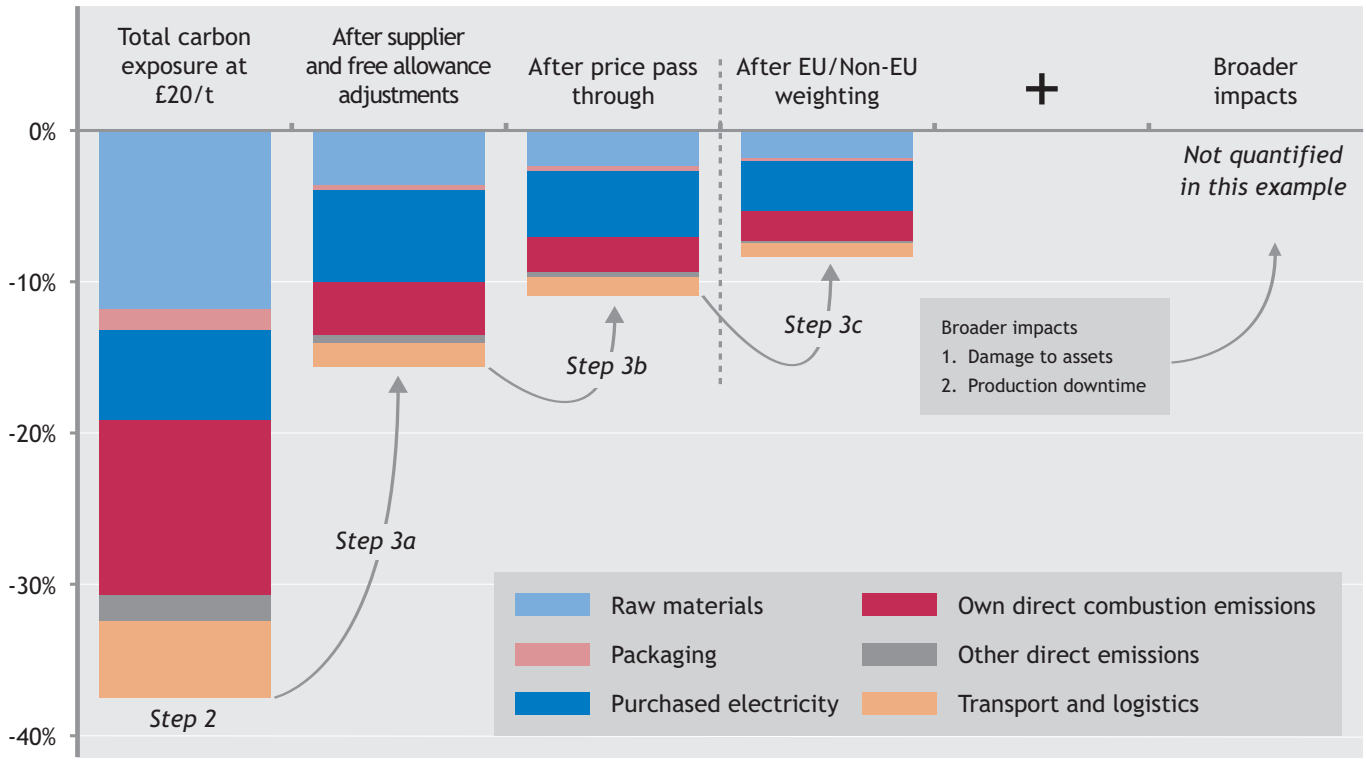
Finally, it is a reasonable assumption that even in a post-Kyoto (i.e. post-2012) world, regulations in many regions outside of the EU — including the developing world and the USA — may still be a lot less rigorous. We have therefore made a final adjustment, adjusting the risk to take out the proportion of business (30% in this case) located outside of the EU.

Step 4. Opportunities and other

Companies are not just exposed through their emissions. For several there are (harder to quantify) business risks linked to weather exposure and changing demand patterns. Although not quantified in this example, our case study Bulk Commodity Chemicals company may face additional climate-linked risks from extreme weather (damage to assets, or production shut down) or product demand.

The following graph summarises the case study calculation, as a percentage of 2004 EBIT.

***Case study** — Bulk Commodity Chemicals*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 30% cost pass through to customers and around a quarter of business located outside of the EU.

What does this analysis tell us?

Whilst total carbon emissions exposure (with all emissions costed at £20/tCO_2) is around 38% of EBIT, this reduces to just 11% once free allowances, supplier adjustments and price pass through have been taken into account. Adjusting to remove any regulatory cost on operations outside the EU reduces this profit exposure further to 8%.

The analysis clearly helps understand where the company is most impacted.

Although actual electricity-linked emissions are relatively low as a proportion of the total emissions exposure (see the first column), the energy pricing mechanics discussed above mean that this becomes the most material cost element, after adjustments are made for free allowances and supply chain pass through. Put another way, electricity-linked emissions still represent c. 6% of EBIT in the second column, whilst everything else has decreased. Electricity-linked emissions are the largest cost exposure (column 2), despite not representing the largest actual emissions exposure (column 1).

The case study's largest areas of emissions exposure (column 1) are through its direct fuel combustion and raw materials. Direct fuel combustion is easy to monitor, and controlling energy usage will have been a cost issue, even before carbon emissions increased attention in this area. However, much less is known or reported by the company on the carbon intensity and regulatory treatment of emissions from key raw materials. This would appear to be an area that should be understood and disclosed in much greater detail than appeared to be currently the case in the chemical companies reviewed.

The other major issue is clearly price pass through. The additional cost incurred (16% of EBIT in the second column) is pretty significant, yet only 30% of this additional cost can be passed through. Is this 30% cost assumption correct, and how is it expected to develop going forward?

Finally, although the analysis did not quantify a broader impact risk in this case[14] this is an area of potential importance. As already discussed, production in certain chemical sites could become increasingly exposed to weather-linked disruption. In addition, commodity chemicals is a complex area, with demand for each product often focused on a few specific uses. If one of these end markets is subject to significant emissions regulation, consumer pressure or other climate change-linked influence, that could have further significant impact on our chemical companies specialising in that area.

Selected other climate-linked opportunities can exist in the chemicals sector. In the autumn of 2005, the French company Rhodia announced that it had reached agreement on CDM approval for a N_2O reduction project in its subsidiaries in Korea and Brazil,[15] generating a sizeable new revenue stream for the company.

[14] See Appendix 1 for case studies where one or two specific risks exist, and hence this element has been quantified.

[15] The Clean Development Mechanism (CDM) is discussed in Appendix 2, but can briefly be summarised as a tool through which a developed world investor can gain emission credits for an investment in the developing world which will result in a reduction in CO_2 or other greenhouse gases emissions. One tonne N_2O (nitrous oxide) is equivalent to 23t CO_2 in global warming impact.

5 Summary and analysis of all ten case studies

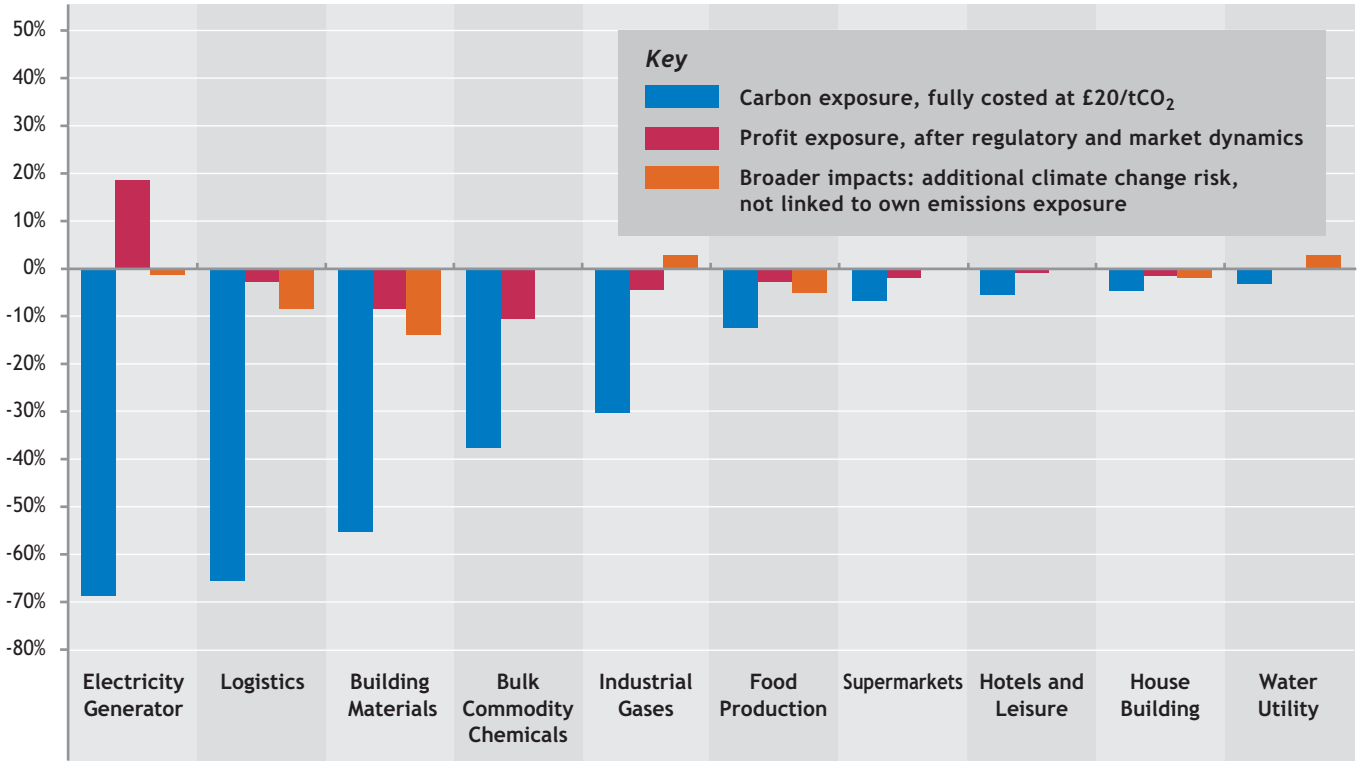
A summary of the analysis for each sector case study is available in Appendix 1. The findings are summarised in the graph below:

- The blue bars show the full carbon emissions exposure, with all associated carbon emissions costed at £20/tCO_2. These figures represent each case study's 'carbon emissions exposure' or 'emissions exposure'.
- The red bars show this emission-linked exposure, once regulatory and market dynamics have been taken into account. These figures represent each case study's 'profit exposure' to emissions regulation.
- The orange bars show the additional profit risk or upside from broader climate change impacts, not linked to the case study's own emissions exposure. These calculations are harder to quantify, but are key estimates. In some sectors — such as Logistics, Building Materials, Food Production and House Building — this less quantifiable risk is the more material.

Total value at risk is represented by the red and orange bars combined. Clearly, as the graph illustrates, this is not the same as simple 'emissions exposure'. Different companies and sectors have (a) different carbon emissions regulatory treatment and carbon cost exposure, (b) different carbon emission abatement opportunities, and (c) different abilities to pass costs through to customers. Certain companies also experience significant additional climate change risk, not directly linked to their own emissions profile.

Only the Building Materials and Bulk Commodity Chemicals case studies have value at risk clearly in excess of 10% of EBIT by 2013. For Building Materials, this risk is primarily linked to the broader risk of weather-linked construction delays, rather than direct emission regulation. The Building Materials sector is also exposed to the high carbon intensity of materials such as cement. The Bulk Commodity Chemicals case study also faces high energy requirements, a high carbon supply chain, and difficulty in passing any carbon associated costs forward.

Value at risk from climate change
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: In order to provide a like-for-like comparison, the value at risk analysis above is shown before the EU/Non-EU adjustment, i.e. it compares a 100% EU based supermarket, versus a 100% EU based hotel and leisure group.

Under our assumptions, only the Building Materials and Bulk Commodity Chemicals case studies have potential value at risk clearly in excess of 10% of EBIT by 2013. For Building Materials, this risk is primarily linked to the broader risk of weather-linked construction delays, rather than direct emissions regulation. Logistics may also see value at risk of this magnitude, if its long-haul air freight growth rates are hit.

Logistics may also see value at risk of this magnitude, if its long-haul air freight growth rates are hit. Despite having such high emissions exposure, the logistics sector is assumed to pass virtually all of these additional emissions-linked costs on to its customer base.

The profit exposure and broader impacts risk for other sectors is significantly lower. The Electricity Generator case study sees significant profit upside (as already forecast in commentary surrounding Phase One of the EU ETS), due to the mechanics of marginal cost pricing (see page 11).

Carbon exposure is clearly not the same as value at risk

Different companies and sectors have:

- Different carbon emissions regulatory treatment and carbon cost exposure
- Different carbon emission abatement opportunities
- Different abilities to pass through costs to customers.

Certain companies also experience climate change risk, not directly linked to their own emissions profile — this can be from weather risk or changing demand patterns.

Despite its relatively high emissions intensity, Industrial Gases is not especially exposed financially, due to the high percentage of costs that can be passed through to customers. It also sees potential upside from new markets surrounding carbon sequestration and hydrogen infrastructure.

Out of the five lower emissions exposed case studies, Food Production and House Building are potentially the most exposed, in part due to their weather risks (potentially disrupting supply for Food Production, and entailing construction delays and potential asset write down for House Building).

Hotels and Leisure can pass a high proportion of costs through to customers and energy is a low component of costs. For Supermarkets, packaging would appear to be its most significant, but hardest to quantify, issue.

Water Utilities, as a regulated industry, are assumed to be able to pass through all additional costs to customers. They are expected to need to make increased investments for climate-linked storm and flood defence and also to cope with droughts, but the mechanics of their regulation means this increased asset base will allow a rise in profits.

A significant risk that can be reduced substantially if properly managed

When analysed on a fully costed basis at £20/tCO_2 (the blue bars), emissions exposure is clearly a material risk, with five of our ten case studies seeing a potential impact in excess of 20% of EBIT.

However, properly managed, this risk is reduced. Regulatory and market dynamics mean that the actual profit exposure (the red bars) is much lower.

If the company fully understands the implications of emission constraints, it will know where to focus its lobbying and negotiation attention — whether with government regulators, higher-carbon suppliers or pricing discussions with customers. For many, emission constraints and the 'cost of carbon' should influence capex and investment plans: a low value at risk can be reduced even further if emissions can be cut at less than the ongoing trading price of carbon, reducing the number of allowances the company needs to purchase, or even allowing excess allowances to be sold. Other financial opportunities (such as CDM investments[16], technology developments or new markets) can be relevant, and should be explored and followed as appropriate.

The risk reduction (from the blue bars to the red bars) is an estimate, based upon the competitive and regulatory assumptions discussed in Appendix 1. For a well managed company this risk could be reduced even further, and could even turn positive, as is currently the case in our Electricity Generator example. Alternatively, the risk could remain higher, if negotiations on allocation and pricing fail, and if inappropriate investments are made.[17]

[16] The CDM (Clean Development Mechanism) is a mechanism under which companies and governments can meet part of their Kyoto commitment through investing in greenhouse gas emission reductions in the developing world. Emission credits generated from CDM investments can be used on the EU ETS, alongside other emission allowances.

[17] For example, investing in less energy efficient process equipment capex, without recognising the cost and emission implications a few years down the line.

Assumptions

The analysis has been based around a single regulatory scenario for 2013:[18]

We have assumed a 70% free allowance allocation, versus business as usual. We have assumed a cost of carbon of £20/tCO_2. We have assumed that by 2013 the electricity sector passes through 50% of the marginal cost impact that valuing carbon at £20/tCO_2 would have on the cost of coal-fired generation. (Coal-fired generation is assumed to be the 'technology at the margin' — i.e. the technology that sets the market price).

A harsher regime, with a higher carbon price or the need to purchase a greater proportion of allowances, could make the impact significantly higher.

Broader impacts may be the higher risk or opportunity

Companies also need to be aware of the potential broader impacts (the orange bars), representing climate change risk not specifically linked to their emissions exposure. The graph on page 14 highlights that for Logistics, Building Materials, Food Production and House Building, non-emissions linked exposure is most significant. This mostly derives from weather risk and some changing demand patterns, assuming a gradual trend away from higher carbon products.

For Industrial Gases and the Water Utility, these broader impacts represented EBIT upside, due to new developing markets (hydrogen and carbon sequestration) for the gases sector and weather-linked investments increasing the Water Utility's regulated asset base.

Sources of exposure vary

The different sectors analysed are exposed in very different manners, as illustrated in the table below and in the graphs in Appendix 1. The detailed analysis allows an element of prioritisation to take place, through indicating which areas are the largest potential exposure.

For some, such as Industrial Gases, their electricity cost exposure is the largest item. For others, such as House Building and Bulk Commodity Chemicals, the emissions 'embedded' in key raw materials are most important. For some, the key issue clearly comes down to energy use (whether direct combustion or electricity); for others, broader impacts such as weather risk are more material.

Critically, not all information required is disclosed by the companies

The table opposite summarises emissions disclosure within the sectors and companies analysed.

Logistics was the only case study to disclose all emissions (excluding some for recent acquisitions). The Electricity Generator case study also disclosed a very high proportion of emissions, only excluding any reference to carbon emissions linked to the extraction of natural gas.

Most other sectors disclosed their own direct manufacturing emissions and those associated with their electricity use (using the Defra conversion factor for average grid electricity of 0.43tCO_2/MWh).

Case study	Key risks and other comments
Electricity Gen.	Regulatory treatment. Current upside.
Logistics	Minimal direct impact, but secondary risk through potential reduction in long haul freight.
Building Materials	Weather risks outweigh carbon intensity of materials.
Commodity Chem.	Carbon cost pass through from suppliers. Energy use.
Industrial Gases	Exposure to electricity costs and direct fuel, and extent to which the customer base will bear these.
Food Production	Packaging and logistics. Supply chain. Some weather risks.
Supermarket	Packaging and electricity. Supply chain and transport.
Hotels and Leisure	Electricity and construction. Consumer awareness of 'green' issues.
House Building	Carbon intensity of materials and weather risks. Flood exposure of land bank.
Water Utility	Storm risk, although regulatory structure mitigates financial impact.

[18] Appendix 3 includes a summary of regulatory scenarios for two of the case studies.

Emissions disclosed in companies analysed				
Sector	**Disclosed**		**Estimates required**	
Logistics	100%	Electricity, Own Direct Fuel	0%	—
Electricity Gen.	96%	Own Direct	4%	Raw Material (gas) Supply
Industrial Gases	87%	Electricity, Own Direct	13%	Raw Material, Packaging, Distribution
Water Utility	77%	Electricity, Own Direct, CH_4 in some	23%	N_2O, Bought in Materials, CH_4 in some
Hotels and Leisure	61%	Electricity and Gas	39%	Bought in goods, Transport
Commodity Chem.	51%	Electricity, Own Direct	49%	Raw Materials, Packaging, Distribution
Food Production	47%	Electricity, Own Direct	53%	Raw Materials (sugar), Packaging, Distribution
Supermarket	35%	Electricity, Own Direct	65%	Packaging, Distribution
Building Materials	29%	Electricity, Own Direct	71%	Raw Materials, Packaging, Transport and Distribution
House Building	0%	None	100%	Electricity, Own Direct, Raw Materials, Transport and Logistics

Emissions associated with raw materials production, packaging, transport and distribution were typically excluded. Occasionally, a company discloses some material on this, often just for one business unit. These analyses, together with third party research (e.g. on packaging, carbon in buildings, etc.) allowed estimates to be made, in most cases. Where the estimated numbers are highly significant, more work should be done by companies (and their shareholders) in that sector on understanding this.

Some of this missing material may exist within companies. However, for consistency, **this analysis has been based strictly on public domain information**. Part of its value has been to show what an independent third party could find out about different companies' exposure from such current public information. Where possible, interviews were held with selected investment analysts and other third party experts covering the different areas.

Uncertainties need to be recognised

As highlighted above, not everything needed for this analysis was disclosed by the companies, and hence estimates were required in several areas.

A second area of uncertainty surrounds the regulatory assumptions made. The approach has analysed value at risk under a theoretical 2013 regulatory framework and using a single estimate in each case for allowance allocation, price pass through and other competitive dynamics.

Regulatory assumptions — a recap

We have assumed a 70% free allowance allocation, versus business as usual. We have assumed a cost of carbon of £20/tCO_2. We have assumed that by 2013 the electricity sector passes through 50% of the marginal cost impact that valuing carbon at £20/tCO_2 would have on the cost of coal-fired generation. (Coal-fired generation is assumed to be the 'technology at the margin' — i.e. the technology that sets the market price).

We have also needed to make assumptions on the potential for price pass through.

The assumptions made are consistent and have been outlined for each case study in Appendix 1. Appendix 3 includes two examples of scenario analysis.

6 Implications for senior management and investors

The findings of this research clearly show that companies need to look further than just their own emissions and energy use in order to understand their exposure to climate change. Raw materials which involve significant carbon in their extraction or production, and associated services (such as logistics and packaging) can be key. For some sectors, merely looking at 'direct' and electricity-linked 'indirect' carbon emissions overlooks broader more significant business risks.

Large companies — in most cases — represent a portfolio of assets, whether in different product or industry areas, or different geographic locations. Whilst some assets may be significantly exposed to climate change, others may be more protected. Smaller companies, with more restricted operations, may be more affected.

Many companies are already taking actions to reduce energy use which both cuts costs and emissions. Some have also started looking at logistics, again reducing costs as well as emissions. Very few companies, however, are incorporating their full climate change risk exposure into their strategic thinking and it could have a significant impact.

An issue for both senior management and investors

Whilst initially climate change can appear a highly material risk, properly managed, this downside risk can be minimised. For some sectors, the analysis even suggests an uplift in profits. What is critical is that companies need to fully understand the risks and opportunities associated with this complex area, and develop robust plans to address them. There will be large creation and distribution of shareholder value in the transition to a low carbon economy — there will be winners and losers at sector level and within sectors at company level. The winners are more likely to be those businesses that take the time to understand and address this complex area.

- **Senior company management** needs to ensure that emissions regulation is fully understood and integrated into the company's business planning and operations, in addition to the potential weather-related/physical impacts. If the company fully understands the implications of emission constraints, it will know where to focus its lobbying and negotiation attention — whether with government regulators, higher-carbon suppliers, or pricing discussions with customers. For many, emission constraints and the 'cost of carbon' should influence capex and investment plans. Other financial opportunities (such as CDM investments[19], technology developments or new markets) should be seriously explored.
- **Investors**, particularly in those sectors more highly exposed to the issue, should ensure that climate change forms part of their ongoing dialogue with the companies in which they invest. From a governance perspective, they will want to ensure risks are being appropriately managed. From a valuation perspective, the companies themselves are best placed to provide information on the financial impacts of regulatory announcements (such as the announcement of 2008-12 National Allocation Plans due in mid-2006, and any decisions on post-2012 regulation) and other drivers.

The facing page outlines a list of questions that the Carbon Trust believes could be asked in order to ascertain whether this appropriate risk management is taking place.

The Carbon Trust

Set up in 2001, the Carbon Trust is an independent company, business led and funded by government, tasked with reducing greenhouse gas emissions in business and the public sector. We work directly with UK companies of all sizes to help reduce carbon emissions and develop new low carbon technologies. We also periodically undertake detailed research to improve understanding of climate change issues.

The Carbon Trust, through its Carbon Management programme, helps UK companies understand the strategic impact of climate change on their businesses, and take action. For more details on this programme, and other Carbon Trust activity, please email info@carbontrust.co.uk or visit www.thecarbontrust.co.uk.

Quantifying value at risk from climate change in financial terms is an ongoing area of activity for the Carbon Trust. We are organising a range of workshops and projects around this area over the coming months. If you are interested in taking part, please email investors@carbontrust.co.uk.

[19] The Clean Development Mechanism (CDM) is a mechanism linked to the Kyoto Protocol, under which companies and investors can gain tradable emission allowances from investments in greenhouse gas reduction projects in the developing world.

Assessing corporate risk from climate change

1. **What is the company's full exposure to greenhouse gas emissions, including those linked to energy use, transport, logistics and supply chain?**

   Does the company fully understand its exposure to greenhouse gas emissions, including those linked to energy use, transport and logistics, and its supply chain? Which emissions does it disclose? Which emissions are estimated solely for internal purposes? Which emissions are ignored, and how often is that decision (to overlook such emissions) reviewed? Are emissions benchmarked against competitors or industry standards, and — if so — how does the company compare?

2. **What is the company's exposure to emissions regulation cost, and how is this expected to develop?**

   How are the company's emissions currently regulated, and what is the cost incurred? How is this expected to develop going forward, and what are the cost/planning implications? What regulatory and price scenarios are routinely run during business planning?

3. **What other climate change impacts may affect the company?**

   Could demand patterns change as (a) consumer awareness of climate change increases, and (b) lower-carbon products become more competitive? Is the company exposed to extreme weather events? How do such risk factors feed into the planning process?

4. **Are there supply side risks, either with electricity costs or other high carbon raw materials?**

   How exposed is the company to rising energy prices, and to what extent has this been hedged? Are other key bought-in goods (including packaging) linked to high greenhouse gas emissions, and what are the implications?

5. **Are there significant competitiveness implications, and how well placed is the company versus its direct competitors?**

   How much of the incremental cost associated with climate change can be passed on to customers? Does the company face direct competition from non-EU producers, less exposed to emissions regulation? Does the company face competition from lower-carbon substitute products? What scenarios are analysed during business planning? What are their implications? Do competitors have different outsourcing strategies and does this impact positively or negatively their ability to react to carbon issues?

6. **Process Technology: What would be the cost of reducing emissions by 5%, 10% or 20%, and does the company own any proprietary IP in this area?**

   If the company needed to reduce emissions by 5%, 10% or 20%, how could this be achieved, and what would be the cost? Is the company itself involved in development in this area of process emissions efficiency? What is the estimated value of its IP, and what is its strategy for exploiting this?

7. **New Market Technology: Does climate change open up new market opportunities, and how is the company positioned versus competitors in these new areas?**

   Does climate change open up new market opportunities, that the company would be well placed to address? How is the company positioned versus competitors in these new areas? What are the revenue projections, and how much has been invested to date?

Appendix 1 Case studies analysed

The analysis included five high carbon and five lower carbon case studies. Their carbon intensity of EBIT is shown below, in terms of kg CO_2 emitted per £ EBIT in 2004.

These estimates, when costed at £20/tCO_2 give the first column in each of the charts below.

High carbon case studies and description	Kg CO_2e/£ EBIT[1]
Electricity Generator Electricity generator, with mix of hydro and fossil fuel generation. Also distribution. Mainly UK.	35
Logistics Global freight management and contract logistics.	33
Building Materials Supplier of bulk aggregates, including concrete. EU and international.	28
Commodity Chemicals Supplier of bulk commodity chemicals. Mainly EU based, but subject to wider competition.	19
Industrial Gases Supplier of industrial gases for a range of industries and applications. High electricity use. EU and international.	15

[1] Estimated 2004 total associated CO_2e emissions, divided by 2004 EBIT.

Lower carbon case studies and description	Kg CO_2e/£ EBIT[1]
Food Production A blend of food and drink producers. Around 50% of operations based outside the EU. Some exposure to high carbon raw materials such as sugar.	6.1
Supermarkets UK based supermarket chain.	3.3
Hotel and Leisure Group Hotel chain, primarily in the UK.	2.7
House Building UK based house builder. Domestic new build homes.	2.3
Water Utility Regulated water utility operating in England/Wales. Supply of fresh water, and removal and treatment of waste water — for households and industry.	1.5

[1] Estimated 2004 total associated CO_2e emissions, divided by 2004 EBIT.

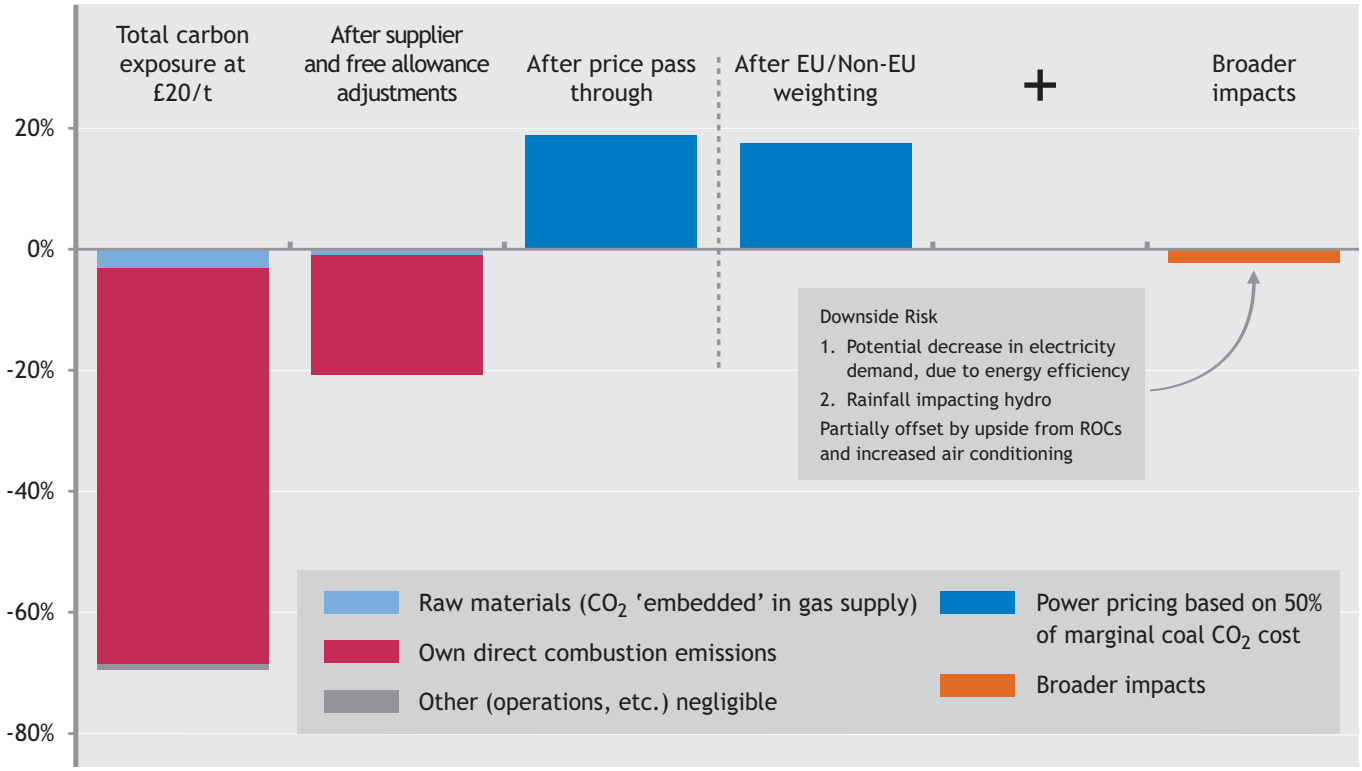
1.1 Electricity Generator

The analysis of the impact of the EU ETS on the electricity sector has been widely documented, but has been included here for comparison too. We have assumed that the price of carbon gets passed through at 50% of the carbon price impact on the marginal cost of coal-fired generation — see page 11. This results in a profit uplift for the sector.

The analysis below includes recognition of the significant energy-linked CO_2 emissions associated with the production and delivery of natural gas.

The sector faces some downside risk: a potential reduction in electricity demand due to rising prices and energy efficiency programmes and potential risk to hydro generation of electricity from lower rainfall. There may be some demand upside from increased air conditioning. There may also be a substitution risk from renewables, or upside from Renewable Obligation Certificates for those companies involved in renewable generation. The figure calculated below in the final column is a Cairneagle estimate of these combined factors.

***Case study** — Electricity Generator*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances and just less than 10% of business located outside the EU. The electricity sector is assumed pass through costs at the 50% of the CO_2 impact on the marginal cost of coal generation (the technology at the margin).

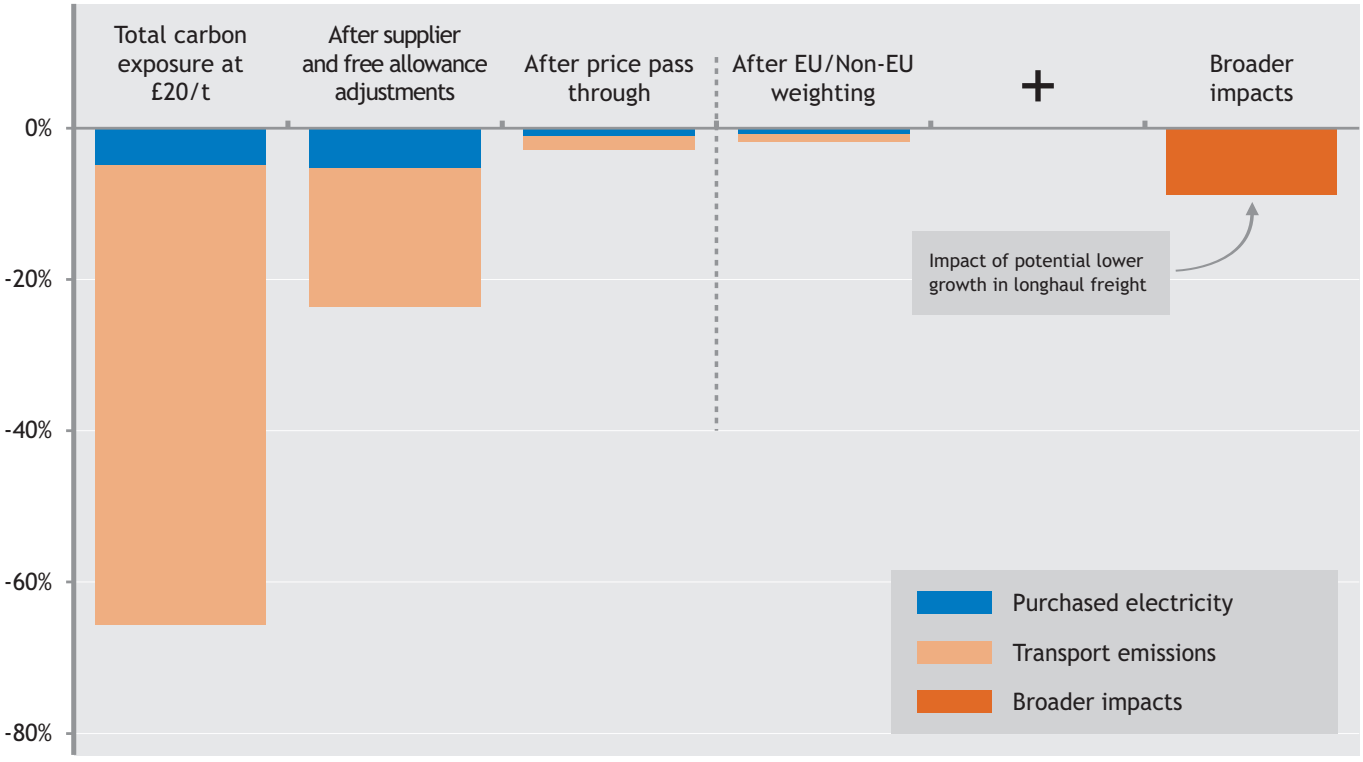
1.2 Logistics

The logistics case study is clearly heavily associated with carbon emissions, due to its high exposure to transport. This covers both its own emissions, and those of third party contractors (airlines, etc.).

Our analysis assumes that transport emissions (particularly air freight transport) will be covered by the EU ETS by 2013, resulting in a cost (after free allowances) of 23% of EBIT. However, most (90%) of these additional costs will be passed straight through to customers.

A more significant risk is a reduction in demand for air freight for relatively low value, high weight products. In order to estimate this, a simple valuation model was created for the case study analysed, split by division, and based on broker estimates. The future growth rate assumed by analysts for Far East air freight was then halved. This resulted in a (roughly estimated) potential downside risk of 8%.

Case study *— Logistics company*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 90% cost pass through to customers and around 40% of business located outside of the EU.

1.3 Building Materials

The Building Materials case study chosen is a bulk supplier of aggregates (including sand, gravel and ready mix concrete) and specific building products (e.g. bricks, blocks and precast concrete products such as concrete pipes).

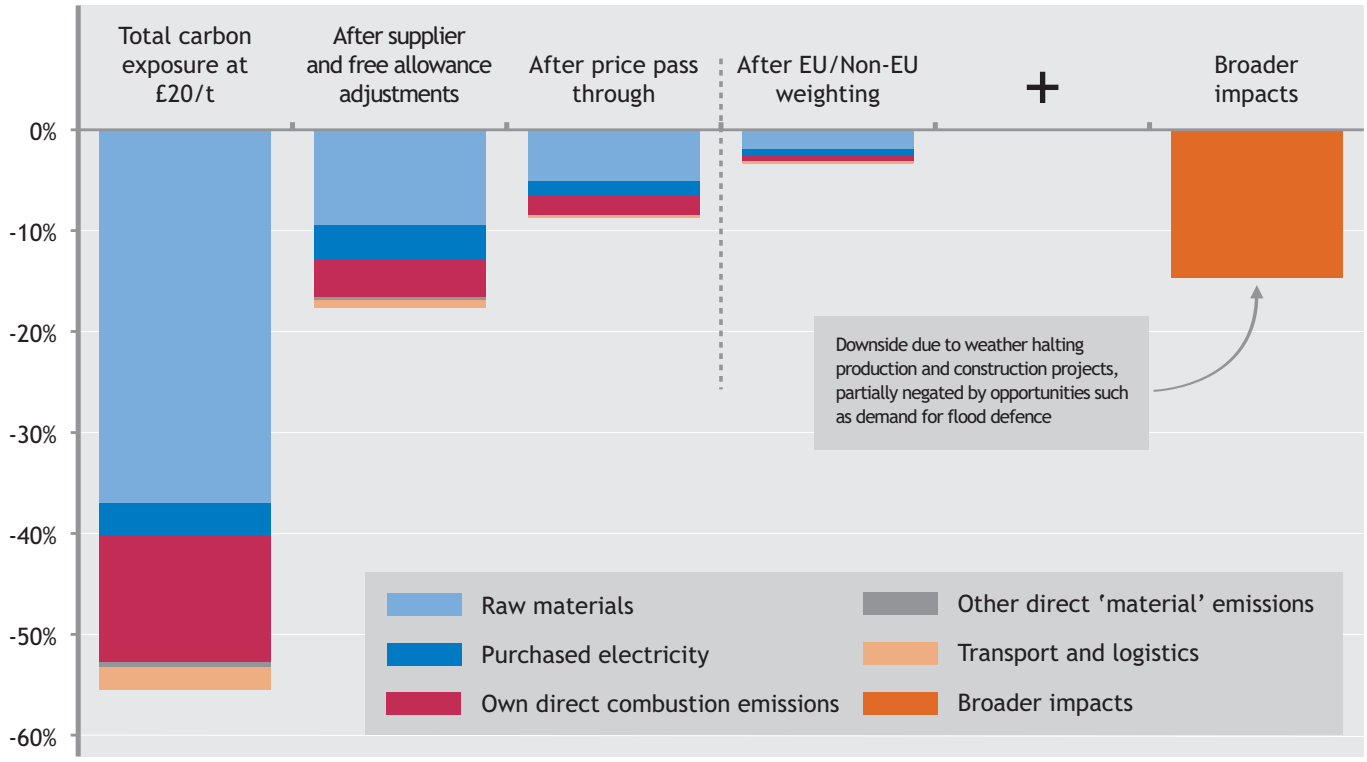
Interviews with investment analysts suggested that the cement industry has relatively high price pass through potential, pointing out that cement margins have not been impacted by recent increases in energy costs. However, for concrete and brick suppliers, such price pass through is much harder. We have assumed an average of 50% of additional costs incurred is passed through to customers.

In this example we have quantified broader potential impacts. These reflect a potential 5% decrease in revenue, equivalent to a c. 18% decrease in operating profits due to:

- Longer term risk from substitute products as the cost of cement and concrete products rise due to their embedded CO_2
- Downside due to weather halting both the company's own production and customer construction, both of which can delay revenue and increase stock.

This has been netted off against a c. 1% potential revenue uplift in new opportunities such as flood defences, resulting in a net negative 'broader impact' of around 14-15% of EBIT.

Case study *— Building Materials*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 50% cost pass through to customers and around two thirds of business located outside of the EU.

75% of raw materials emissions are from cement or steel: these are covered by the EU ETS and have been assessed using our methodology's standard approach of 70% free EU ETS allowances — resulting in a net cost to our case study of £6/tCO_2 for these emissions.

The remaining 25% of raw material emissions are from raw materials such as bitumen — which whilst not in the EU ETS is subject to the CCL and CCLAs (see glossary or page 6). These have been assessed using the current CCL, assuming the 80% discount requirements are met — resulting in a net cost to our case study of £2/tCO_2 for these emissions.

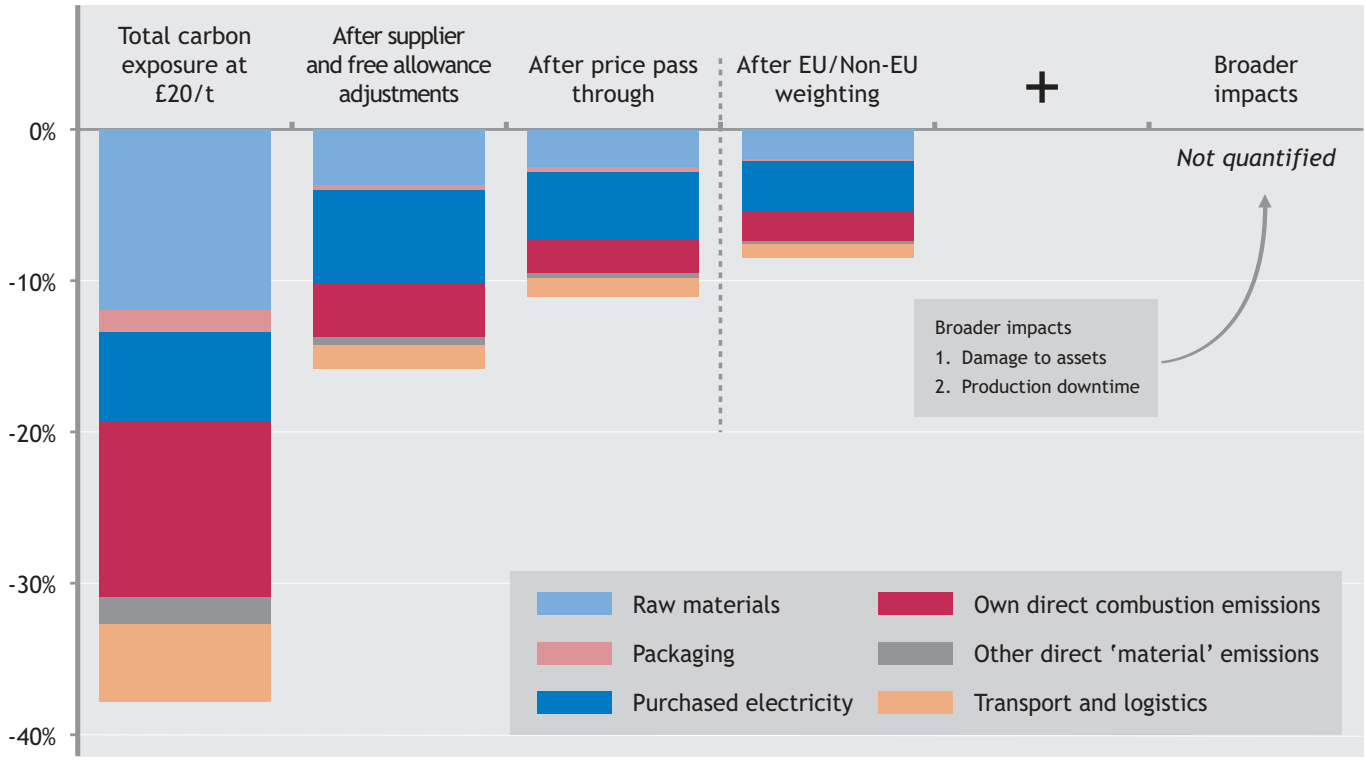
1.4 Bulk Commodity Chemicals

The next example looks at our Bulk Commodity Chemicals case study. What is a relatively high potential exposure (in terms of % of 2004 EBIT, fully costed at £20/t) reduces when free allowances, pass through and non-EU adjustments are taken into account.

A 30% cost pass through to customers was assumed: this reflects the highly competitive nature of such a company's commodity products, and the existence of international competition (especially Middle East for petroleum based commodity chemicals). A speciality chemicals company would typically have a higher pass through rate.

No broader impacts were quantified, although there is a financial risk associated with potential weather linked asset damage, and production downtime due to extreme weather affecting either the case study company or its suppliers (e.g. the impact on Texas based facilities with 2005 hurricanes).

***Case study** — Bulk Commodity Chemicals*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 30% cost pass through to customers and around a quarter of business located outside of the EU.

1.5 Industrial Gases

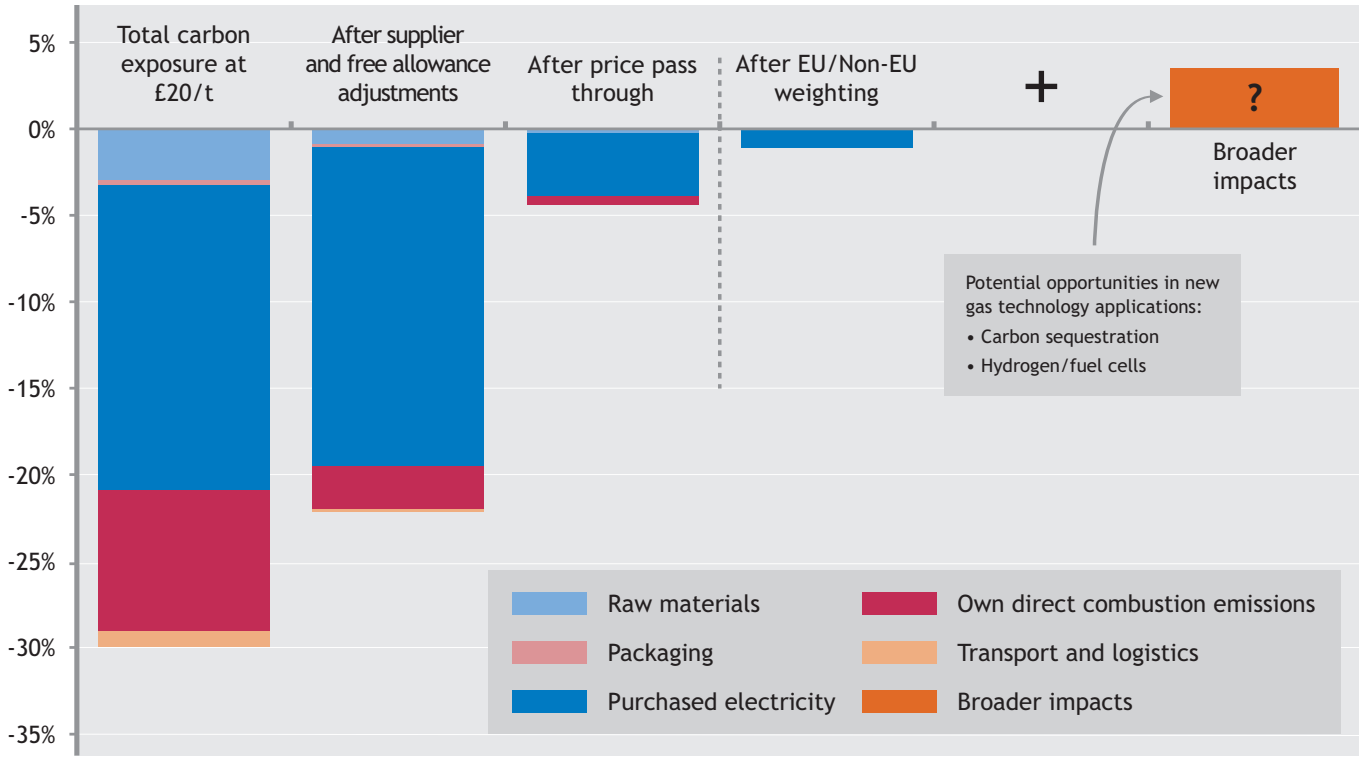
The case for our Industrial Gases example is quite different to the preceding two case studies. Most of its exposure to greenhouse gases is through its electricity use, the carbon intensity of which is calculated using the Defra reporting guideline of 0.43tCO_2e/MWh.

As explained on page 11, our analysis assumes that — unlike the profit-neutral scenario used for other suppliers — the electricity sector passes through costs at the higher level of 50% of the carbon price impact on the marginal cost of coal-fired generation (the technology at the margin).

However, the nature of the industrial gases business means that the company is likely to be able to pass through most of these costs (we have assumed an 80% pass through rate). There are no real substitute products in most market segments and non-EU imports are unlikely given transportation costs. A proportion of sales are through long term contracts, generally assumed to include energy-related price pass through.

Potential upside exists in new markets such as carbon sequestration and hydrogen/fuel cells. The extent to which these are being pursued by companies in this sector (and hence the potential value upside) may vary.

Case study *— Industrial Gases*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 80% cost pass through to customers and around 75% of business located outside of the EU.

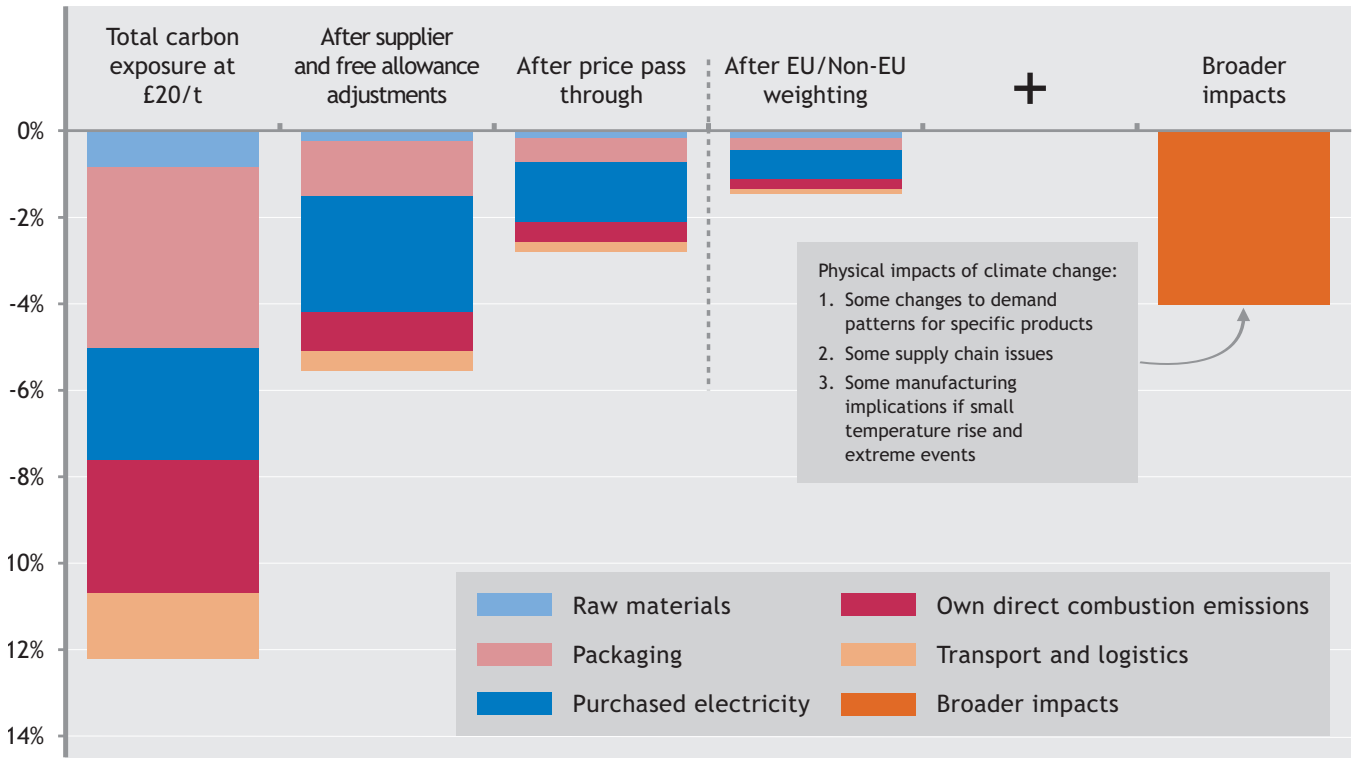
1.6 Food Production

The Food Production case study is exposed to a wide range of sources of emissions. These include emissions associated with transport and distribution, its own fuel and purchased electricity, packaging (more significant than expected) and some key high carbon/high energy raw materials (such as sugar). We have assumed an average 50% cost pass through to customers.

There may be some changes to demand patterns for specific products, although for diversified manufacturers the impact is likely to be small as such impacts will only affect part of the business. There may also be some supply chain issues. In March 2005, analysis published by the Carbon Trust on Brand Value at Risk highlighted the food and beverage production sector as one considerably more exposed to such intangible matters than its carbon intensity would suggest.

The Food Production case study was based on a blend of food and drink producers. Other companies in the food sector which could perhaps be more exposed to climate change are those that own farms or plantations in a limited geographic area, or those that rely heavily on imports using air freight.

Case study *— Food Production*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 50% cost pass through to customers and around 50% of business located outside of the EU.

1.7 Supermarket

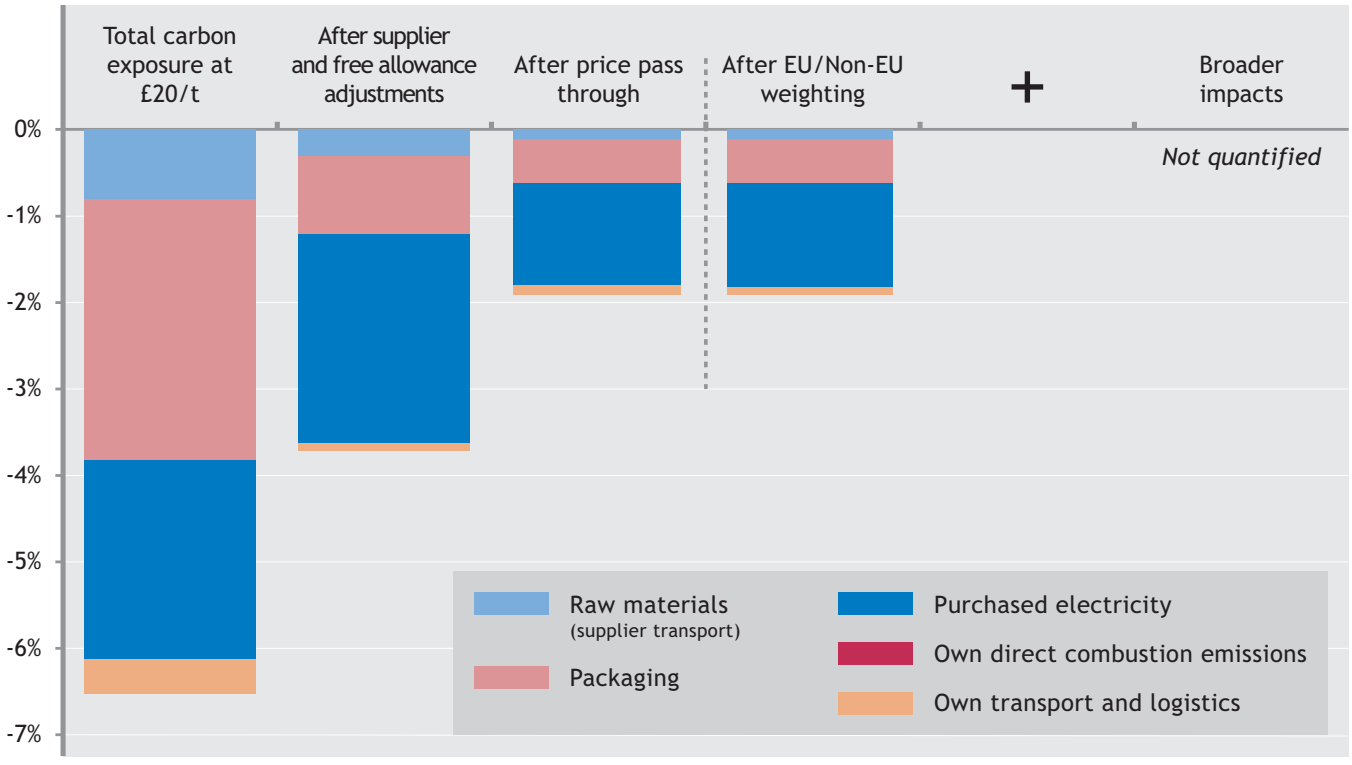
The analysis for the Supermarket case study is shown below. Assuming a 50% cost pass through, the potential exposure to climate change would be around 2% of EBIT.

Around 8% of fresh produce by value arrives by air freight. The introduction of a carbon cost on air freight would have a negligible impact on profits but could have some broader strategic implications. To some extent, the large supermarket's international sourcing expertise represents a competitive advantage over small retailers — a reduction in international sourcing could lead to a small decrease in this particular competitive advantage.

Transport represents a relatively significant source of CO_2 emissions, covering both distribution from suppliers to the supermarket depots, and distribution further back in the supply chain ('supplier transport').

The most significant issue — although hardest to quantify — appears to be packaging. Around 40% of fresh products on the shelves are typically the supermarket's own label, so the supermarket itself should be able to have significant impact into this area. There is also packaging in transit, in display and as carrier bags. As well as the cost implications of the carbon 'embedded' in packaging, this is quite a visible consumer issue (again see *Brand Value at Risk*, the Carbon Trust, March 2005).

Case study *— Supermarket*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



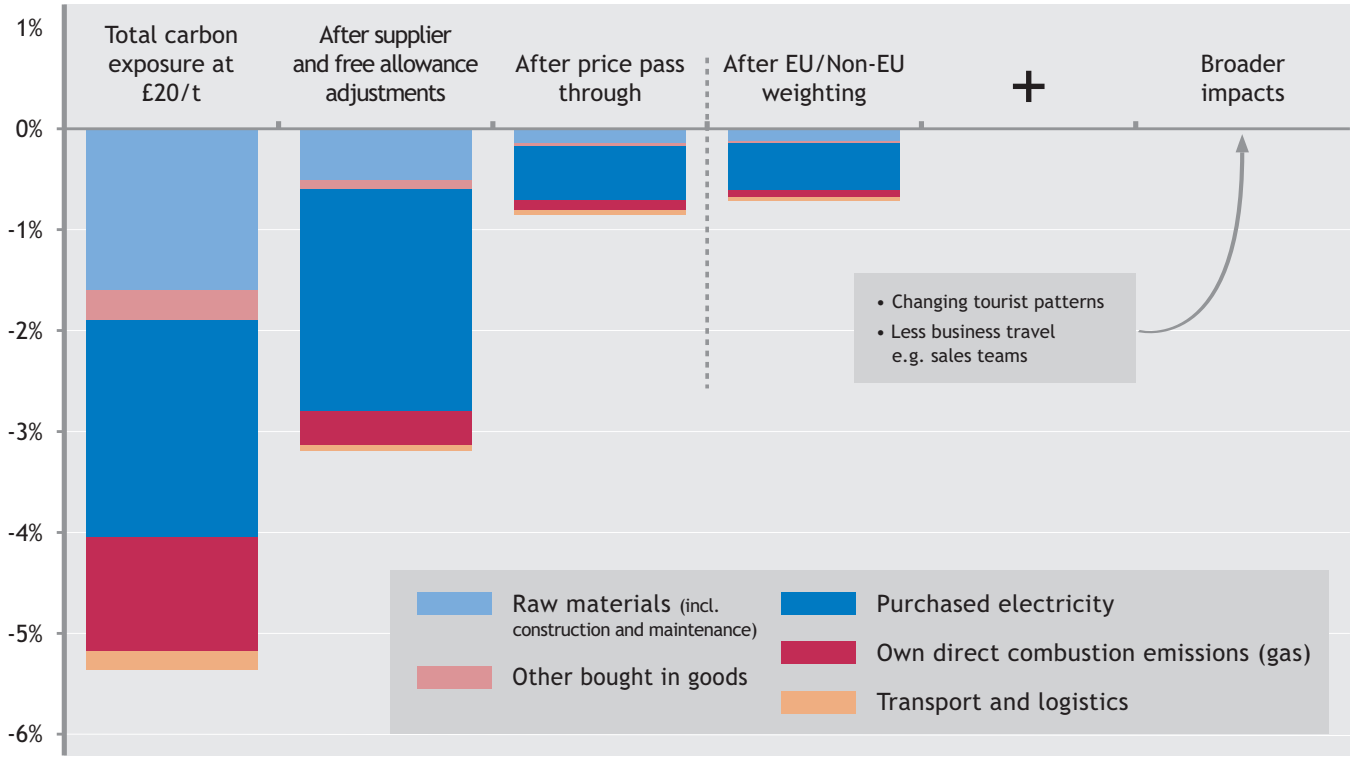
Note: Assumes 70% free allowances, electricity base case, 50% cost pass through to customers and a 100% UK based operation.

1.8 Hotels and Leisure

The Hotel and Leisure sector's main exposure is through energy use. Energy typically equates to around 2% of a hotel's revenue, although this statistic can vary widely between old and new, luxury and basic. Much of the cost impact associated with climate change can be passed on to customers — relative performance versus competing hotels is key.

There are significant amounts of CO_2 'embedded' in materials associated with construction and maintenance (steel, concrete, etc.). The physical effects of climate change may impact demand, and this is potentially the biggest impact to value, although it is difficult to quantify and impacts are long term. The cost of travel (cost of emissions) may also impact here. As business awareness of extended carbon footprint grows, there may well be a tendency for corporate clients to favour hotels based on environmental issues.

Case study *— Hotels and Leisure*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 75% cost pass through to customers and only around 10-15% of business located outside of the EU.

1.9 House Building

Within the house building sector, most materials (cement, steel, chemicals, glass) are energy/carbon intensive. The sector may also be exposed to costs linked to higher buildings energy standards, although initial analyst discussions implied these were not thought to be too burdensome financially.

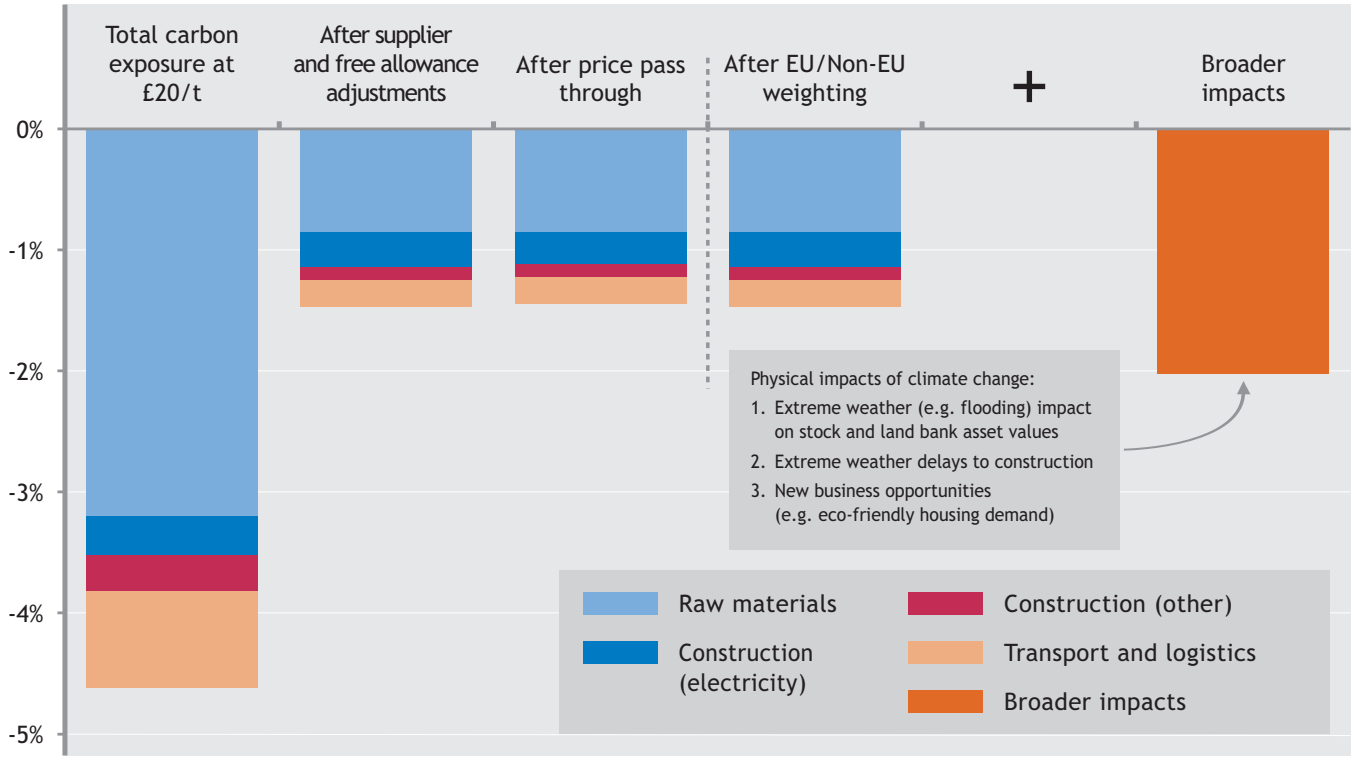
It is very difficult for this sector to pass forward such additional costs. The new build home price is set by the 'second hand' homes market, and demand is highly geared to the economy, interest rates and employment. There are some opportunities however, to develop new eco-friendly buildings, as both consumer awareness and energy costs rise. Such activity can also help with planning permission.

70% of the CO_2 associated with construction is due to the embedded CO_2 in the building materials. Of this, half is from cement. The larger house builders do have the power to squeeze their suppliers on price, especially in difficult market conditions.

At present, 11% of new homes in the UK are built in flood risk areas. Flooding is likely to become a more serious issue. Most house builders own a substantial 'land bank' (land purchased, but not yet developed) — of similar value to market capitalisation for our case study. The location of this land portfolio is not generally disclosed, and it is therefore difficult for an outsider to assess its potential flood risk. Depreciation of a company's land bank value may occur.

Although the house building sector has low operational gearing, the high proportion of work in progress means that profit is highly sensitive to short term changes in prices, but less so to volume. The sector is also exposed to wet weather related construction delays.

Case study *— House Building*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 0% cost pass through to customers and 100% of business located in the UK.

Around 80% of raw materials emissions are from cement, steel or bricks: these are assumed to be covered by the EU ETS and have been assessed using our methodology's standard approach of 70% free EU ETS allowances — resulting in a net cost to our case study of £6/tCO_2 for these emissions.

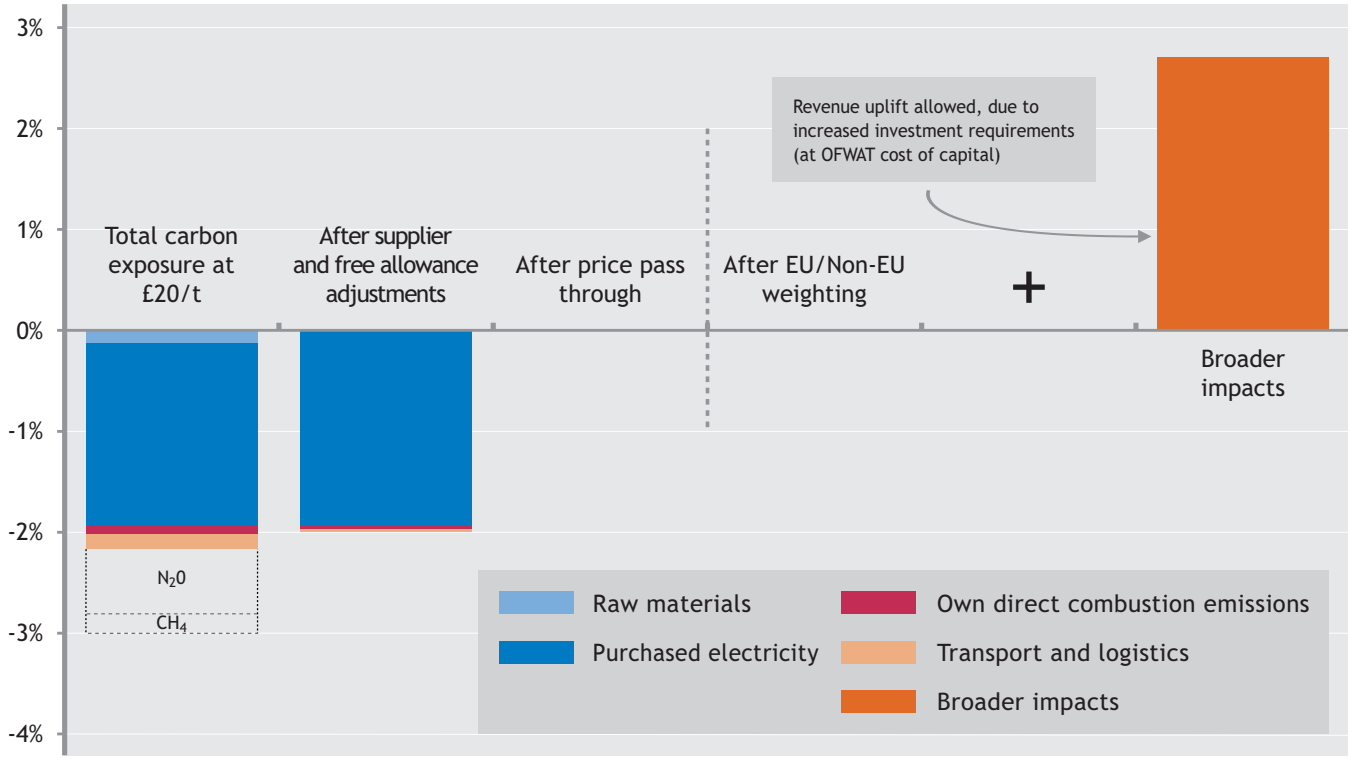
The remaining c. 20% of raw material emissions are from raw materials which, whilst not in the EU ETS, are subject to the CCL and CCLAs (see glossary or page 6). As in the Building Materials case study, these have been assessed using the current CCL, assuming the 80% discount requirements are met — resulting in a net cost to our case study of £2/tCO_2 for these emissions.

1.10 Water Utility

The water industry in England and Wales is a regulated industry, overseen by the water regulator, Ofwat. Given the current regulatory framework, we have assumed that additional costs linked to energy/carbon use will be passed through directly to consumers.

It is widely acknowledged that the water sector will need to invest in infrastructure to cope with the forecast extreme events (primarily flooding and drought). Due to the regulatory mechanism, an increase in agreed annual capex will allow higher prices to be charged — resulting in a small positive uplift to EBIT.

***Case study** — Water Utility*
Potential impact in 2013 as % of EBIT, based on 2004 operating statistics



Note: Assumes 70% free allowances, electricity base case, 100% cost pass through to customers and 100% of business located in the UK.

Appendix 2 The EU Emissions Trading Scheme overview

The EU Emissions Trading Scheme (EU ETS) is a 'cap and trade' scheme regulating industrial carbon dioxide emissions in the (now enlarged) European Union. Phase One of the scheme runs from 1st January 2005 to 31st December 2007. Phase Two runs from 1st January 2008 to 31st December 2012, coinciding with the Kyoto Protocol's commitment period.

Around half of EU carbon dioxide emissions are covered by the scheme.

National Allocation Plans

Each country produces a National Allocation Plan (NAP) in advance for each Phase of the scheme. Each country's NAP outlines the total number of emissions allowances that will be allocated, and allocates these amongst the various installations (individual operating sites) within that country's jurisdiction.

The allowances are currently being allocated for free; however, clearly they have a value, represented by the trading price for carbon. For this reason, the allocation mechanism has been subject to much lobbying and debate.

The NAPs must be approved by the European Commission for consistency. Each installation is allocated a set number of emission allowances to cover its operations. If it holds insufficient allowances to cover its emissions it is able to purchase additional allowances from other installations in the trading scheme. If it holds an excess of allowances it is able to sell these to other parties. At the centre of the scheme is a desire to achieve the EU's greenhouse gas target at the minimum cost.

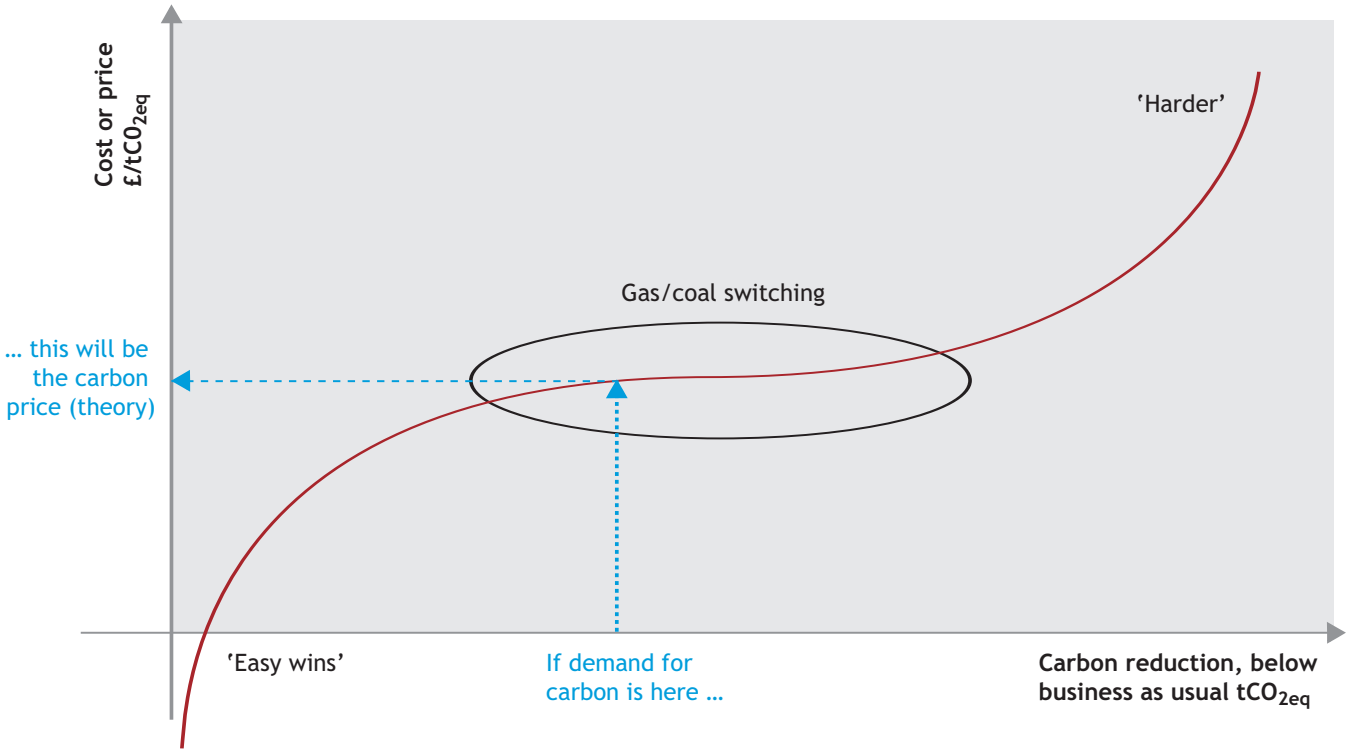
The NAPs must keep a proportion of allowances to one side for use by new entrants.

End of year reconciliation

At the end of each year, each site must surrender sufficient allowances to cover its CO_2 emissions for that year. These surrendered allowances are then cancelled. If a site is unable to surrender sufficient allowances, it is penalised at a cost of €40/t in the first phase, rising to €100/t in the second phase. In addition, the amount of the deficit in allowances is carried over to the following year.

Unused allowances can be carried forward within a Phase, but no such 'banking' is permitted between Phase One and Phase Two.

EU marginal abatement curve



Sectors covered

The scheme currently covers a range of named sectors as outlined in the table below. These include all thermal combustion installations above a 20MW threshold capacity. The scheme is expected to be expanded in the future, to include other gases and industries (including aviation), and potentially link into other geographic trading schemes.

Sectors covered by the EU ETS — Phase One	
Energy activities	Combustion installations (above 20MW threshold capacity) Oil refineries Coke ovens
Ferrous metals	Iron and steel production
Mineral industries	Glass manufacture Cement clinker and lime production Brick and tile manufacturing Ceramic products
Other activities	Pulp Paper

The EU ETS and similar trading schemes represent just part of the 'flexible mechanisms' permitted under the Kyoto Protocol. Other flexible mechanisms include CDM (Clean Development Mechanism) and JI (Joint Implementation), which both enable a company or country to receive emission credits for an investment in a greenhouse gas reducing project in another country (the 'host country'). The process is defined as Joint Implementation when the host country is a developed world country with an emissions target of its own. Projects in developing countries, with no targets, are covered under the Clean Development Mechanism.

Carbon price — theory

The diagram opposite outlines the simple theory behind how the carbon price is set. Each phase of the EU ETS (e.g. Phase One 2005-2007) can be viewed as a ringfenced supply/demand balance. Assuming there is a shortage of carbon allowances in the market, the trading price for 'carbon' is set by the marginal abatement cost.

The trading scheme encourages emission reductions to take place where most cost effective. A site which could cheaply reduce emissions ('Easy wins'), or even do so at zero cost, can make this reduction, and sell its resulting unused allowances through the trading scheme. Another site, which only had more expensive ('Harder') emission reduction opportunities, could purchase these allowances at a price below its own cost of emissions reduction.

If it is assumed that all the most cost effective reductions ('Easy wins') are made, the theoretical carbon trading price can be derived from the 'marginal abatement cost curve' as illustrated in blue.

'Easy wins' typically cover cost effective energy efficient measures. The next — large — potential carbon saving in terms of cost effectiveness typically comes from switching between gas-fired and coal-fired thermal electricity generation in the European power sector. As explained on page 11, gas-fired electricity generation emits significantly less CO_2 per MWh than coal-fired electricity generation. If further reductions are needed, over and above those achieved through 'Easy wins' and 'Gas/coal switching', these are typically more costly ('Harder') production upgrades, requiring a much higher carbon price to make them cost effective.

Appendix 3 Example sensitivity analyses

The sensitivity to key issues is summarised below for two of the case studies.

For Industrial Gases, the biggest uncertainty appears to be the extent to which the company will be exposed to higher electricity prices, and how much can these be passed on to customers.

Example 1 *Industrial Gases*

Scenario		% of EBIT
Base Case		4.4
Allowances	60-80% (Base case 70%)	4.2-4.7
Price pass through	70-90% (Base case 80%)	2.2-6.7
Electricity	1. Electricity sector profit neutral 2. Pass through at 50% of marginal coal price 3. Pass through at 75% of marginal coal price	1.8 4.4 6.3

For Building Materials, the largest uncertainty appears to be its allocation of free allowances, and the extent to which suppliers (of bulk aggregates) will pass on any of their raw material costs.

Example 2 *Building Materials*

Scenario		% of EBIT
Base Case		8.5
Allowances	60-80% (Base case 70%)	6.4-10.7
Price pass through	40-60% (Base case 50%)	6.8-10.3
Electricity	1. Electricity sector profit neutral 2. Pass through at 50% of marginal coal price 3. Pass through at 75% of marginal coal price	7.4 8.5 9.4
Suppliers	Only half of Raw Material carbon costs incurred passed through to company (assumed unlikely)	6.3

Appendix 4 Glossary of terms

Capex	Capital investment expenditure.
Carbon dioxide (CO_2)	Carbon dioxide accounts for around 80% of the developed world greenhouse gas impact, and around 60% of the impact globally. It is heavily linked to energy consumption, being released wherever fossil fuels are burnt, whether in industry, power stations, domestic households or vehicle exhausts.
Carbon dioxide equivalent (CO_2e)	Different greenhouse gases have different climate change impact per tonne of gas. For ease of analysis, these are often converted into 'CO_2 equivalent'. For example, 1 tonne of methane is equivalent to 23 tonnes of CO_2, or 23 tonnes CO_2e.
Carbon emissions	A shorthand term to describe carbon dioxide emissions. Linked terms include **high-carbon** and **low-carbon**, to describe processes and products that involve particularly high or low levels of carbon dioxide emissions. When discussing the EU Emissions Trading Scheme, the term 'carbon emissions' is often shortened still further to 'emissions'.
Carbon emissions exposure, or emissions exposure	A measure of how exposed the company's operations are to carbon emissions, including its exposure to carbon emissions elsewhere in its supply chain. Costed at £20/tCO_2, this gives the first column in each of the graphs. Linked terms include **cost exposure** (after adjustments have been made for supplier pass through and free allowances) and **profit exposure** (after the potential for passing prices through to customers has also been taken into account).
Carbon price	The cost of an emission allowance covering one tonne of CO_2. The current EU ETS carbon price is around €27/tCO_2, as at mid-February 2006. For the 2013 analysis, we have used a price of £20/tCO_2 (see page 11).
Case study	The analysis published focuses on ten case study companies. Ten 'case study companies' have been studied, from a range of sectors. In some cases, the 'case study company' analysed is strictly linked to a single company within that sector. In others, just a single corporate division has been reviewed, and in others yet again, characteristics from several companies have been combined, to produce a more representative example.
Clean Development Mechanism (CDM)	A mechanism under which companies and governments can meet part of their Kyoto commitment through investing in greenhouse gas emission reductions in the developing world. Emission credits generated from CDM investments can be used on the EU ETS, alongside other emission allowances.
Climate change	Climate change is caused by emissions of greenhouse gases into the atmosphere – concentrations of which have been increasing since the start of the industrial revolution. Weather changes include warming, changes in precipitation patterns and an increasing frequency of extreme events.
Climate Change Levy (CCL)	A tax on industrial energy use in the UK (see page 6).
Climate Change Levy Agreements (CCLAs)	Agreed energy efficiency improvement targets (agreed either by individual companies or on a sector basis) that offer an 80% reduction in the CCL, provided they are met (see page 6).
Direct/indirect energy emissions	Carbon dioxide emissions linked to energy use. Direct energy-linked emissions arise from the company's own combustion of fuel on site. Indirect energy-linked emissions arise from the company's electricity use. Indirect energy emissions are often called electricity-linked emissions.
EBIT	Earnings before interest and tax, a commonly used measure of profit.

EU-15	The fifteen EU Member States at the time the Kyoto Protocol was agreed. The EU-15 was given a single Kyoto target of an '8% reduction in 'CO_2 equivalent' versus 1990 levels', which was allocated out through the Burden Sharing Agreement. Within this, the UK's target is a 12.5% reduction.
EU European Climate Change Programme (ECCP)	A broad range of measures to meet greenhouse gas reduction targets in the EU (see page 6).
EU Emissions Trading Scheme (EU ETS)	A 'cap and trade' scheme to regulate industrial carbon dioxide emissions in the European Union (EU). The scheme began on 1st January 2005. Further details can be found on pages 6-7, and in Appendix 2.
Emission allowances	At the end of each calendar year, each site regulated by the EU ETS must submit sufficient (industrial carbon dioxide) emission allowances to cover its verified emissions for that year. These can either be the 'free allowances' allocated to that site under its host country's National Allocation Plan, or further allowances purchased from other participants under the EU ETS.
Free emission allowances, or free allowances	The (industrial carbon dioxide) emission allowances allocated for free to each site under, its host country's National Allocation Plan. Through allocating such allowances with a small shortfall, the EU ETS encourages a reduction in greenhouse gases to take place, in whichever sites have the lowest cost abatement opportunities (see page 6 and Appendix 2).
Greenhouse gas	The category of gases responsible for climate change. Carbon Dioxide (CO_2) is the largest contributor, responsible for 80% of the greenhouse gas impact. Other greenhouse gases include methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), together with various HFCs and CFCs.
Kyoto Protocol	A UN governed, legally binding international treaty restricting developed world (excluding the USA and Australia) greenhouse gas emissions from 2008-2012. Further details can be found on page 6.
Kyoto compliance period	The five year period covering 2008-2012. This is the same time period as Phase Two of the EU Emissions Trading Scheme.
Post-Kyoto	A generic description to describe 2013 and beyond. International emissions targets and regulatory details for this time period are not yet known, but are expected to involve tighter constraints and broadening coverage. Longer term, greenhouse gas emission reductions of around 50-60% from 1990 levels are thought necessary. Discussions on this have already begun. High priority is being placed on engaging with countries not currently regulated by the Kyoto Protocol, particularly the USA, India and China.
National Allocation Plan	The plan detailing each EU Member State's allocation of Free Allowances within the EU Emissions Trading Scheme (see page 6 and Appendix 2).
Non-CO_2 greenhouse gas	A term to describe the greenhouse gases apart from carbon dioxide. These are not included within the EU Emissions Trading Scheme (which only covers energy-linked CO_2), although they are included — on a CO_2e basis — within the Kyoto Protocol, and can qualify for CDM investments.
Phase One	Phase One of the EU Emissions Trading Scheme, covers the three years 2005-2007.
Phase Two	Phase Two of the EU Emissions Trading Scheme, covers the five years 2008-2012.
Renewables Obligation	An obligation on UK electricity suppliers to supply an increasing proportion of their electricity from renewable sources. Part of the UK climate change programme.

The Carbon Trust

The Carbon Trust is an independent, not for profit company, set up in 2001 by the UK Government to take the lead on low carbon technology and innovation within the public and private sector in the UK. It is funded by the Department for Environment, Food and Rural Affairs, the Scottish Executive, the Welsh Assembly Government and Invest Northern Ireland. Full information on the organisation's activities can be found on the Carbon Trust website: www.thecarbontrust.co.uk.

The Carbon Trust engages directly with UK companies in a number of ways, including through its Carbon Management service. This offers wide support on energy efficiency and other low carbon issues, and enables companies to take a broad view of the implications of climate change on their activities.

In addition to its work with UK companies, the Carbon Trust also engages with the financial community, through its Investor Engagement programme. The company has also produced a wide variety of publications which are available online, free of charge. For further information, please visit www.thecarbontrust.co.uk/investors, or contact Emma Johnson and the Investor Engagement team through investors@carbontrust.co.uk.

Cairneagle Associates

Cairneagle Associates is a strategic management consultancy that provides top level support to major corporations, financial institutions and ambitious entrepreneurs. Its core expertise is in providing support for complex decision-making where the consultancy offers powerful analytics, practical experience and bespoke solutions via small teams of senior advisors. For more details see www.cairneagle.com or contact David Sanders at david.sanders@cairneagle.com.

www.thecarbontrust.co.uk
0800 085 2005

The Carbon Trust is an independent company set up by the Government to help the UK meet its climate change obligations through business-focused solutions to carbon emission reduction. The Carbon Trust is grant funded by Defra, the Scottish Executive, the Welsh Assembly Government and Invest Northern Ireland.

The Carbon Trust works with business and the public sector to cut carbon emissions and capture the commercial potential of low carbon technologies.

This information is being made available to you as part of the Carbon Trust's general activity of promoting deployment of, and investment in, low carbon technology.

The quantitative analysis in this Report is drawn from work carried out for the Carbon Trust by Cairneagle Associates during 2005. It has been based on public information sources only.

Whilst reasonable steps have been taken to ensure that the information contained in this Report is correct, neither the Carbon Trust nor Cairneagle Associates give any warranty or make any representation as to its accuracy, nor do they accept any liability for any errors or omissions or for any loss arising from reliance on it. The publication of this Report should not be taken as implying any endorsement by the Carbon Trust of any of the assumptions made in this Report's analysis.

Neither the Carbon Trust nor Cairneagle Associates are giving investment advice in this document, and you must take your own view on the merits of, and the risks attached to, any investment decision you may undertake. You may wish to obtain professional advice.

The Carbon Trust is a company limited by guarantee. Registered in England and Wales Number 4190230.
Registered at: 8th Floor, 3 Clement's Inn, London WC2A 2AZ.

This brochure has been printed using recycled paper.

Published March 2006.

CTC602

CARBON TRUST

Making business sense of climate change