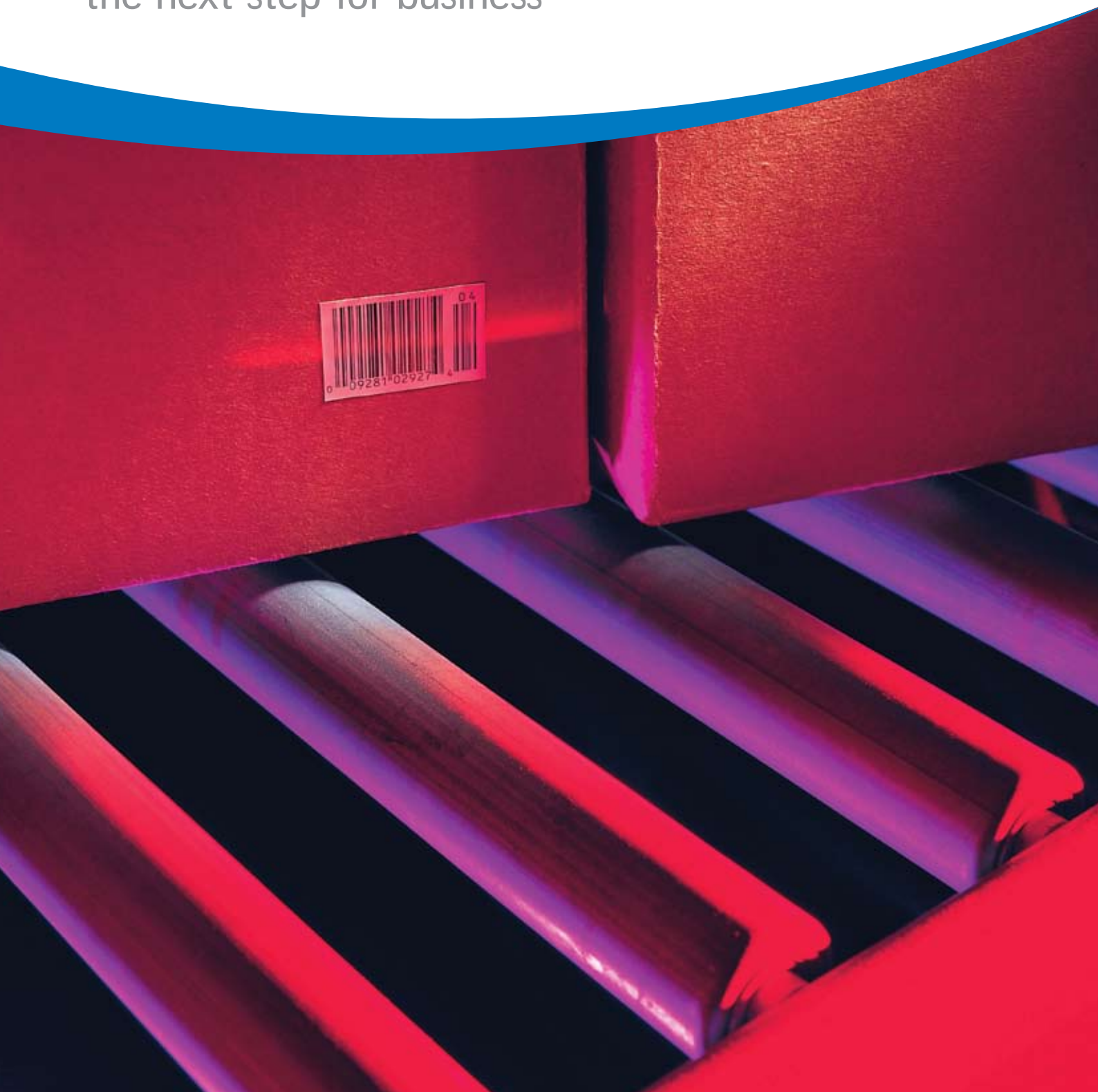
CARBON TRUST

Making business sense of climate change

Carbon footprints in the supply chain:

the next step for business



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Preface

Energy efficiency has succeeded, and will continue to succeed, in delivering valuable carbon and cost savings for business. Mitigating climate change, however, will require more fundamental changes to the way that business delivers products and services to the end consumer. The level of the challenge is reflected in the target, set out by Government in the 2003 Energy White Paper, to reduce carbon emissions in the UK by 60% from 1990 levels by 2050.

We describe here a new practical approach to reduce the carbon emissions in the products we all consume, by understanding and optimising emissions across full product supply chains.

Supply chain intervention has been used successfully by companies for decades to improve their financial bottom line. Successful companies have expanded their field of vision to look at the processes and operations of the companies that they buy from and companies that they sell to. This has allowed them to make better, more informed decisions about how to run their own operations. Many benefits have been seen: improved productivity, increased efficiency, reduced waste, lower capital requirements and enhanced product development are just a few. Could a supply chain approach be used just as successfully in the drive to cut carbon emissions across the economy?

The Carbon Trust recently published a report titled '*The carbon emissions generated in all that we consume*'. This report turns the traditional view of business carbon emissions on its head by showing that all the emissions across the economy are generated to meet the needs of the end consumer. For example, iron ore is not made into steel because steel bars themselves are useful but because they, in turn, can be made into components for the televisions we all watch and the buildings we all live in. To fully understand the carbon emissions associated with our television sets, we need to consider not only the electricity used to run them but also the energy used to make and deliver all the parts, and the energy to dismantle, dispose and recycle them afterwards too. That report shows how all emissions sources can be tied back to the provision of different products and services to meet the needs of the end consumer. It also shows the importance of linking all the supply chain steps together to look at the problem as a whole. The report concludes that companies can use a supply chain approach to look for new ways of reducing carbon emissions, just as they have been using supply chain analysis to deliver financial benefits for decades.

To demonstrate the practical value that can be gained by business from supply chain analysis — both financial and environmental — the Carbon Trust has created a business tool for carbon management across the supply chain. A methodology has been developed to build the carbon footprint of different products by analysing the carbon emissions generated by energy use across the supply chain. This has been successfully piloted with the supply chains of different newspaper and snack foods products. The methodology developed and the results of the pilot studies are presented in this report.

Executive summary

This report describes a new way for business to manage carbon emissions and increase profits at the same time by building and then reducing the carbon footprint of their products.

The report highlights the financial and environmental value of reducing carbon emissions across the supply chain through two case studies, completed in snack foods with Walkers and in newspapers with Trinity Mirror. We expect that this report can help companies in all sectors to develop their strategies to combat climate change. It should allow companies to act on the opportunities in their supply chains to reduce emissions and make money at the same time.

Background

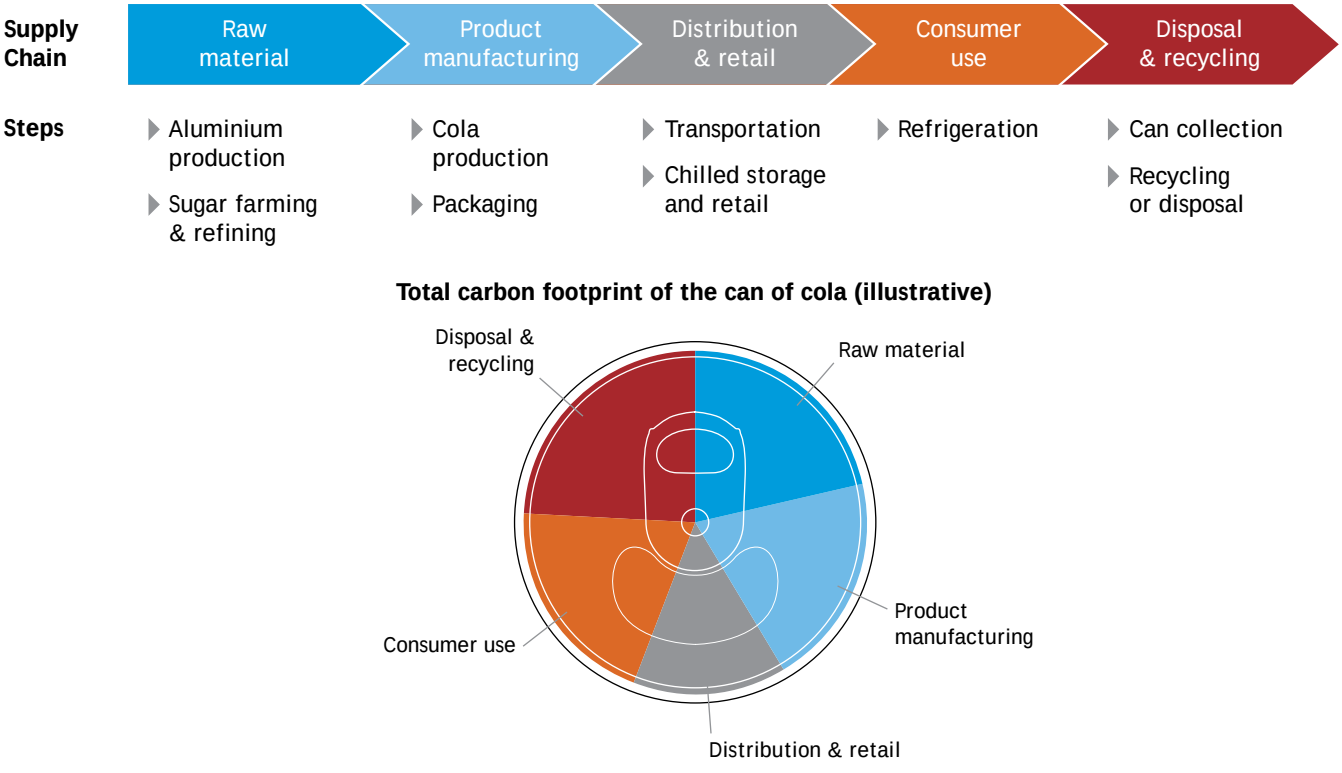
Managing the carbon footprint of products across the supply chain is the next step for business to take in the effort to reduce carbon emissions and mitigate climate change. There are several issues driving business to take action, including:

- Increases in direct energy costs and the energy costs of suppliers
- Existing and planned legislation which penalises high energy consumption and rewards emissions reductions
- Changing consumer attitudes to climate change, presenting forward-thinking companies with an opportunity to develop and market low-carbon products.

As we move to a more carbon-constrained world, business will ultimately have to meet customer needs in a way that generates fewer carbon emissions. Business energy efficiency and low-carbon energy supply have played, and will continue to play, an important role but more fundamental solutions are also needed. Managing the carbon footprint of products across the supply chain is just such a solution.

Managing the carbon footprint of a product means minimising the carbon emissions required to deliver that product to the end consumer. The carbon footprint of a product is the carbon dioxide emitted across the supply chain for a single unit of that product. For example, the carbon footprint of cola is the total net amount of carbon dioxide emitted to produce, use and dispose of a single can of cola. Of course, carbon dioxide is not the only greenhouse gas; it is often important to include the global warming effect of the other greenhouse gases when building the carbon footprint of a product.

Figure 1: *Schematic of the supply chain of a can of cola, and its proportional carbon footprint (illustrative)*



The cola example is illustrated more fully in Figure 1. Thinking about carbon emissions in this joined-up way shows the contribution that each of the steps along the supply chain make to the total carbon footprint of the product. The total carbon emissions are not just those due to the manufacturing processes or those due to 'food miles' but should be based on all the steps in the supply chain to produce, use and dispose of or recycle the can of cola.

This approach, often called carbon life-cycle analysis, helps us to understand the reasons why emissions are generated across the economy. Processes, and their emissions, do not occur in isolation but are always part of the supply chains for different products or services.

At the economy-wide level, it is possible to take every emissions source and allocate it to the supply chain of a different product or service. The end result is to show that all the emissions generated in an economy exist to deliver products and services to meet the needs of the end consumer.

At the individual product level, this supply chain approach has the potential to find significant emissions reduction opportunities and large financial benefits by reducing the carbon footprint of the product. It can help individual companies to understand the carbon emissions across their supply chains and allow them to prioritise areas where further reductions in emissions can be achieved. It can ultimately help all companies make better informed decisions in product manufacturing, purchasing, distribution and product development by considering the costs and liabilities that exist whenever carbon emissions are generated. As consumer attitudes change, it also allows forward-thinking companies to develop low-carbon products to capture new markets and generate higher profits over time. This is the next step in the evolution of efforts to reduce carbon emissions and mitigate climate change.

Key findings from the pilot projects

To demonstrate the value of this approach, the Carbon Trust completed two pilot studies with Walkers and Trinity Mirror.

With Walkers, the study focused on the supply chains of Quavers, Doritos and Walkers Crisps whilst with Trinity Mirror the focus was the Daily Mirror and weekend Celebs on Sunday magazine. Each pilot:

- Built a picture of the carbon footprint of each product by measuring life-cycle emissions across the entire supply chain
- Identified the largest emissions sources both within their own operations and across the activities of other companies operating in the supply chain
- Developed and prioritised opportunities that will reduce emissions, cut costs and create new commercial opportunities.

The two pilot projects have identified savings opportunities worth 28,000 tonnes of CO_2 and £2.7 million per annum, as well as developing an understanding of the carbon implications of different business decisions across each supply chain. This carbon saving is equivalent to the total annual emissions from 5,000 UK households.

The project showed that carbon saving opportunities can be categorised into a series of different types. Among those identified in the pilots are:

- Correcting a market failure: Where there is a perverse incentive between companies in the supply chain and so extra cost and extra carbon emissions are artificially created because of that perverse incentive
- Product change: Where changing the final product mix or product configuration can reduce the emissions across the supply chain
- Supply chain reconfiguration: Where changing specific processes or the way processes are completed can reduce emissions at key stages in the supply chain.

Specific details of each of these opportunities are given in the case studies later in the report.

Many companies are traditionally quite inward-focused about energy consumption and carbon emissions. The pilots show that if they are willing to broaden their horizons to work collaboratively with other companies in their supply chain, then there are additional opportunities to build influence, create knowledge, reduce carbon emissions and generate financial returns.

This approach can be used across a broad range of products and supply chains — forward-thinking companies in all sectors can use this to identify new emissions reduction opportunities. We also believe that supply chain carbon management is a valuable tool that can be of great benefit to the companies we work with. The Carbon Trust is rolling out a supply chain product to develop this opportunity and we encourage all companies to work collaboratively with their own supply chains to reduce emissions and capture the commercial opportunities that arise.

Introduction

Background — building on carbon management

In 2003 the Carbon Trust developed Carbon Management. The aim of Carbon Management was to help companies to understand systematically the business risks and opportunities associated with climate change. We have since worked with over 100 large organisations including 28 of the FTSE 100. This programme of activity has proved very successful both in identifying business opportunities and in delivering significant carbon savings.

Keen to build on the success of this work, we wanted to expand from looking at the carbon management opportunities at the level of an individual company to the level of an end-to-end supply chain i.e. from raw materials to end consumer.

This is mirrored in the approaches of many of the leading companies we work with when they look for opportunities to improve their operations. For companies that recognise the need to reduce energy costs and to play their part in mitigation of climate change, integrated supply chain analysis is the next logical step in their efforts to reduce carbon emissions. The drivers to take this further action are many, including:

- Increases in direct energy costs and the energy costs of suppliers
- Existing and planned legislation which penalises high energy consumption and rewards emissions reductions
- Changing consumer attitudes to climate change, presenting forward-thinking companies with an opportunity to develop and market low-carbon products.

Broadly speaking, there are three stages that a company can focus on to reduce carbon emissions and mitigate climate change. They are illustrated in Figure 2 below.

The stages can be described in a bit more detail as follows:

Stage 1: Direct emissions reduction — this focuses efforts on reducing direct emissions by:

- Implementing all cost effective energy efficiency measures, such as heating and lighting upgrades, using new process technologies and delivering staff training and awareness programmes (see www.carbontrust.co.uk/energy for further details)
- Developing low-carbon energy sources such as on-site generation
- Addressing the more strategic business risks and opportunities associated with climate change (see www.carbontrust.co.uk/carbon for further details). Typically, this can include work on regulatory compliance, value at risk, future cost of carbon, other market risks and opportunities, and shareholder and other stakeholder impacts.

There are a number of benefits in doing this, including cost savings from reducing energy bills, increased operational efficiency, the mitigation of regulatory risks and an improved company reputation as good corporate citizens.

Stage 2: Indirect emissions reduction — this looks at opportunities to reduce indirect emissions by working with organisations across the supply chain. By considering all of the raw materials and processes required to get a product to market, it allows the carbon footprint of the final product to be calculated. This can be used to identify opportunities to make significant additional cuts in emissions and energy

Figure 2: *The three stages of carbon emission reduction*

Stage	Description
Stage 1: Direct Emissions Reduction	Reduces directly controlled emissions through, for example energy efficiency and low-carbon energy supply
Stage 2: Indirect Emissions Reduction	Reduces emissions and costs across the supply chain and helps develop revenue opportunities from low-carbon products
Stage 3 (Optional): Offsetting	If appropriate, offsets emissions using high quality offsets from verified projects that create truly additional emission reductions

costs across the supply chain. As consumer attitudes change, it also allows forward-thinking companies to develop low-carbon products to capture new markets and generate higher profits over time.

Stage 3 (Optional): Offsetting — It may then be appropriate for some companies to develop a voluntary offsetting strategy. Carbon offsetting is where a company buys credits associated with environmental projects that reduce emissions of carbon dioxide or other greenhouse gases around the world, as a way of offsetting their own carbon emissions. For some service-sector or consumer-facing organisations, there may be PR and corporate social responsibility benefits from offsetting some of their emissions. For any offsetting strategy to be successful, it is key that the offsets purchased are of high quality and from verified projects that create truly additional emission reductions.

In stage 1, direct emissions are being addressed by a variety of activities across business, including a suite of products offered by the Carbon Trust. In addition, some companies are already developing their offsetting strategies and buying offsets as part of stage 3. To achieve the UK's carbon reduction targets much deeper cuts in emissions will be needed over time, so there is also a need to focus on the second stage and consider indirect emissions reduction opportunities across the supply chain.

Economy-wide emissions

In January 2006, the Carbon Trust published the report '*The carbon emissions generated in all that we consume*'. The report shows how all industrial emissions can ultimately be tied back to the provision of products and services to meet the needs of the consumer.

The study took carbon emissions at source, categorised by industry sector — e.g. electricity, steel or chemicals production — and reallocated them to the point of consumption — e.g. ready-meals, clothing or sports centres. The total emissions allocated to 10 different consumer needs are illustrated in Figure 3.

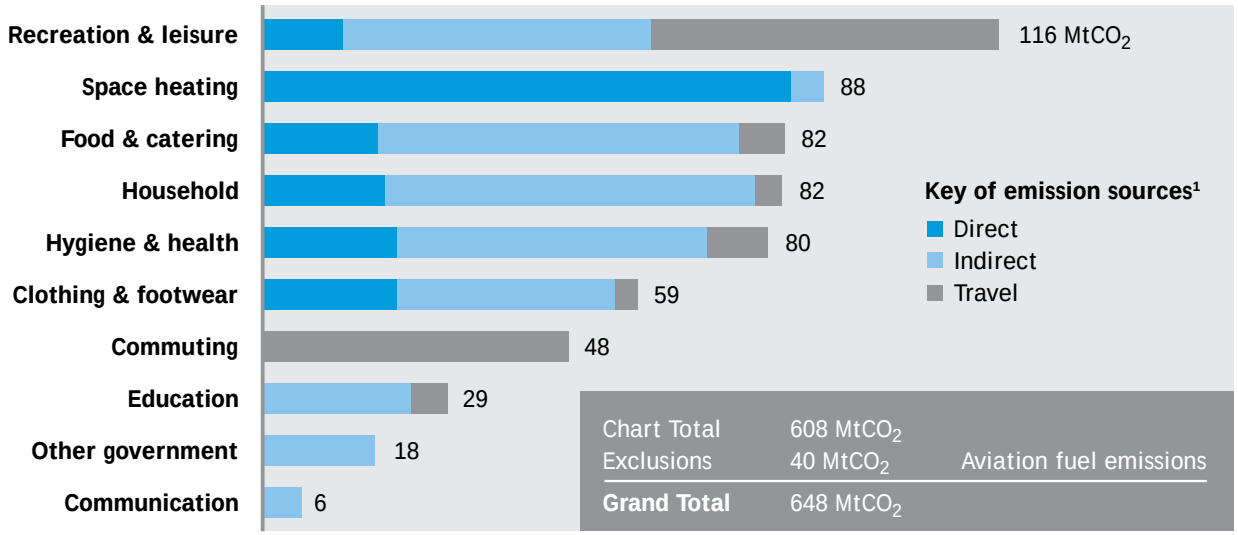
The study highlighted the opportunity for business to use a supply chain approach to understand the underlying drivers of emissions sources from energy use in their operations and across the supply chains in which they play a part. It encouraged business to adopt this new way of thinking to drive positive change from a financial and a carbon perspective. Since the publication of the report, the Carbon Trust has been frequently asked to explain how to complete such an analysis in practice and what value it brings — the new supply chain carbon management approach described here answers both of these questions.

Low-carbon supply chain pilot

To further explain our supply chain approach and to demonstrate the value of low-carbon supply chain analysis and building product carbon footprints, we conducted an industry pilot. The results of the pilot study, completed in early 2006, are presented in two parts:

- A description of the methodology developed to complete a supply chain analysis
- The case study results from our two pilots with Trinity Mirror in newsprint and Walkers in snack foods.

Figure 3: *A split of all emissions by consumer need*



Source: Carbon Trust Report (CTC603), '*The carbon emissions generated in all that we consume*', using the UK Carbon Attribution Model, Centre for Environmental Strategy, University of Surrey, 2006.

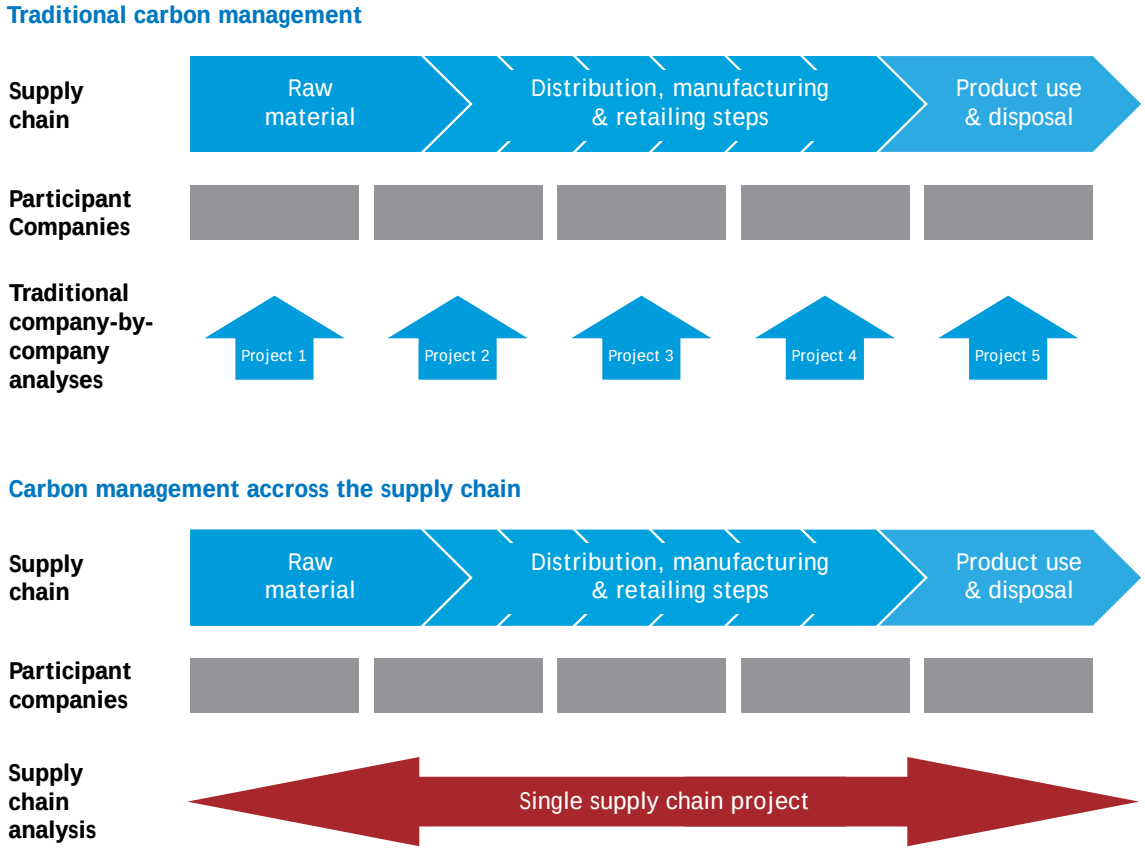
[1] Direct emissions are the emissions associated with the direct consumption of (non-transport related) fossil fuels and electricity in the household. Travel-related emissions include emissions from transport fuels and the indirect emissions from transport goods and services (e.g. buses, coaches and taxis). Indirect emissions include the supply chain emissions from other goods and services, including emissions from space heating or lighting by the service and government sectors.

Method: Carbon management across the supply chain

The overall approach

Traditional energy efficiency and carbon management initiatives analyse the operations of single companies or even single sites. The supply chain approach extends this analysis to cover specific processes from multiple sites and multiple companies operating in a single supply chain. This allows the full carbon footprint for each product to be created. A comparison of the traditional carbon management approach and the supply chain approach is shown in Figure 4.

Figure 4: *Schematic comparison of traditional carbon management and carbon management across supply chain*



The supply chain approach differs in many aspects from the traditional 'single company' carbon management approach as follows:

Traditional carbon management	Carbon management across the supply chain
Single participant involved	Multiple participants, starting with a 'lead client', typically a large company operating at the consumer-end of the supply chain
Analysis covering single supply chain stage for multiple products	Analysis covering complete supply chain for a single product
Companies engaged individually	Companies engaged collaboratively up and down the supply chain
Carbon savings typically come from efficiencies within each company's operations	Carbon savings come from both internal efficiencies and from external process change and reorganisation

The detailed methodology

The methodology developed draws heavily on standard life-cycle analysis techniques (LCA). The United Nations Environment Programme (UNEP) describes LCA as "…the process of evaluating the effects that a product has on the environment over the entire period of its life cycle… extraction and processing; manufacture; transport and distribution; use, re-use and maintenance; recycling and final disposal."[2].

UNEP also highlights the key aspects of LCA, namely:

- Identifying and quantifying the environmental loads involved — the energy and raw materials used, and the emissions and wastes consequently released
- Assessing and evaluating the potential environmental impacts of these loads
- Assessing the opportunities available to bring about environmental improvements.

These key aspects and other aspects of LCA best practice have been built into the Carbon Trust supply chain methodology. The methodology can be summarised in four chronological steps as follows:

Step 1	Initial analysis & engagement
Step 2	Construction of the carbon footprint
Step 3	Opportunity identification & prioritisation
Step 4	Presentation of results & implementation planning

[2] 'Life Cycle Assessment: What it is and how to do it'; United Nations Environment Programme; www.unep.org; 1996.

The key tasks in each step are as follows:

Initial analysis and engagement

- Engage the lead client
- Agree specific product supply chain(s) and the scope and boundaries of study
- Build supply chain process map and identify major raw materials.

Construction of the carbon footprint

- Identify key supply chain companies and contacts: make introductions
- Collect energy and emissions data, focusing on energy-intensive stages across the supply chain
- Construct a mass balance for the supply chain, ensuring 'what goes in must come out' for raw materials, waste, energy and emissions
- Construct carbon footprints, showing emissions by process/supply chain stage.

Opportunity identification and prioritisation

- Highlight high emission sources and look for emissions reduction opportunities
- Evaluate net impact of opportunities on carbon and cost
- Plot opportunities on cost-carbon matrix to prioritise those with high carbon and high cost-saving potential.

Presentation of results and implementation planning

- Identify next steps to implement change within target supply chain
- Present carbon footprints and reduction opportunities assessment to supply chain participants, trade bodies and other stakeholders
- Support ongoing implementation steps.

Geography

One of the key benefits of the supply chain approach is that it allows a product-based view of business emissions. To build a complete picture of the supply chain for a product consumed in the UK, it is often necessary to include emissions generated overseas. Indeed, the majority of products consumed in the UK have some part of their supply chain overseas. For the purposes of the pilots with Walkers and Trinity Mirror, all relevant emissions sources have been included whether the carbon is emitted in the UK or abroad.

Influencing business processes and carbon emissions overseas can be more difficult than if they occurred in the UK. Because the business customer in the UK is buying a product or service from the overseas supplier, however, strong business links and shared interests will help to facilitate change, particularly given the fact that climate change is a shared global problem.

Results of the pilot

Detailed results of the two studies in snack foods with Walkers and in newspapers with Trinity Mirror are described in the following sections. Some generic benefits and challenges can be highlighted as well as some standard outputs:

Benefits

- The methodology allows the inclusion of emissions from product use, re-use, recycling and disposal alongside emissions from production and distribution in an integrated way. It identifies carbon savings beyond the scope of those identified by other analysis techniques
- Because the scope is wider than in traditional analyses, the emissions reduction opportunities identified tend to be larger
- The methodology helps explain the existence of particular processes and emissions sources and raises awareness of potential trade-offs, for example between more efficient centralised manufacturing and the additional distribution miles that result
- It raises awareness across the supply chain of all the carbon emissions sources and engages new companies in the task of reducing those emissions and associated costs. As consumer attitudes change over time, it also allows forward-thinking companies to develop low-carbon products to capture new markets and generate higher profits.

Challenges

- Data confidentiality is a key consideration for all companies. Costs and other commercial information were not needed to complete the analysis so confidentiality could be maintained. In addition, any process-specific energy or emissions data were aggregated in the final results
- The results are not necessarily applicable to the industry as a whole. The studies analyse specific product supply chains with specific companies and processes involved. Because the analyses are specific, it is not possible to make sector-wide recommendations from the results
- The opportunities are typically more fundamental than simple energy efficiency changes and so are likely to be harder to implement.

Standard outputs

The data gathered for each supply chain stage can be aggregated to build the carbon footprint of the product. This shows how the emissions at each life-cycle stage contribute to the final carbon footprint. The example in Figure 5 below, shows that the total carbon footprint of product Y is 1.2 kg CO_2 per unit of product Y sold. It also shows that the raw material production, manufacturing and disposal stages contribute most to the carbon footprint while transport and consumption are less important.

Comparisons across different products can also be made, as illustrated in Figure 6 below. Here, the total carbon footprint of product Y is compared against products X and Z. This can be useful when analysing two competing products which meet the same consumer need but have different raw materials and different production processes, for example in comparing crisps with other potato-based snacks and with corn-based tortilla chips.

Figure 5: Carbon footprint showing emissions from each supply chain stage

kg CO_2 per final product sold

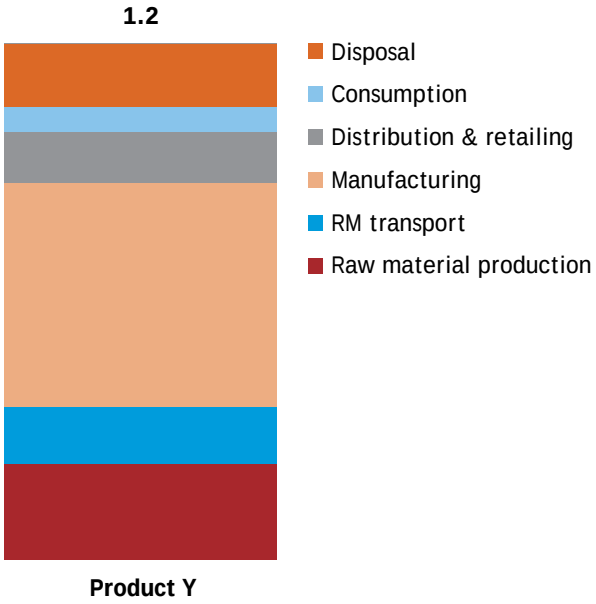
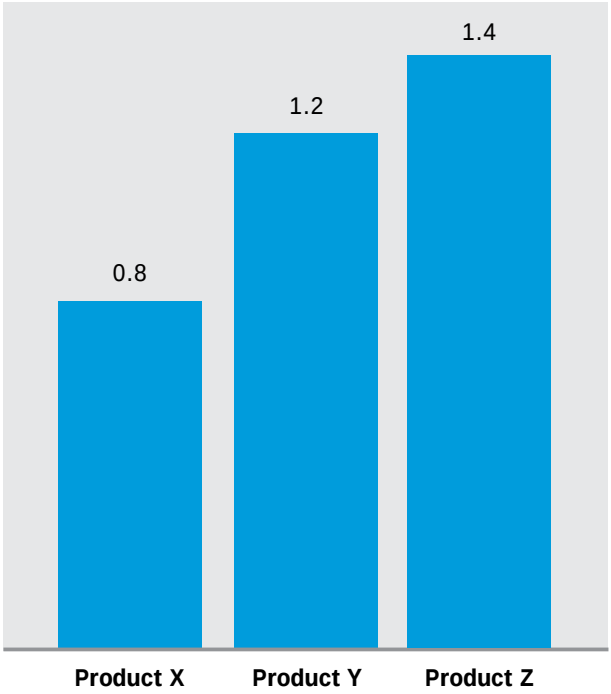


Figure 6: Comparison of carbon footprints for different products

kg CO_2 per final product sold



Case study 1: Walkers

Introduction

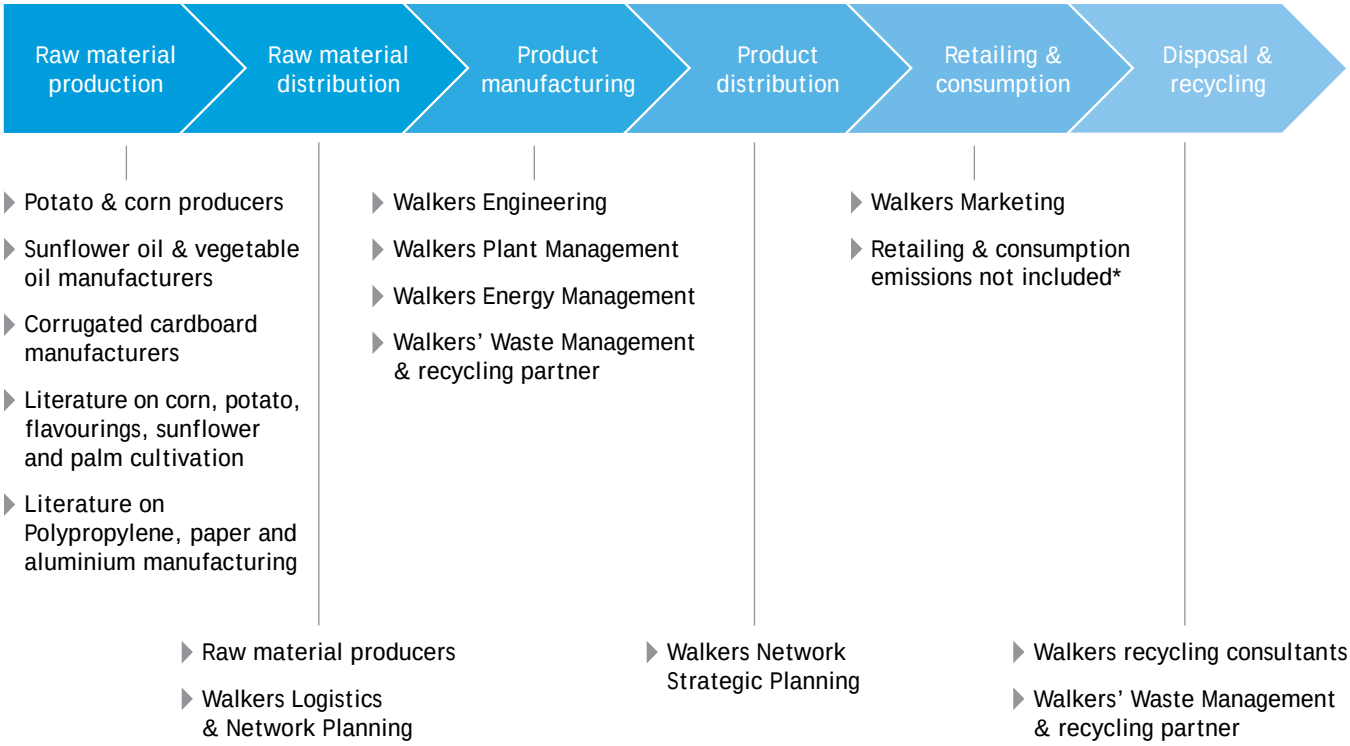
Walkers is the UK's largest snack foods manufacturer with brands such as Walkers, Wotsits, Quavers, Doritos and Walkers Sensations. Walkers estimates that 11 million people eat one of their products every day. The company employs over 4,000 people in 15 locations across the UK.

Walkers, and its parent company PepsiCo, have been working with the Carbon Trust on energy efficiency and Carbon Management for more than two years, identifying opportunities to save more than 2,000 tonnes of CO_2 per annum and reduce their energy bills by approximately £225,000. This supply chain study represented an opportunity for Walkers to demonstrate its continuing commitment to emissions reduction, whilst looking for new ways to boost profitability through energy savings. PepsiCo are now using the methodology to analyse supply chain emissions from the other products in their portfolio.

Products analysed

The project analysed three competing products in the Walkers range: Crisps, Quavers and Doritos. The products satisfy very similar consumer needs yet the raw materials, manufacturing processes and carbon emissions are very different for each of the three. This type of comparison helps to create benchmarks for best practice for different steps in the supply chain and for the carbon footprints of the products overall.

Figure 7: *Companies engaged in the data collection process*



*Snack foods are not refrigerated or heated in store or in the home and so retail and consumption emissions were not included.

Processes analysed and companies engaged

For each of the three products, the full product life-cycle was analysed, considering emissions from fuel use in raw material production and distribution through manufacturing and product distribution to disposal and recycling.

Suppliers and other supply chain partners were engaged to provide energy data. There was good willingness to participate in the study from all parties; they were keen to learn more about the carbon emissions from their operations and the overall emissions from the whole supply chains. A summary of the different parties engaged and the data gathered is shown on the previous page in Figure 7.

In addition, the Waste Resources Action Programme (WRAP) contributed to the insight gained around waste management and recycling opportunities, and the Energy Saving Trust (EST) contributed on energy savings potential of improved fleet management practices.

The data gathered was used to build a mass balance map of the flows of materials and energy through the supply chain and to build a footprint of the life-cycle emissions for each product, like those shown in Figures 5 and 6 previously. These results were then used to identify opportunities to reduce emissions by changing process flows and by changing the way the supply chain is structured.

Key insights

The study yielded new insight about the overall emissions from the whole supply chain and about individual steps and processes. The high-level results can be summarised as follows:

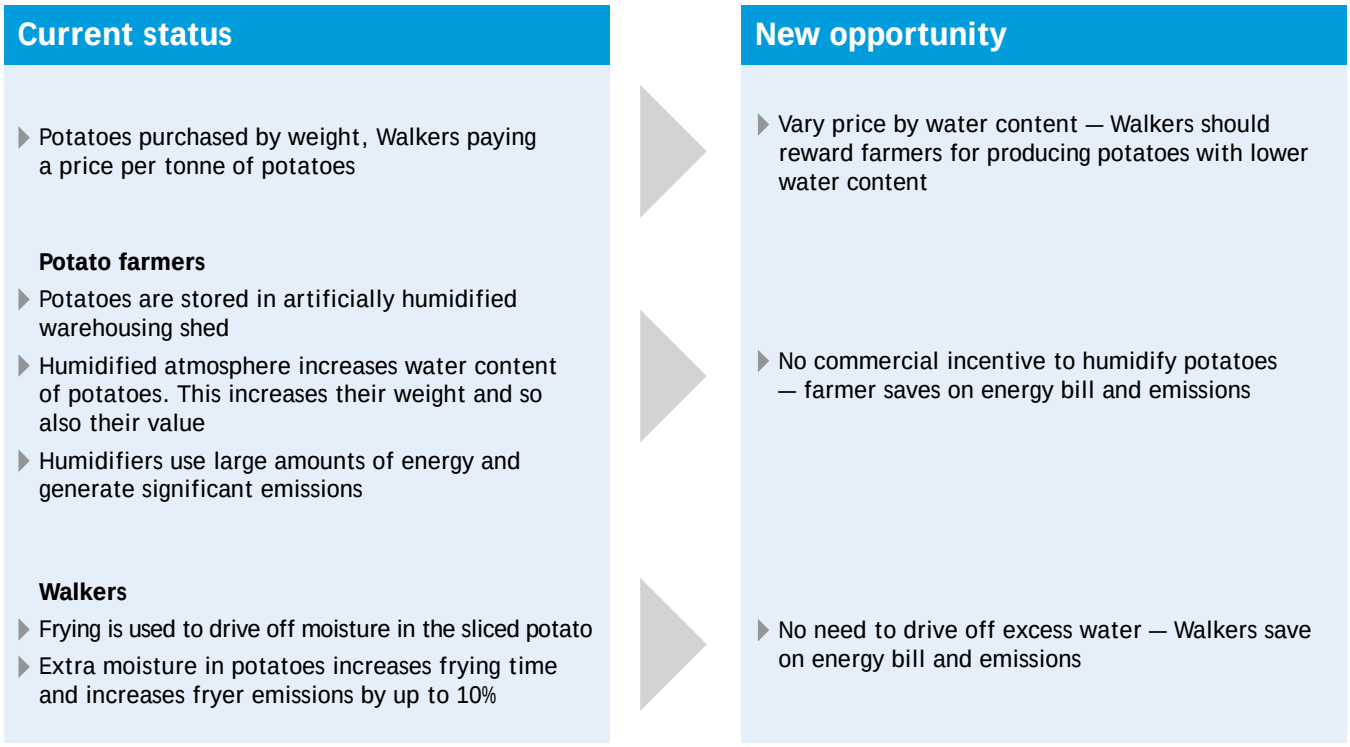
- Carbon emissions are primarily driven by raw materials and manufacturing; differences in emissions between products reflect different raw material choices, packaging and the frying/baking processes in manufacturing
- Whilst energy consumption is a major factor, energy source is equally important; frying processes using natural gas emit less carbon than those using grid electricity, because of the different levels of emissions from the fuels involved
- The moisture content driven off by heat in frying/baking is an important driver of carbon emissions in Walkers manufacturing
- Packaging makes up approximately a third of the total supply chain emissions
- Overall, the study identified opportunities to achieve savings of 18,000 tonnes of CO_2 per annum, equivalent to 8% of the total emissions across the supply chain.

Example: Correcting a market failure — water content of potatoes

A key opportunity relates to the water content of the potatoes that Walkers purchases. The overall supply chain can save up to 9,200 tonnes CO_2 and £1.2 million per annum by changing the way that potatoes are traded; Walkers can reduce the emissions from the potato frying stage by up to 10%.

In this example, commercial incentives had become misaligned resulting in a situation where both the potato farmers and Walkers are using more energy than they need to. By changing the way potatoes are purchased, savings can be made by both parties. The opportunity is summarised in Figure 8.

Figure 8: *Opportunity to reduce water content of potatoes*



Case study 2: Trinity Mirror

Introduction

Trinity Mirror is the UK's largest newspaper publisher with some 240 local and regional newspapers, five national newspapers and four sports titles, as well as over 100 websites and a variety of magazines, directories and exhibitions. Over the course of a week 20 million people read at least one Trinity Mirror newspaper. With its headquarters at Canary Wharf in London, the Group employs approximately 11,000 people across the UK.

Trinity Mirror has a strong history of energy management within its operations. The company also recognises that a significant portion of the carbon emissions across the supply chain comes from the processes to manufacture the paper that they use. This project allowed Trinity Mirror to develop an understanding of the emissions across the supply chain and take the lead in developing carbon best practice in the newspaper publishing supply chain.

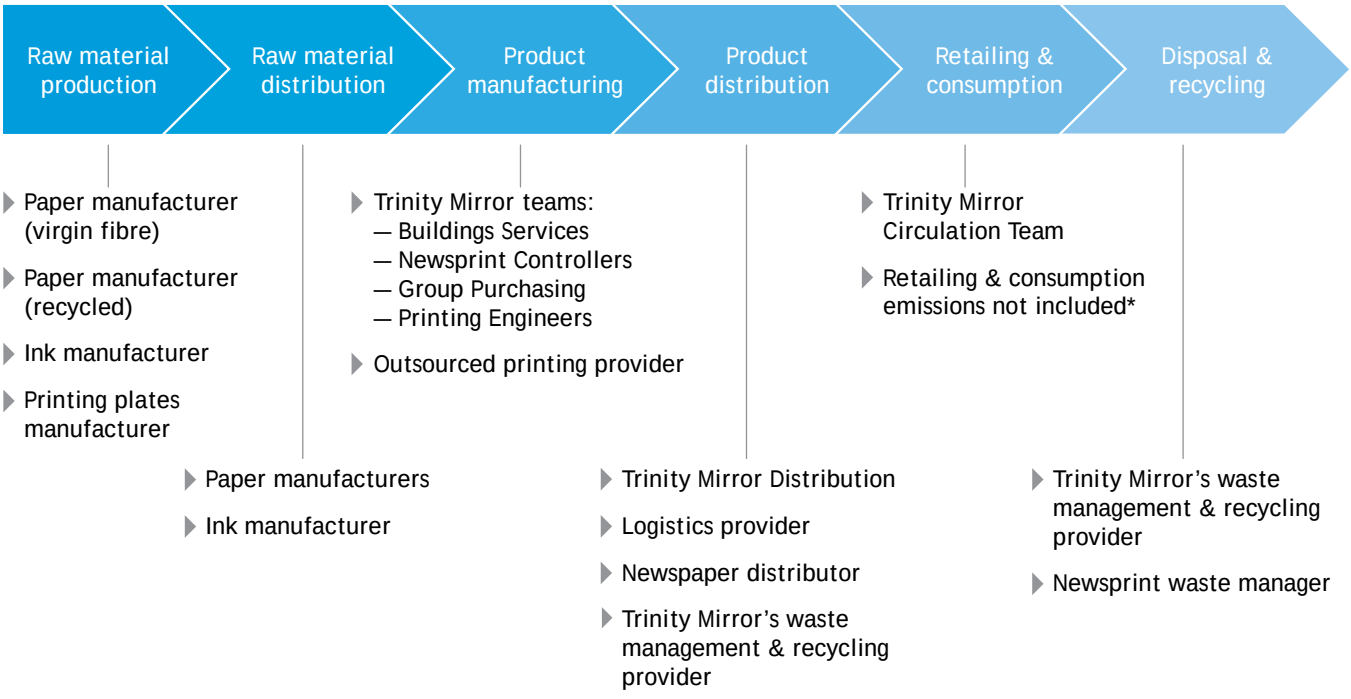
Products analysed

The study analysed two complementary products in the Trinity Mirror range: the Daily Mirror and the glossy Celebs on Sunday magazine. The products use paper of different quality, with different recycled content and are printed using different printing processes in different places.

Processes analysed and companies engaged

The methodology was again used to complete a full life-cycle analysis for both products, considering emissions from energy use in raw material production, through manufacturing and product distribution to use and disposal. The newspaper supply chain is relatively complex because a significant portion of the post-consumer waste is collected for recycling. Some of that paper ends up back as raw newsprint at the start of the supply chain.

Figure 9: *Companies engaged in the data collection process*



*Newspapers are not refrigerated or heated in store or in the home and so retail and consumption emissions were not included.

Suppliers and other supply chain partners were engaged to provide energy data. Data was gathered from paper manufacturers in Sweden and the UK, printers in the UK and continental Europe and other supply chain participants in the UK. A summary of the different parties engaged and the data gathered is shown in Figure 9.

In addition, the Waste Resources Action Programme (WRAP) contributed to the insight gained around recycling processes and future recycling opportunities.

As with Walkers, the data gathered was used to build a mass balance map of the flows of materials and energy through the supply chain and to build a footprint of the life-cycle emissions for each product. Because the product has high retail throughput and does not require heating or refrigeration, the analysis assumed that retailing and consumer use emissions would be negligible. The analysis was then used to identify opportunities to reduce emissions by changing process flows and changing the way the supply chain is structured.

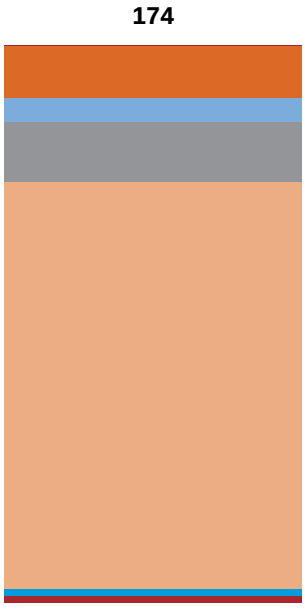
Key insights

The study measured overall emissions from the whole supply chain and from individual steps and processes. The high-level results can be summarised as follows:

- The supply chain of the Daily Mirror newspaper, made with 100% UK-recycled newsprint, emits 174g CO_2 per final newspaper sold. The average Daily Mirror weighs 182g and has a carbon footprint of 0.95kg CO_2 per kg sold
- Emissions from Trinity Mirror's operations make up less than one fifth of the total carbon footprint of the Daily Mirror. 80% of the carbon footprint is added by processes and raw materials used by other companies in the supply chain. This shows the value to be gained from a collaborative supply chain approach
- Paper manufacturing is the most energy intensive process in the supply chain accounting for more than 70% of the total energy use. This is illustrated for the Daily Mirror newspaper in Figure 10
- Manufacturing paper for use in glossy magazines is more energy intensive than for newsprint, because of the lower recycled fibre content and the requirement for a higher quality finish. Glossy colour printing is also more energy intensive than newspaper printing, reflecting ink and printing technology used
- Increasing the percentage of recovered fibre in paper manufacturing reduces energy usage, as shown later in Figure 12; however,
- Energy source, rather than energy use, in paper manufacturing is the main driver of carbon emissions. Using a lower emission energy source has a greater impact on carbon emissions than increasing the recycled fibre content. This is illustrated in Figures 13 and 14.

Figure 10: *Carbon footprint of the Daily Mirror*

g CO_2 per final newspaper sold



- Disposal (transport of waste, returns & collections)
- Newspaper distribution (transport & warehousing)
- Printing
- Paper manufacture
- Transport (raw materials to mill, paper to printer)
- Ink production

Note: The chart only includes supply chain steps where energy consumption is a significant portion of the total. Retailing and consumer use emissions are insignificant. The analysis assumes burning of biomass in paper manufacture is carbon neutral. Emissions from landfill of newsprint are not included.

Sources: Carbon Trust desk research; Supplier Interviews; Carbon Trust analysis. Any data provided by direct suppliers of Trinity Mirror have been aggregated.

Carbon saving opportunities

The study highlighted a variety of different carbon saving opportunities, across the supply chain. Two examples are described here:

Example 1: Product change — misalignment between emissions reduction and commercial incentives

Two areas for emissions reduction focus on altering the Trinity Mirror product mix by:

- Reducing the number of pages in each edition
- Reducing the volume of glossy magazine pages in favour of standard newsprint pages.

Both changes would reduce the carbon emissions and the energy costs for Trinity Mirror. There are wider impacts, however, which means they are unlikely to be implemented. These are summarised in Figure 11 below.

In both these cases, the cost savings from reduced energy consumption across the supply chain are offset by the loss in revenue from advertising or sales.

Given these financial constraints it is difficult to make the case that Trinity Mirror should take action on its own. Success may be achieved if all the major newspaper publishers worked in collaboration but such a shift would only occur as a result of significant changes in consumer demand.

Figure 11: *Description of opportunities for product change*

Opportunity	Carbon emissions and energy costs		Product revenues		Overall profits	
Reduce the number of pages in each edition	Reduces the emissions from each stage in the supply chain by reducing the volume of paper	✓	Reduces the space for advertising so reduces advertising revenue	✗	Loss of profits: Energy cost savings less than loss in advertising revenue	✗
Reduce the volume of glossy magazine pages in favour of standard newsprint pages	Newsprint paper manufacturing and printing both use less energy than glossy magazine paper	✓	May harm sales and advertising revenues from glossy pages	✗	Loss of profits: Energy costs savings less than loss in sales and advertising revenue	✗

Example 2: Supply chain reconfiguration — energy source and UK competitiveness

The largest opportunities for Trinity Mirror to reduce the carbon footprint of the Daily Mirror are to:

A: Buy paper from a supplier using minimum energy in its production; where

B: The energy comes from a low-emission source.

These two opportunities are explained separately and then their interrelation discussed.

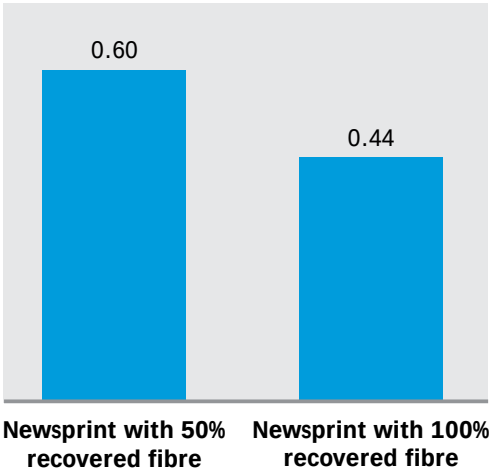
A: Buy paper from a supplier using minimum energy

Because the energy cost to manufacture paper is large, all the major paper manufacturers already give great emphasis to energy efficiency. It is difficult for Trinity Mirror to differentiate between suppliers on this basis.

The other significant driver of energy use in paper manufacturing is the recycled paper content, as illustrated in Figure 12. Increasing the recycled content significantly reduces the energy consumed in paper manufacturing. On this basis, Trinity Mirror should look to source all its paper from suppliers producing high recycled fibre paper. The Government Waste Strategy, 2000, sets out the agreement between the UK Government and the Newspaper Publishers Association to increase newspaper recycled fibre content. The financial incentive for paper manufacturers to minimise energy consumption aligns well with the government target to increase recycled fibre content.

In addition, carbon emissions from fuel use and electricity are not the only sources of greenhouse gas emissions. Many UK newspapers end up in landfill. When landfilled newspaper decays over time, it emits methane gas. Much of this methane gas can be captured and used as fuel but some cannot be captured and so escapes to the atmosphere. Methane has a global warming potential of 21; this means that emitting 1 tonne of methane causes the same level of global warming as emitting 21 tonnes of carbon dioxide[3]. Reducing methane emissions by reducing the volume of landfilled paper is another good reason to increase the recycle rate of newspapers. The total escaped methane emissions from landfill are estimated to be approximately equivalent to 30g CO_2 from every Daily Mirror sold[4]. We have already shown that carbon emissions from energy use are 174g CO_2 per Daily Mirror. Methane generation in landfill is clearly an important additional emissions source in the supply chain.

Figure 12: *Effect of recycled fibre content on paper manufacturing energy consumption*



- The chart shows energy used in paper manufacturing, so excludes energy used in distribution, disposal and other steps
- Energy usage in paper manufacture driven by pulping (virgin fibre) versus de-inking (recovered fibre)
- Energy use in pulping is much greater than energy use in de-inking.

Note: 50% recycled paper manufacture energy use is split across electricity, natural gas, coal, oil and biomass.

100% recycled paper manufacture energy use is split across electricity, natural gas and biomass.

Sources: Carbon Trust desk research; Supplier interviews & interviews with WRAP; Carbon Trust analysis. Any data provided by direct suppliers of Trinity Mirror have been aggregated.

[3] Source: 100-year global warming potentials, Intergovernmental Panel on Climate Change, 1995.

[4] Sources: Impact of Energy from Waste and Recycling Policy on UK Greenhouse Gas Emissions, a report for Defra; Environmental Resource Management Limited; January 2006; Mass Balance of UK Newspapers, University of Paisley & Biffaward, 2005; Carbon Trust analysis.

B: Paper manufacturing using low-emission energy

The most significant driver of emissions is the source of the energy used in paper manufacturing. Paper manufacturing plants typically use a mix of energy sources including grid electricity (from the country in which the manufacturing plant is located), gas and CHP (combined heat and power), coal and oil, and biomass (combustion of wood fuel and paper sludge). Each of these sources of energy emit different amounts of CO_2 as illustrated in Figure 13.

There is significant variance in the electricity grid emissions in different countries, driven by the different generating technologies used. In Sweden, the electricity grid is powered predominantly by hydro-electric and nuclear whereas the UK grid is powered predominantly by coal and gas. There is also a significant variance in emissions from local generation using different energy sources as illustrated below.

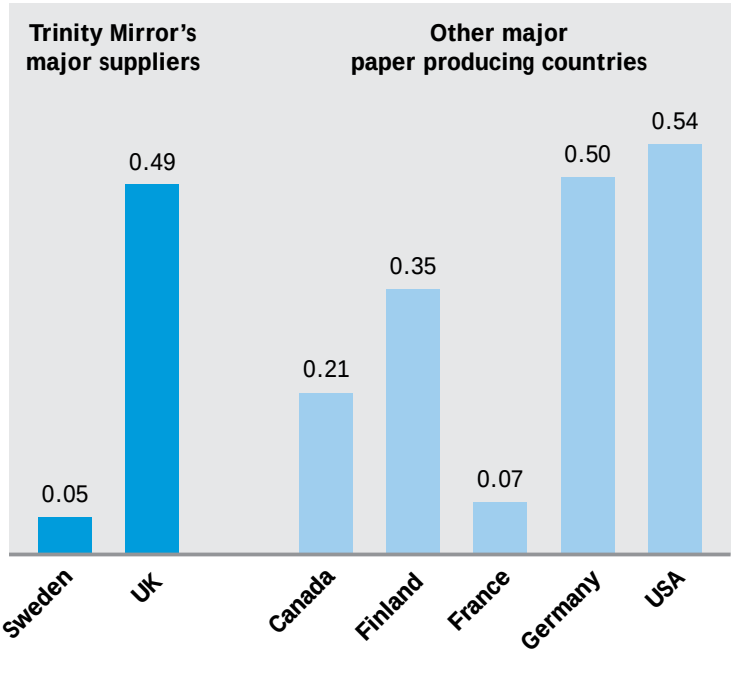
Relationship between reduction in energy use and energy source

It seems clear that to minimise emissions, Trinity Mirror should buy paper with high recycled content from a supplier using low-carbon energy sources. In reality, however, the relationship between recycled fibre content and emissions source is not well aligned, as described below.

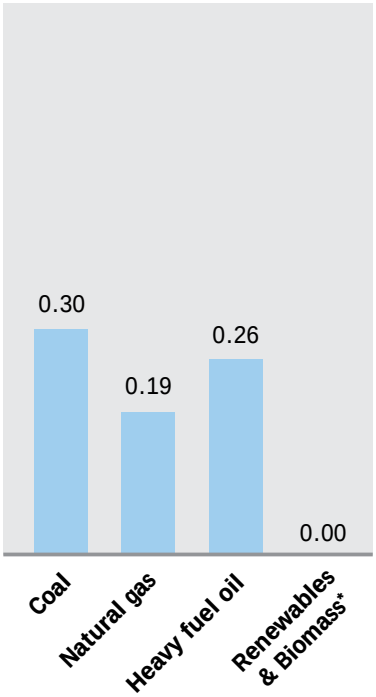
Typically, Trinity Mirror purchases 100% recycled paper from manufacturers in the UK. Because the paper is recycled and the manufacturing plants are well run and efficient, energy use is minimised. In this case, the manufacturers typically use a mix of UK grid electricity and CHP plant burning both natural gas and biomass.

Figure 13: *Comparison of carbon emissions for different energy sources used in paper manufacturing*

Direct emissions from grid electricity
kg CO_2 per delivered kWh



Direct emissions from local generation
kg CO_2 per kWh heat generated



*Renewables includes Wind, Solar, Hydro.

Note: Grid electricity figures are net of plant losses and transmission and distribution losses across the grid. Local fuel use figures are expressed in kWh heat produced and so do not factor in any subsequent conversion loss (i.e. heat to electricity in a CHP plant).

The figure for UK grid electricity differs from the 0.43 kg CO2 per delivered kWh often quoted. The figure quoted here uses different data sources and covers a more recent time-period.

Sources: IEA Energy Statistics and Energy Balances, 2003, Dukes Digest of United Kingdom Energy Statistics 2005, DTI, Energy & Carbon Conversions, Action Energy, 2004.

Paper with lower recycled fibre content is typically forested and manufactured in Scandinavia and shipped to the UK. Because the paper has lower recycled content, the energy consumption in manufacturing is higher (as already illustrated in Figure 12). In the example analysed in the study, the manufacturer of 50% recycled fibre paper in Sweden uses Swedish grid electricity with some natural gas, coal, oil, wood fuel and biomass.

The 'energy-use' and 'energy-source' effects combine to give the overall emissions across the supply chain. A comparison of these two examples is shown in Figure 14.

The Swedish example includes emissions from forestry and higher emissions from transport of the timber and paper. This is more than offset by the lower emissions from paper manufacturing. The key difference in paper manufacturing is due to the use of Swedish (lower-carbon) grid electricity versus UK (higher-carbon) grid electricity.

This does not, of course, mean that all newsprint manufacturing should be switched to Sweden. Industry capacity, regulation and cost are some of the many other important considerations. It does, however, stress the importance of using lower-emission energy sources in paper manufacturing.

In the future, if business has to pick up more of the cost of carbon or if carbon emissions become a factor in the purchasing decisions of newspaper publishers, then UK paper manufacturers may find themselves at a strategic disadvantage versus their Swedish competitors. There is a clear opportunity for UK paper manufacturers to mitigate this risk by reducing the carbon footprint of their energy sources, in particular by developing opportunities to further switch away from UK grid electricity to CHP burning gas, to CHP burning biomass and to other alternative energy sources.

In addition, this analysis illustrates the importance of reducing the carbon footprint of the UK electricity grid and the positive effect that this could have on future competitiveness of UK industry.

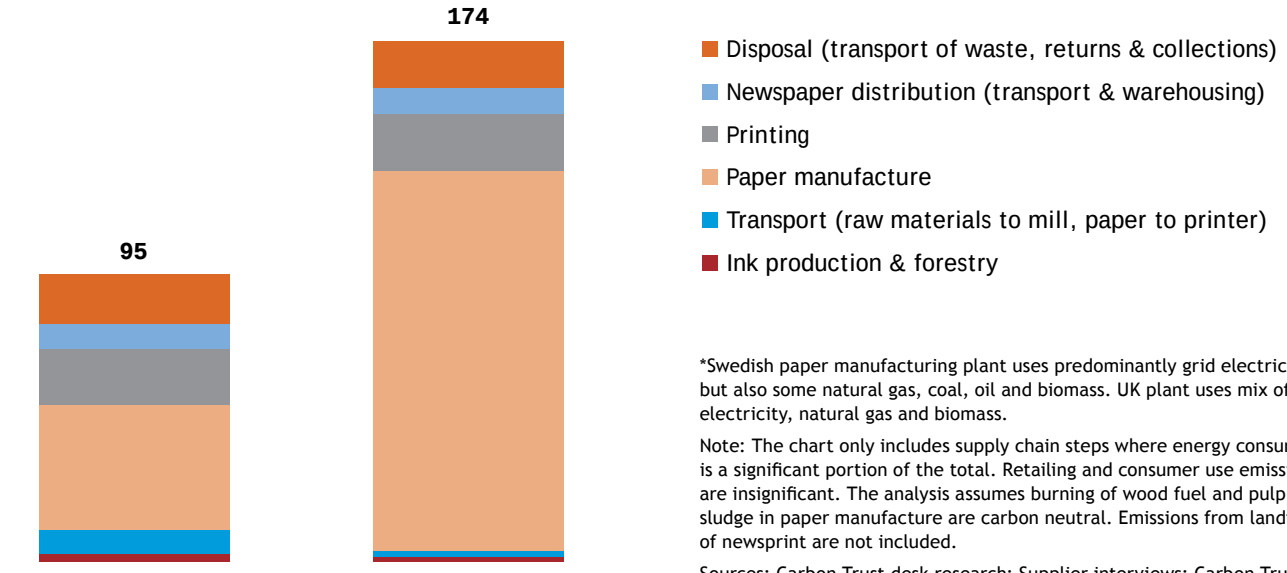
Applicability of the analysis

It should be noted that this study is specific to the Trinity Mirror supply chain. As such, the results are not necessarily true for the whole newspaper publishing industry, when other macro effects may become important.

For example, a proportion of all the newspaper sold still ends up in landfill and paper fibres cannot be recycled indefinitely as they break over time. This means that there is insufficient supply of 100% recycled paper in the system to meet the existing demand. It is therefore a requirement to introduce some new virgin fibre into the system.

Figure 14: *Comparison of carbon footprint for different newspaper suppliers*

g CO_2 per final newspaper sold



*Swedish paper manufacturing plant uses predominantly grid electricity but also some natural gas, coal, oil and biomass. UK plant uses mix of grid electricity, natural gas and biomass.

Note: The chart only includes supply chain steps where energy consumption is a significant portion of the total. Retailing and consumer use emissions are insignificant. The analysis assumes burning of wood fuel and pulp sludge in paper manufacture are carbon neutral. Emissions from landfill of newsprint are not included.

Sources: Carbon Trust desk research; Supplier interviews; Carbon Trust analysis. Any data provided by direct suppliers of Trinity Mirror have been aggregated.

Conclusion

Managing the carbon footprint of products across the supply chain is the next step for business to take in the effort to reduce carbon emissions and mitigate climate change. As we move to a more carbon-constrained world, business will have to meet customer needs in a way that generates fewer carbon emissions. Business energy efficiency has played, and will continue to play, an important role but more fundamental solutions are also needed. Managing carbon footprints of products across the supply chain is just such a solution.

There are several different issues which are driving companies to take further action on climate change, including:

- Increases in direct energy costs and the energy costs of suppliers
- Existing and planned legislation which penalises high energy consumption and rewards emissions reductions
- Changing consumer attitudes to climate change, presenting forward-thinking companies with an opportunity to develop and market low-carbon products.

The Carbon Trust believes that an organisation truly committed to addressing these should:

- Firstly, focus on its direct emissions by implementing all cost effective energy efficiency measures and reducing the carbon intensity of its energy supply
- Secondly, look at opportunities to reduce its indirect emissions. This can be done by working with other companies to develop strategies to reduce emissions and cut costs up and down the supply chain. With changing consumer attitudes to climate change, it also presents forward-thinking companies with an opportunity to develop and market new low-carbon products
- If appropriate, consider the option of developing an offset strategy that purchases high quality offsets from verified projects that create truly additional emission reductions.

This report has shown that working collaboratively across the supply chain has the potential to realise very large carbon savings and also develop new profit opportunities by changing the way that products are delivered to the consumer. Through the case studies in snack foods with Walkers and in newspapers with Trinity Mirror, we have shown how to:

- Build a picture of the carbon footprint of a product by measuring emissions across the supply chain
- Identify the largest emissions sources across the supply chain
- Develop and prioritise emissions reduction opportunities with positive financial impacts.

Some of the savings opportunities fly in the face of conventional wisdom yet between them, the two pilot projects have identified opportunities worth 28,000 tonnes of CO_2 and £2.7 million per annum across the supply chain, as well as generating new insight into the carbon implications of different business decisions. Both companies are now building on this work to develop their strategies further.

Many companies are traditionally quite inward-focused about energy consumption and carbon emissions. The pilots show that if they are willing to broaden their horizons to work collaboratively with other companies in their supply chain, then there are additional opportunities to build influence, create knowledge, reduce carbon emissions and generate financial returns. Above all, this is a practical process which can be used to deliver measurable results.

What next?

This supply chain approach has the potential to unlock significant emissions reductions and large financial benefits by reducing the carbon footprint at an individual product level. It can help individual companies to understand the carbon emissions across the supply chains in which they operate and allow them to prioritise areas where further reductions in emissions can be achieved. It can ultimately help all of business make better informed decisions in product manufacturing, purchasing, distribution and product development by considering the costs and liabilities that exist whenever carbon emissions are generated. This is the next step in the evolution of efforts to reduce carbon emissions and mitigate climate change.

After the success of the two pilot projects, the Carbon Trust is rolling out its supply chain carbon management product. We will be running a series of supply chain projects with different companies and in different industries, looking for new learning opportunities and new carbon savings opportunities. Companies interested in working with the Carbon Trust on any of our products should contact a Carbon Trust Account Manager on 0800 085 2005 or via our website at www.carbontrust.co.uk.

This supply chain approach can be used across a broad range of products and supply chains — forward-thinking companies in any sector can use this to identify new emissions reduction initiatives. We would encourage all companies to adopt this approach and work with their own supply chains. It has the potential to realise significant carbon savings and develop new profit opportunities as we create a low-carbon economy.

www.carbontrust.co.uk
0800 085 2005

CARBON TRUST

Making business sense of climate change

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

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 the Department for Environment, Food and Rural Affairs, the Department of Trade and Industry, the Scottish Executive, the Welsh Assembly Government and Invest Northern Ireland.

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