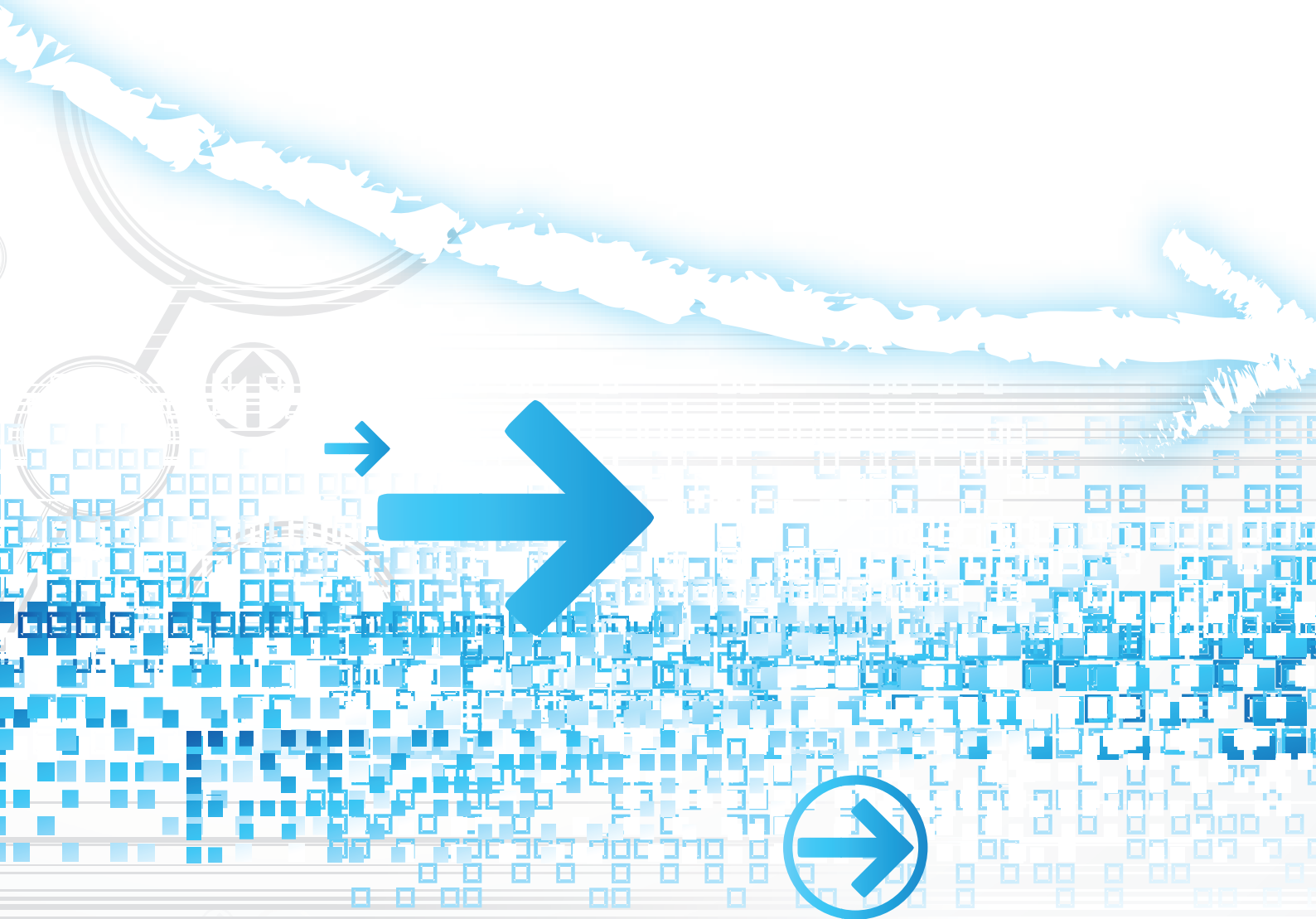


Making the change

The transition to low carbon supply chains.



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FOREWORD

The answer to a sustainable future is multi-faceted: it involves environmental protection, being more green in our approach to energy use and conservation, recycling and re-use and at the same time maintaining our standard of living, or helping those who aspire to the standard we enjoy to achieve it without compromising the planet. At the same time it would be dangerous to listen to those who would have us believe that it is too expensive to take action. The answer does not lie exclusively with new technology – there is much that we can achieve by better control of the technology we have now. As a responsible business community we should set that as our target rather than waiting for others to act for us.

Nigel Davies

Technical Director, Muntons PLC

EXECUTIVE SUMMARY

This report, produced by the Centre for Low Carbon Futures' Low Carbon Supply Chain Project, raises key points in relation to the transition to low carbon supply chains in Yorkshire and the Humber. These key points are identified to facilitate an understanding of the transition towards low carbon supply chains from a business perspective. It must be noted that there are a number of interdependencies present between and amongst the drivers and barriers reported here. These interdependencies are involved within business decisions that are both driving and impeding low carbon activities in the region. The key points also highlight and advocate the application of certain technologies and interventions that are being employed by businesses in the region to good effect, whose promotion via funding and awareness campaigns could stimulate further CO₂ reductions in the supply chains that inhabit and dissect the Yorkshire and the Humber region.

KEY POINTS IN SUMMARY: THE DRIVERS OF LOW CARBON SUPPLY CHAINS

FINANCIAL SAVINGS: THE IMPACT OF LOW CARBON INITIATIVES ON BOTTOM LINE PROFITS

- Companies wishing to promote low carbon working practices throughout their supply chains need to demonstrate the economic benefits to the firms involved.
- Payback calculations represent strong levers for capital expenditure to those responsible for business decisions. However, business case proposals for low carbon investments should also include CO₂ reduction figures and other relevant factors to increase the likelihood of a positive outcome.
- Investment decisions are often undertaken away from the applicant firm/branch plant, in another city or even country. These decision-makers may be focused on economic rather than environmental parameters, a factor that should be considered when applying for capital expenditure funding for low carbon projects.
- Some businesses remain unaware of the support and incentives that are available to promote and facilitate low carbon investment – promotion is needed to remediate this.

MARKETING GREEN CREDENTIALS, CORPORATE IDENTITY AND GREEN INDEXES

- Marketing green credentials can enhance corporate image and add value to products and services for businesses and their supply chains.
- Competition between firms drives emission reduction activities and investment and promotes supply chain collaboration.

ENVIRONMENTAL ETHICS

- Fostering an environmental ethic amongst staff can be beneficial at all levels of a business, particularly in regard to green behavioural practices such as energy efficiency and recycling.
- Buy-in from senior management has the ability to drive forward environmental activities within firms and their supply chains. Initiatives should be targeted at business leaders and key staff to enhance their environmental awareness in order to inform and influence their business decisions.
- There is increasing awareness of environmental matters amongst the general public and working population. Efforts to promote green citizenry in the home and at the workplace are improving people's reception of environmental initiatives.

ENVIRONMENTAL MANAGEMENT SYSTEMS

- Environmental Management Systems help companies structure, manage and report environmental improvements. Their inclusion of supply chain criteria promotes collaboration between firms and continued environmental improvement throughout the supply chain.
- Less time consuming systems for environmental management would help SMEs improve and monitor environmental performance.
- The increasing emphasis of environmental criteria within supply chain management should prompt firms who are not actively pursuing a low carbon trajectory to consider the security of their position and act now to ensure their future economic and environmental sustainability.

EXTERNAL INFLUENCES: SUPPORT STRUCTURES AND AGENCIES

- The limited evidence of effective supply chain collaboration in the region suggests that further efforts are needed to promote the benefits, methods, and necessity of reducing supply chain CO₂ emissions.
- Support agencies, trade bodies and Universities play an important role in the diffusion of environmental knowledge amongst businesses throughout the supply chain.
- Trade bodies and support agencies play a particularly important role for businesses without the capacity to employ staff dedicated to environmental responsibilities such as meeting legislative requirements.

EVENTS AND KNOWLEDGE EXCHANGE: WORKSHOPS, PRESENTATIONS, SITE VISITS

- Targeted regional events concerning the transition to and benefits of low carbon working practices influence businesses. Businesses felt they benefit most from hearing business case studies concerning the options, logistics and benefits of differing low carbon schemes and technologies.

SUPPLY CHAIN WORKING/ RELATIONS AND PROCUREMENT

- There is a perception amongst the businesses interviewed for this project that procurement contracts will increasingly include environmental criteria. Despite the notion that the influence of environmental factors is currently second to traditional factors of cost, reliability and quality, green procurement practices are driving efforts to reduce environmental impact as companies ensure that they future-proof economic sustainability.
- Green procurement is at present an under-utilised but effective way of greening supply chains. The inclusion of environmental criteria within procurement contract should therefore be promoted across supply chains who are wishing to reduce their overall emissions.

POLICY AND REGULATION

- Policy and legislation has led to a professionalisation of environmental management within large firms that has improved emissions reduction as well as structuring methods of monitoring and reporting changes.
- Even within large firms there are key staff who do not understand the requirements of emissions related policy and legislation. Management staff in firms whose Carbon Reduction Commitment (CRC) and Climate Change Agreements (CCA) are negotiated by trade bodies or those working in branch plants do not understand the implications of non-compliance nor the rewards associated with exceeding CCA targets.

KEY POINTS IN SUMMARY: BARRIERS TO LOW CARBON WORKING AND SUPPLY CHAINS

UPFRONT COSTS: BOTTOM LINE PROFITS AND PAYBACK PERIOD

- Businesses need to be made aware of all funding sources and incentives relating to capital expenditure on energy efficient schemes and technology.
- The long-term economic benefits of environmental investments require promotion amongst businesses in the region to prevent short-termism and encourage investments across supply chains. Intervention from government and support agencies is needed to support this approach to long-term economic and environmental sustainability.

ISOLATED SPECIALIST SUPPLY CHAINS AND DISTANCE FROM CUSTOMER

- Some firms experience little pressure from within and beyond their supply chain to engage with the low carbon agenda. These businesses and supply chains need identifying to facilitate the cross-sector transition to low carbon supply chains in Yorkshire and the Humber.
- Current methods of carbon footprinting often exclude Scope 3 emissions that result from the activities of supply chain partners. Action is required to ensure that firms beyond immediate consumer glare are accountable for their respective supply chain emissions.

ORGANISATIONAL CAPACITY AND AWARENESS

- SMEs are faced with multiple barriers in the transition towards low carbon working practices. Although it is more likely that these businesses qualify for support, they are often unaware of what is available to them and the potential opportunities for them to lower their emissions and costs.

LACK OF KNOWLEDGE, UNCERTAINTY AND RISK

- Although it is important for companies to prioritise and tackle their largest emissions sources first, all options should be considered when producing and implementing an emissions reduction strategy. Approaches to corporate governance that integrate environmental activities across firms should be promoted to remediate this problem.
- There is widespread uncertainty about the benefits and logistics (such as disruption) of installing and undertaking certain low carbon projects.
- The pace of technology and variety of low carbon solutions on offer can delay or prevent firms from committing to low carbon investments in technology.

KEY POINTS IN SUMMARY: KEY PERFORMANCE INDICATORS TO BE CONSIDERED

THE IDENTIFICATION AND DEVELOPMENT OF A RANGE OF KEY PERFORMANCE INDICATORS TO BE CONSIDERED FOR THE SUSTAINABLE BENCHMARKING OF SUPPLY CHAINS

- Firms are adopting a very traditional approach in Supply Chain Evaluation (as testified by the lack of adoption of environmental indicators within their supply chain evaluation methods) with little focus on environmental issues from a supply chain perspective.
- While businesses understand the need to manage the sustainability of their supply chains, they are facing difficulties in keeping track of the results of the interventions because of the difficulty in measuring impacts.

KEY POINTS IN SUMMARY: LOW CARBON INTERVENTIONS/TECHNOLOGIES

LOW CARBON INTERVENTIONS/TECHNOLOGIES EVIDENT IN THE TRANSITION TO LOW CARBON SUPPLY CHAINS IN YORKSHIRE AND THE HUMBER

SUPPLY CHAIN RESTRUCTURING INTERVENTIONS

Adopting interventions that are aimed at restructuring the whole supply chain requires the involvement of supply chain partners. This may be challenging, even in the feasibility study phase, in terms of data availability and complexity.

LOGISTICS AND FLEET MANAGEMENT LOW CARBON INTERVENTIONS

Green innovations in transport and logistics will gradually replace the less efficient current standards as awareness and adoption increases; moreover, costs for alternative fuels engines are likely to decrease with time. Despite the most effective logistics interventions being high cost, some fleet management interventions such as green driver training can be characterised by low cost and high impact.

VIRTUAL MEETINGS: SUITES AND TECHNIQUES

Virtual meetings cut emissions and costs, but there remains a culture within some businesses that face-to-face contact is always necessary. Businesses should be encouraged to trial virtual meeting techniques because it is only through using these applications that an appreciation of their ease of use and comparability to face-to-face business contact can be gained.

ENERGY AND CARBON AWARENESS CAMPAIGNS

Awareness campaigns help change behaviour and significantly reduce emissions with minimal investment. However, there is a real challenge in organising effective awareness campaigns. There is often a failure to embed awareness campaigns and the behaviours they promote within organisational structures and at a supply chain level, which means impact fades post-campaign.

ENERGY/RESOURCE MANAGEMENT SYSTEMS

The implementation of such systems can facilitate energy benchmarking, optimise utility procurement, and help manage overall energy costs. Data can be further disaggregated, allowing firms to monitor branch plants resource consumption (electricity, gas, water) so they can examine data for differences, trial interventions at different sites and examine outcomes, creating competition between differing locations. However, the implementation can be challenging in terms of data collection, especially if firms have a distributed structure (across more facilities), similarly to any other kind of ERP system.

ONSITE RENEWABLE GENERATION

Onsite renewable generation has the potential to significantly reduce the emissions of companies in the region.

At present, firms are hesitant to commit to onsite renewable energy due to the upfront costs, long payback periods, uncertainties (concerning the technologies and incentives), and a lack of in-house expertise.

VOLTAGE OPTIMISATION

Many firms in the Yorkshire and the Humber region consider emissions reducing technological solutions such as voltage optimisation to be novel and risky. Therefore, proven technology that generates savings in energy consumption and associated emissions requires promotion. This would support the business decisions of those who are uncertain of the benefits and facilitate the ongoing transition towards low carbon supply chains in Yorkshire and the Humber.

HEAT EXCHANGE/RECOVERY

Although many firms are taking advantage of the benefits offered by heat recovery, it was felt by business representatives that it remains under-utilised across sectors and supply chains due to lack of awareness of the opportunities and/or the capital required for installations.

VARIABLE SPEED DRIVES

Like voltage optimisation, variable speed drives are proven technology with the ability to improve energy efficiency dramatically. Despite this, some companies remain unaware of the benefits and potential savings that they offer.

INTRODUCTION AND STRUCTURE OF THE REPORT

The purpose of this report is to explore how businesses in the Yorkshire and the Humber region are responding to the need to reduce their emissions throughout their supply chains.

This is part of the transition towards a low carbon economy in the UK, stimulated by the Climate Change Act 2008 – a long-term legally binding framework to reduce CO₂ emissions and tackle climate change. The act promotes the transition towards a low carbon economy through emission reduction target of 34% by 2020, increasing to 80% by 2050 (DECC, 2009 and 2011). Meeting these goals requires cross-sector joined up action between businesses and their supply chain partners including the decarbonisation of the power suppliers (Committee on Climate Change (CCC) 2008). To help achieve this a range of legislation has been put in place to encourage emissions reductions in business and monitor progress, including the Carbon Reduction Commitment (CRC), EU Emissions Trading Scheme (EU ETS), Climate Change Levy (CCL) and Building Regulations. Incentives such as Enhanced Capital Allowances (ECA) and the Feed-in Tariff (FiTs) have also been developed to encourage energy efficiency and the installation of onsite renewable energy generation.

This report produced by the Centre for Low Carbon Futures' (CLCF) Low Carbon Supply Chain Project examines the drivers and barriers, measures of evaluating progress and the key technologies and interventions involved in meeting the region's commitment to the low carbon transition.

The majority of companies across Yorkshire and the Humber are embracing opportunities to improve the energy efficiency of their activities, products and services and are in turn reducing CO₂ emissions. However, despite some notable exceptions, supply chain wide collaboration on energy efficiency and emissions reduction is not common practice. The main reason behind this is that efforts to improve efficiency and reduce emissions predominantly result from business decisions undertaken autonomously, on an intra rather than inter firm basis. Low carbon activities that are being undertaken are not always readily visible to supply chain partners or others from respective or associated sectors and businesses.

Drawing upon interviews with business leaders and support agencies, the first section of this report sets out to detail the main drivers and barriers within the dynamics of the transition towards low carbon supply chains in Yorkshire and the Humber. Next, drawing upon results from an online survey of regional firms, the report details the identification and development of a range of Key Performance Indicators to be considered for the sustainable benchmarking of supply chains. Finally, again drawing information from the interviews and survey, a number of key technologies and interventions that are driving or have the potential to drive down CO₂ emissions amongst businesses and their supply chains are detailed, accompanied by examples from businesses across the region.

SECTION 1: DRIVERS AND BARRIERS OF THE TRANSITION TO LOW CARBON SUPPLY CHAINS: THE DYNAMICS OF IMPLEMENTING LOW CARBON INTERVENTIONS

This section represents the findings from interviews undertaken to explore the drivers and barriers of the ongoing transition to low carbon supply chains and working practices. It should be noted that because internal business decisions are central to the transition to low carbon working it is not possible to separate out intra-business low carbon practices from inter-business supply chain-wide low carbon practices.

For a low carbon supply chain to exist, each firm must be able to make autonomous decisions that lead to CO₂ reductions within their respective portion of the supply chain. These decisions may, or may not, be initiated via negotiations, but are nevertheless crucial for the transition towards low carbon supply chains. Despite the fact that most low carbon interventions were undertaken autonomously by businesses, they retained identifiable benefits for the wider supply chain. For example, an East Yorkshire company from the food and drink sector invested in a new energy efficient product storage complex. This not only improved its own carbon footprint, it increased the shelf life of its products further along the supply chain, thus reducing waste.

“The better the conditions we can keep our products under, the better it lasts in the latter processing stages. Savings have been made elsewhere in the supply chain because of what we have done here.”

(Food and drink, large firm East Yorkshire)

However, despite evidence of supply chain benefits from intra-firm activities, there remains a need for joined up working and supply chain collaboration to effectively reduce supply chain emissions.

As with all business decisions, those relating to the transition to low carbon supply chains are complex, diverse and often interdependent. For the sake of clarity this report will discuss the most commonly cited drivers and barriers to low carbon working disclosed by companies and support agencies across the region. For each driver and barrier described, key points are raised about their respective implications and potential contributions to furthering the transition towards low carbon supply chains in Yorkshire and the Humber. This will help policy makers and business leaders understand the dynamics of implementing low carbon schemes within businesses and their supply chains.

METHODOLOGY

The content of this section of the report is drawn from forty semi-structured interviews with firms and support agencies active across Yorkshire and the Humber. Sampling purposively focused largely on three sectors of the regional economy – food and drink; biofuels; and advanced materials¹ – although firms from other sectors have been consulted to gain further coverage. Firms were selected from regional databases of companies rather than self-selection to ensure that some were contacted who do not consider themselves as operating according to low carbon principles. From this, we explore the rationales given for behaviour that has both enhanced or counteracted the transition towards low carbon supply chains.

Businesses are quoted anonymously in this section of the report as the views of respondents were not necessarily representative of those of the companies in which they are employed.

The firms selected for interview ranged in size from Small to Medium Enterprises (SMEs) to large Multi-National Enterprises (MNEs) with the purpose of gaining as wide a picture of the factors that affect the uptake of low carbon practices and technologies as possible. In addition, a number of support agencies have also been interviewed (see Appendix 2). This has provided us with a perspective from beyond the 'company line' where purported aspects of corporate image and public relations can distort the reality of environmental motives for investment and action. This feature of the methodology has allowed us to gain access to their expert perspectives upon the transition towards low carbon supply chains in the region. Stakeholders in the low carbon transition, such as Quangos, local government agencies, trade organisations, environmental consultants and third sector organisations, have all been approached for this element of the research.

The results in this section of the report have been verified and discussed with our industrial partners who make up the project's Business Advisory Group (BAG) (see Appendix 4 for a list of BAG member organisations). The project team met with the BAG on a quarterly basis throughout the project. Interim results from the interviews have been discussed in depth. This process that has helped us to select business relevant drivers and barriers in addition to what are considered to be the most effective and appropriate intervention types to reduce supply chain wide emissions in Yorkshire and the Humber.

The majority of interviews were undertaken in person at the firms' regional premises to facilitate dialogue with the multiple staff involved with low carbon schemes and decision-making, and also to see firsthand the types of low carbon interventions that are being implemented, both within businesses and their supply chains. In cases where this was not possible, company representatives were interviewed over the phone. The interviews were all digitally recorded and then transcribed. The written transcripts were then coded utilising a grounded theory approach within the qualitative analysis software package NVivo. The coded transcripts, as well as other documents provided by the companies and support agencies such as environmental policy and strategy documents, represent the primary evidence drawn upon within this section of the report, with secondary data utilised, where necessary, to add detail to the areas highlighted by interviewees but not expanded upon.

¹ The selection of these sectors was related to the original scope of the study and to the priority sectors for the regional economy proposed by Centre for Low Carbon Futures.

DRIVERS OF THE TRANSITION

THE DRIVERS OF THE TRANSITION TOWARDS LOW CARBON SUPPLY CHAINS IN YORKSHIRE AND THE HUMBER

Levels of supply chain collaboration vary widely within businesses and their supply chains across Yorkshire and the Humber. There are a number of highly proactive firms that promote and steer the low carbon activities of their supply chains. However, there are many SMEs and large firms who have little or no contact with supply chain partners concerning their energy efficiency and associated CO₂ emissions. Despite this, all of the firms visited during this aspect of the research were, to a greater or lesser extent, engaged in attempts to reduce the emissions relating to their own activities and there was a high awareness of the multiple benefits of interventions to increase efficiency. Across the different sectors and supply chains most firms strongly adhered to the principle that any capital expenditure, be it on vehicles, equipment or machinery should be accompanied by an efficiency saving with an associated reduction in emissions.

“When it comes to replacing machinery and making capital expenditure we would always expect to make an efficiency saving and accrue a payback. It doesn't matter if the payback is lengthy because it's an essential investment in the future of the plant. With energy bills only going in one direction, the savings are only going to increase which more than justifies it as a business decision.”

(Advanced manufacturing, SME, East Yorkshire)

This economic rationale, accompanied by environmental benefits, represented the central driver of business decisions relating to the transition to low carbon businesses and supply chains.

- Financial savings
- Marketing green credentials
- Environmental ethics
- Environmental Management Systems
- External influences: Support structure and agencies
- Events and knowledge exchange
- Supply chain collaboration
- Procurement
- Policy and regulation.

FINANCIAL SAVINGS: THE IMPACT OF LOW CARBON INITIATIVES ON BOTTOM LINE PROFITS

Across all of the businesses interviewed, increased bottom line profits were regarded as the overwhelming driver of low carbon activities and investments within firms and their supply chains. Notwithstanding the motivation for the investment (upgrade, replacement, environmental ethics, etc.), if an investment did not lead to financial savings either directly by reducing energy use, or proportionally by increasing throughput/output, it was unlikely to be considered a viable proposition and funded. The critical element of this process was calculating the payback period for low carbon investments.

The payback period of energy efficiency/low carbon schemes was used by several firms as a strategic method of prioritising action. In a similar fashion to the production of Marginal Abatement Cost (MAC) Curves, calculating payback enables firms to examine which carbon reduction measures will save the most money. Using this method, firms choose from a selection of pre-identified interventions and then examine which makes best financial sense and, if they are taking emissions into account, which saves the most CO₂.

"We have had a 10-year energy management programme in place, which has prioritised all projects with payback better than three years."

(Food and drink manufacturer, PLC, East Yorkshire)

The payback periods acceptable for making investments varied widely, with some firms more focused upon the long-term economic stability of their business. For example, one firm was considering large scale investments with up to a seven year payback period, whereas others focused upon their short-term profit and loss accounts. Payback periods that were identified as below one year were, in most cases, acted upon immediately with longer periods undergoing further consideration and business planning.

"I identified a payback of four years by installing double glazing in the foyer and office areas of the building, but that got turned down. Well, you know I could spend £30,000 on something better, so the accountant over in our Belgian office, payback is all they think about. I'm going to relook at the business proposal and see if it can be strengthened. I expected the figures alone to justify it. Perhaps I was being blasé and should have mentioned the associated problems like the offices being cold in the winter."

(Advanced manufacturing, branch plant of large MNE, East Yorkshire)

The above example illustrates that the payback alone does not guarantee investment and that further information should be included to lever investment. This may be more important when decisions are made away from the plant by a head office or board of directors elsewhere. In this example the decision maker was an accountant based in Belgium receiving capital expenditure requests (with potentially better paybacks) from plants around the world – in order to guarantee funding low carbon projects may need to justify themselves in more ways than payback period.

However, the business leaders interviewed who were actively involved in making decisions about capital expenditure did consider payback calculations to be critical to making effective decisions and helping to remove guesswork and risks from their investments. The following statement illustrates how the payback for a low carbon investment helped a firm justify an energy efficiency project.

“They (the suppliers) are going to give us a four-year guarantee on a three-year payback, or a three and a bit year payback. So there’s that built-in comfort that I would probably get at least six months or nine months where I am not paying for them and I have already paid for them out of savings. And if they run for another nine months, that’s basically a free period for us. I think they will run a lot longer than that, I hope, but the thing is that if they don’t, at least we know that we are covered.”

(Food and drink storage, large firm, West Yorkshire)

Some firms also factored incentives into payback periods, such as Soft Loans from the Carbon Trust, FiTs, ROCs and ECA for energy saving technologies. However, awareness of such schemes varied widely between businesses.

This notion of economic savings as a central driver of the transition towards low carbon working was also a key message promoted by the regional support agencies.

“The messages we promote are obviously the environmental aspects, but very much that it is good for business too, pushing the business benefits of being low carbon – and not just the money that you can save, but the business opportunities for that. So that is one of the key messages that we have.”

(Adam Frost, Business in the Community)

Emma Davies from the Energy Savings Trust (EST) described that the prospect of economic savings was an effective way to engage businesses and introduce them to low carbon working.

“People do not always engage with the carbon agenda so cost is a better approach to engagement.”

(Emma Davies, Senior Outreach Coordinator for EST in Yorkshire and the Humber)

These sentiments were echoed by representatives of other support agencies such as CO₂Sense Yorkshire², Manufacturing Advice Service (MAS) and trade bodies including the Food and Drink Federation (FDF) European Farming Foods Partnership (EFFP) as well as private consultants involved in energy efficiency within the regions’ businesses and their supply chains.

KEY POINTS: COMPANIES WISHING TO PROMOTE LOW CARBON WORKING PRACTICES THROUGHOUT THEIR SUPPLY CHAINS NEED TO EMPHASISE AND DEMONSTRATE THE ECONOMIC BENEFITS FOR THE FIRMS INVOLVED.

PAYBACK CALCULATIONS REPRESENT STRONG LEVERS FOR CAPITAL EXPENDITURE TO THOSE RESPONSIBLE FOR BUSINESS DECISIONS. HOWEVER, BUSINESS CASE PROPOSALS FOR LOW CARBON INVESTMENTS SHOULD ALSO INCLUDE CO₂ REDUCTION FIGURES AND OTHER RELEVANT FACTORS TO INCREASE THE LIKELIHOOD OF A POSITIVE OUTCOME.

INVESTMENT DECISIONS ARE OFTEN UNDERTAKEN OUTSIDE OF CONTEXT OF THE APPLICANT FIRM, IN ANOTHER CITY AND/OR COUNTRY. THESE DECISION MAKERS MAY BE FOCUSED ON ECONOMIC RATHER THAN ENVIRONMENTAL PARAMETERS, A FACTOR THAT SHOULD BE CONSIDERED WHILST APPLYING FOR CAPITAL EXPENDITURE FUNDING FOR LOW CARBON PROJECTS.

SOME BUSINESSES REMAIN UNAWARE OF THE SUPPORT AND INCENTIVES THAT ARE AVAILABLE TO SUPPORT LOW CARBON INVESTMENT.

² CO₂Sense Yorkshire, support agency based in Yorkshire and the Humber helping businesses reduce their CO₂ emissions.

MARKETING GREEN CREDENTIALS, CORPORATE IDENTITY AND GREEN INDEXES

Related to bottom line profits, marketing was also identified as a driver of low carbon practices. Several of the firms interviewed considered that customer and supply chain recognition of their green corporate image represented a unique selling point for their products and services that could return a value added premium.

“Sustainability runs through everything. It gives us a unique selling point for our products. We get the first movers advantage. So it’s partially sustainability but partially because it sets us apart – and it’s the right thing to do.”

(Food and drink, PLC, East Yorkshire)

In addition to this some believed that their green credentials had the potential to add value to the products and services in an increasingly environmentally aware marketplace.

A selection of the firms interviewed were engaged with environmental league tables and indices such as the Dow Jones Sustainability Index, Times Green Company List and the Humber Environmental Index (run by Business in the Community and CO₂Sense Yorkshire). These businesses were also keen to progress up such league tables and saw them not only as a means of driving their activities and investments, but also as accreditation for their efforts to reduce environmental impact. These types of activities also stipulated supply chain collaboration and awareness as a requirement, a feature which had successfully stimulated further supply chain communication and activities for each of the firms involved.

It has already been outlined that the majority of investments and activities undertaken by firms in this study were openly motivated (either directly or indirectly) by economic rather than environmental motives. Despite this, if these activities returned an environmental benefit they were also marketed as green initiatives. Such firms did not consider this to be greenwash as the environmental benefits were genuine and because they facilitated the normalisation and promotion of low carbon methods technologies and practices.

KEY POINTS: MARKETING GREEN CREDENTIALS CAN ENHANCE CORPORATE IMAGE AND ADD VALUE TO PRODUCTS AND SERVICES FOR BUSINESSES AND THEIR SUPPLY CHAINS.

COMPETITION BETWEEN FIRMS DRIVES EMISSION REDUCTION ACTIVITIES, INVESTMENT AND PROMOTES SUPPLY CHAIN COLLABORATION.

ENVIRONMENTAL ETHICS

Despite the overwhelming presence of economic factors as the driver of low carbon transitions, there was also an element of environmental ethics evident in most of the comments made by the respondents interviewed. There was a theme that, notwithstanding the economics of business, key personnel considered lowering emissions to be 'the right thing to do'.

Simon Bowen from Friends of the Earth (FOE) explained his opinion on this situation:

"FOE has found that there is a lot of altruism in the business community and that, although the bottom line is important, it is not the be all and end all. Chief Executives are human too and realise that climate change will impact them personally as well as through their business activities."

(Simon Bowen, Friends of the Earth)

This sentiment was evident amongst a number of the firms interviewed and, as the respondent below describes, involvement from high-ranking employees can drive a firm's environmental activities.

"The very top actually, the Chief Executive was instrumental in doing this [initiating a company-wide environmental programme] at the very start and I think it was because it was a good thing to do, that was really... without being cynical or anything, it was felt that this is something we should do. There wasn't some big calculation going on about how much we might get back in good publicity and all the rest of it, it was just seen as the right thing to do."

(Service sector, large firm, South Yorkshire)

Some firms declared that environmental ethics of staff were encouraged and developed by in-house training at induction and refresher sessions, with some higher ranking staff in larger firms sent to external events aimed at fostering green corporate ethics. One respondent working for a division of a multinational company explained that her firm had organised for a group of divisional managers to attend an event with a high profile environmentalist speaker. She said that the event had made her realise that environmental concerns were more important than she previously thought.

"I would never have put myself in a category of anybody who cared about the environment, but actually when I listened and I thought about it [at the event organised by the company], I found that I really do and I am prepared to make changes in my life."

(Manufacturing, MNE, West Yorkshire)

Interviewees from businesses and support agencies also identified a growing sense of environmental awareness and responsibility more generally amongst staff, particularly regarding the simple things such as switching off unused equipment, lights, computers, etc. Because of wider societal shifts in the perception of environmental problems, staff were considered to be increasingly receptive to awareness campaigns and other efforts to increase efficiency and reduce emissions.

KEY POINTS: FOSTERING AN ENVIRONMENTAL ETHIC AMONGST STAFF CAN BE BENEFICIAL AT ALL LEVELS OF A BUSINESS PARTICULARLY IN REGARD TO PRACTICES SUCH AS ENERGY EFFICIENCY AND RECYCLING.

BUY-IN FROM SENIOR MANAGEMENT HAS THE ABILITY TO DRIVE FORWARD ENVIRONMENTAL ACTIVITIES WITHIN FIRMS AND THEIR SUPPLY CHAINS. INITIATIVES SHOULD BE TARGETED AT BUSINESS LEADERS AND KEY STAFF TO ENHANCE THEIR ENVIRONMENTAL AWARENESS IN ORDER TO INFORM AND INFLUENCE THEIR BUSINESS DECISIONS.

THERE IS INCREASING AWARENESS OF ENVIRONMENTAL MATTERS AMONGST THE GENERAL PUBLIC AND WORKING POPULATION. EFFORTS TO PROMOTE GREEN CITIZENRY IN THE HOME AND AT THE WORK PLACE ARE IMPROVING PEOPLES' RECEPTION OF ENVIRONMENTAL INITIATIVES.

ENVIRONMENTAL MANAGEMENT SYSTEMS

Environmental Management Systems such as ISO 14001 or the related BS 8555 and the voluntary EU Eco Management and Audit Scheme (EMAS) have been used successfully to structure, implement and monitor CO₂ reductions. ISO 14001 was repeatedly claimed as a stimulus and driver of continuous improvement in relation to low carbon activities.

The accreditation gained was perceived as an important aspect of corporate image and a requirement of the procurement contract and/or environmental permits of certain firms. Environmental Management Systems (EMS) are also acting to promote supply chain collaboration by encouraging businesses to collect information concerning energy efficiency and environmental performance from their suppliers to monitor continual improvement throughout the supply chain. Increasing consideration and emphasis of environmental criteria within supply chain management should prompt firms that are not actively pursuing a low carbon trajectory to consider the security of their position and act now to prevent future problems. The uptake of ISO 14001 had been prompted in several firms by the introduction of the Carbon Reduction Commitment (CRC), which advocates EMS to monitor and record environmental performance. This serves to emphasise both the interdependencies between the drivers of low carbon supply chains and the need for strong policy to facilitate the transition.

Proponents of EMS tended to laud the benefits that the systems generated. Particular emphasis was given to recording and monitoring evidence of environmental performance in a structured format that met internal and external needs. It was suggested that relying on environmental policy documents alone often meant they remained unfulfilled and that EMS gave impetus to the continuous development and extension of environmental programmes. Despite this, smaller firms disclosed that although they met the criteria for accreditation, they could not afford the administrative man hours required to be involved with such schemes, unless they were a requirement of key customers, environmental permits or other legislative requirements.

KEY POINTS: ENVIRONMENTAL MANAGEMENT SYSTEMS HELP COMPANIES STRUCTURE, MANAGE AND REPORT ENVIRONMENTAL IMPROVEMENTS. THEIR INCLUSION OF SUPPLY CHAIN CRITERIA PROMOTES COLLABORATION BETWEEN FIRMS AND CONTINUED ENVIRONMENTAL IMPROVEMENT THROUGHOUT THE SUPPLY CHAIN.

THE DEVELOPMENT AND PROMOTION OF LESS TIME CONSUMING, SIMPLIFIED SYSTEMS FOR ENVIRONMENTAL MANAGEMENT WOULD HELP SMALL AND MEDIUM ENTERPRISES IMPROVE AND MONITOR ENVIRONMENTAL PERFORMANCE.

THE INCREASING EMPHASIS OF ENVIRONMENTAL CRITERIA WITHIN SUPPLY CHAIN MANAGEMENT SHOULD PROMPT FIRMS THAT ARE NOT ACTIVELY PURSUING A LOW CARBON TRAJECTORY TO CONSIDER THE SECURITY OF THEIR POSITION AND ACT NOW TO ENSURE THEIR FUTURE ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY.

EXTERNAL INFLUENCES: SUPPORT STRUCTURES AND AGENCIES

The low carbon working practices of businesses in the regions have been, and continue to be, influenced and supported by a wide range of agencies, institutions and bodies. External agencies were frequently disclosed as identifiers of low carbon opportunities and/or of supporting implementation. Support was given via consultancy and knowledge exchange as well as financial support in the shape of grants or soft loans to support low carbon investments.

Surveys conducted by the Carbon Trust³ found it was a notable driver for business activities and there was near unanimous support and gratitude for its work. For some firms the Carbon Trust surveys represented their main energy efficiency and emissions reductions strategy documents, structuring their investments and changes in working practices. CO₂Sense Yorkshire was similarly praised for its work with businesses throughout the region.

Trade bodies also had an important role for some businesses, particularly in regard to negotiating and collating information regarding Climate Change Agreements (CCA) and the Carbon Reduction Commitment (CRC). They often became a source of knowledge and expertise and were able to distil information and advice upon policy, guidance and low carbon options. Events organised by trade bodies represented an opportunity to share best practice and receive guidance from others within the sector. However, the cost of trade body membership was regarded as a barrier to some smaller companies, but also for larger organisations that felt their own in-house expertise removed the necessity of joining their respective trade body.

Universities in the region also staged regular events and workshops to support businesses wishing to lower their supply chain emissions. Several companies had been involved with universities in relation to environmental schemes. The collaborations had helped lever grants and investment as well as being an important source of knowledge exchange through formal training and dedicated events. For example, one firm had utilised an innovation voucher from its Regional Development Agency to undertake a carbon footprinting exercise across the supply chain and simplify guidance surrounding the reduction of life cycle emissions. This project had led to a reconfiguration of the supply chain that reduced the overall emissions.

KEY POINTS: THE LIMITED EVIDENCE OF EFFECTIVE SUPPLY CHAIN COLLABORATION IN THE REGION SUGGESTS THAT FURTHER EFFORTS ARE NEEDED TO PROMOTE THE BENEFITS, METHODS, AND NECESSITY OF REDUCING SUPPLY CHAIN CO₂ EMISSIONS.

SUPPORT AGENCIES, TRADE BODIES AND UNIVERSITIES PLAY AN IMPORTANT ROLE IN THE DIFFUSION OF ENVIRONMENTAL KNOWLEDGE AMONGST BUSINESSES THROUGHOUT THE SUPPLY CHAIN.

TRADE BODIES AND SUPPORT AGENCIES PLAY A PARTICULARLY IMPORTANT ROLE FOR BUSINESSES WITHOUT THE CAPACITY TO EMPLOY STAFF DEDICATED TO ENVIRONMENTAL RESPONSIBILITIES, SUCH AS MEETING LEGISLATIVE REQUIREMENTS.

³ The Carbon Trust is an independent not for profit company set up by the UK Government with support from business to take the lead on the move towards a low carbon economy.

EVENTS AND KNOWLEDGE EXCHANGE: WORKSHOPS, PRESENTATIONS, SITE VISITS

Most of the personnel interviewed had attended events and workshops relating to reducing emissions. These were regarded as a key source of information and an opportunity to network with others in related fields. Respondents found it useful to see and hear examples of what other firms were doing to reduce their emissions, what methods and technologies they were using, and the benefits they had gained as a result.

Events were usually themed to maximise the relevance to delegates and included a mix of speakers from businesses, support agencies and academia as well as private sector consultants and technological solutions providers. However, several SMEs interviewed disclosed that they could not always spare the time to send staff along to such events.

KEY POINT: TARGETED REGIONAL EVENTS CONCERNING THE TRANSITION TO, AND BENEFITS OF, LOW CARBON WORKING PRACTICES INFLUENCE BUSINESSES. BUSINESSES FELT THEY LEARN MOST FROM HEARING BUSINESS CASE STUDIES CONCERNING THE OPTIONS, LOGISTICS AND BENEFITS OF DIFFERING LOW CARBON SCHEMES AND TECHNOLOGIES.

SUPPLY CHAIN WORKING/RELATIONS AND PROCUREMENT

Although there is a great deal of evidence that businesses are actively pursuing a strategic transition towards low carbon working, effective joined-up working in regard to the transition towards low carbon supply chains remains largely underdeveloped – effective liaison between supply chain partners leading to cuts in CO₂ emissions remains the exception. Despite this, respondents disclosed that they were increasingly being asked about their environmental activities as part of procurement negotiations. However, these respondents often reported that those asking the questions were often ill informed about firm and sector specific elements in regard to the emissions associated with their products and services.

It was assumed in several instances by supply chain partners that there was a direct linear relationship between the percentage of business and percentage of overall emissions. However, this assumption is too simplistic as the emissions related to orders vary according to type of product and their associated manufacturing processes.

In many cases the product cost, quality and the reliability of the firm to deliver, currently outweighed environmental requirements in relation to procurement. However, there was a perception that procurement was likely to become increasingly driven by environmental aspect – there was a need to lower emissions and have robust evidence to prove this in order to ensure the economic sustainability of both the firm and its respective supply chain.

Procurement contracts and procedures were the main, and often only, form of contact between firms and their close supply chain partners. Procurement contracts usually only involved first tier suppliers or customers rather than being supply chain wide. However, there were several exceptions to this. Larger firms at the head of supply chains were mostly likely to be interested in their supply chain wide emissions. Powerful large companies at head of supply chains held influence over smaller companies and often included surveys dedicated to environmental aspects asking for emissions data and evidence of improvement activities. However, it was claimed, on more than one occasion, that the further away a company was in the supply chain, the more likely it was that environmental questions would not ask the right questions, simply because they did not understand or were misinformed about the practices and processes undertaken. One firm was actively involved with its entire supply chain and hosted events and conducted surveys relating to lowering carbon emissions and resource efficiency. By comparison, another firm used external consultants to establish supply chain emissions and promote reductions.

Despite the majority of firms having procurement contracts in place, few admitted to including environmental criteria for the products and services they buy in or those that they deliver. Even when environmental criteria was specified it was felt that cost and quality still took precedence. Because of this several firms were developing systems to effectively include environmental criteria within their procurement and deciding how to weight environmental factors against cost and quality via a balanced scorecard approach.

Questionnaires typically included Corporate and Social Responsibility (CSR) reporting or health, safety and environmental reporting. More recently, some companies had received questionnaires based solely on environmental criteria. However, it was felt that customers and suppliers attempting to calculate product carbon footprints (often using crude estimations) did not always understand the processes and practices of supply chain partners.

“We did a big questionnaire [for a customer] last year. They were actually asking the wrong questions – because frankly they don’t understand the process, they were asking the wrong questions about the processes and were ignoring some of the large carbon emitting processes.”

(Advanced manufacturer, MNE, South Yorkshire)

When asked about supply chain contact and procurement based upon environmental criteria the following response was typical, especially from firms away from the public glare or a distance from the end customer:

“Procurement is based on quality of product. It’s based on a knowledge of the supplier, a relationship with the supplier... and best price. We build relationships with suppliers, we have good suppliers, but we will continue to keep them on their toes. All our carbon initiatives have been undertaken solely by the firm within the firm without supply chain involvement.”

(Manufacturer, SME, East Yorkshire)

The following statement is more representative of respondents’ views regarding the extent of supply chain collaboration on environmental issues:

“Yes, we are aware of what each other is doing and how that is... but that’s probably as far as it goes.”

(Advanced manufacturer, large firm, South Yorkshire)

Many firms recognised or perceived that they were being left behind in respect to green procurement. The firm cited below was representative of others who considered quality before and over environmental credentials – although this situation was slowly changing:

“I think that’s [green procurement practices] an area where the company is woefully, at the moment, behind, really. You know, what I drew on there is pretty much the extent, you know we are not really particularly upstream, we are not really having a great deal of influence in that area or even engagement. We have in our purchasing department now what we call a supplier quality assurance department but they are much more at the moment looking to quality assurance [rather] than environmental issues so it is an area and I have written this into the group and regional policies that we are going to have to get to grips with, but the short answer is no, we haven’t.”

(Advanced manufacturing, MNE, West Yorkshire)

Most businesses considered that environmental factors would become increasingly important in future years. This was regarded as a stimulus for efficiency and low carbon schemes as companies sought to guarantee their economic future by reducing emissions.

KEY POINTS: THERE IS A PERCEPTION AMONGST THE BUSINESSES THAT PROCUREMENT CONTRACTS WILL INCREASINGLY INCLUDE ENVIRONMENTAL CRITERIA. DESPITE THE NOTION THAT THE INFLUENCE OF ENVIRONMENTAL FACTORS IS CURRENTLY SECOND TO TRADITIONAL FACTORS OF COST, RELIABILITY AND QUALITY, GREEN PROCUREMENT PRACTICES ARE DRIVING EFFORTS TO REDUCE ENVIRONMENTAL IMPACT AS COMPANIES ENSURE THAT THEY FUTURE-PROOF ECONOMIC SUSTAINABILITY.

GREEN PROCUREMENT IS AT PRESENT AN UNDER-UTILISED BUT EFFECTIVE WAY OF GREENING SUPPLY CHAINS. THE INCLUSION OF ENVIRONMENTAL CRITERIA WITHIN PROCUREMENT CONTRACTS SHOULD THEREFORE BE PROMOTED ACROSS SUPPLY CHAINS.

POLICY AND REGULATION

Policy and regulation was widely cited as the central driver of low carbon changes and investments – companies had no alternative than to comply with legislation concerning emissions and environmental permits. The Climate Change Levy (CCL) and Carbon Reduction Commitment (CRC) had also stimulated action to cut emissions amongst most of the firms interviewed. High emitting firms were obligated to improve environmental performance under the Integrated Pollution Prevention and Control (IPPC) Directive. This directive stipulates that activities at an installation should be running Best Available Techniques (BAT) to prevent, reduce and eliminate pollution by prioritising efforts on the most significant industrial and agricultural activities.

Furthermore, these larger emitters, through participating in a Climate Change Agreement (CCA), received a discount on the CCL in return for achieving negotiated energy efficiency targets. This legislative requirement represented a strong stimulus in respect to lowering emissions, although certain companies felt that there would come a point whereby they could not reduce emissions any further, necessitating the generation of onsite renewable energy or a change in the energy mix at a national level. Further stimulus to reduce the emissions of industrial firms was provided by the European Union Emissions Trading Scheme (EU ETS). Under this scheme emissions reductions can then be traded alongside other surplus emissions permits for financial gain.

Adhering to policy drivers had stimulated associated developments, such as the implementation of EMS, employing staff to implement and administer emissions reduction and collaboration/contracting of external support. These were regarded as beneficial to the transition to low carbon working practices. However, although meeting policy obligations had stimulated collaborative work between firms working under the same trade bodies or the same sectors, because they did not include criteria on supply chain emissions, they mostly failed to encourage supply chain wide approaches to emissions reduction.

Finally, it was apparent from several interviews that the CRC was not broadly understood by the personnel responsible for managing and implementing emissions reduction schemes. There tended to be two reasons for this:

- firms were using external consultants or trade bodies to manage their CRC and CCAs; and/or
- personnel based within branch plants had few policy related dealings as they were dealt with elsewhere.

In both of these situations firms were actively measuring and reporting emissions but were unsure of the implications.

KEY POINTS: POLICY AND LEGISLATION HAS LED TO A PROFESSIONALISATION OF ENVIRONMENTAL MANAGEMENT WITHIN LARGE FIRMS THAT HAS IMPROVED EMISSIONS REDUCTIONS, AS WELL AS STRUCTURING METHODS OF MONITORING AND REPORTING CHANGES.

EVEN WITHIN SOME LARGE FIRMS KEY STAFF DO NOT UNDERSTAND THE REQUIREMENTS OF EMISSIONS RELATED POLICY AND LEGISLATION. MANAGEMENT STAFF IN FIRMS WHOSE CRC AND CCA ARE NEGOTIATED BY TRADE BODIES OR THOSE WORKING IN BRANCH PLANTS DO NOT UNDERSTAND THE IMPLICATIONS OF NON-COMPLIANCE NOR THE REWARDS ASSOCIATED WITH EXCEEDING CCA TARGETS.

BARRIERS TO LOW CARBON WORKING AND SUPPLY CHAINS

In the next section of the report the barriers to low carbon working and supply chains disclosed in the interviews are presented. The central barriers remained economic – relating to the cost and payback of low carbon schemes. However, it was often cost paired with another interdependent factor faced by the differing firms that prevented low carbon investments and activities from being undertaken.

MAIN BARRIERS TO LOW CARBON SUPPLY CHAIN WORKING

- Cost factors
- Shortage of capital
- Competing priorities
- Short-termism
- Convincing decision makers
- Supply chain isolation/distance from customer
- Company size and organisational capacity
- Lack of awareness, uncertainty and risk

UPFRONT COSTS: BOTTOM LINE PROFITS AND PAYBACK PERIOD

The majority of firms had already tackled what they considered to be their 'low hanging fruit' in regard to carbon emissions. These represented activities or processes with high associated emissions that could be dramatically reduced by proven technology or procedural changes, often returning a short-term payback. Despite the fact that savings represented the key driver, the upfront cost remains the single greatest barrier to the transition towards low carbon working.

These economic barriers were clustered under the following four themes:

- **Shortage of capital to invest** – respondents (from SMEs up to MNEs) frequently highlighted that they had a shortage of capital to invest in energy efficient schemes. They were also struggling to raise revenue from lenders in the current economic climate. This caused them frustration as they recognised that the investment and borrowing would often be paid back within several years making the firm more profitable, or at least offsetting increasing energy and fuel prices.
- **Competing priorities** – during the economic downturn some firms were finding it hard to make low carbon investments when they were having to lay off staff and make cut backs. Even where demonstrable paybacks were achievable these were sometime forgone to prevent bad feeling within the workforce. There were also competing strategic priorities for capital expenditure, which would incur a greater return for the firm than investing in a low carbon scheme.

“ We wanted to do it [insulate plant] about three years ago and we couldn't afford it, and they [the Environment Agency] said yes, you have got to do this and we said well we don't see it as a business priority. It's got a payback of about a year and having the cash in the business it's a no brainer. And it was a no brainer then but it's just that we wanted to spend that £100k somewhere else.”

(SME, East Yorkshire)

Examples such as this further emphasise the need for greater lending opportunities for small businesses in regard to energy efficiency, particularly in circumstances where there are demonstrable short-term paybacks. A related finding was that some firms were not aware of the sources of economic assistance (loans, grants and capital allowances) available to them.

- **Short-termism** – payback was critical for investments made by all firms but there were huge variations in what was considered a good payback period. The majority of firms sought one to two year paybacks, with longer paybacks requiring further justification to gain board approval. There was a certain amount of short-termism displayed by businesses and a perceived failure (often at board level) to recognise the long-term benefit to economic and environmental sustainability. However, those respondents who were board members refuted this, referring to their need to ensure that profit/loss accounts remained healthy.

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- **Convincing decision makers** – related to the previous three factors, some interviewees had found it difficult to convince those who made the decision on capital investments within the business hierarchy. This was identified as a particular problem for firms owned by international groups. These firms had strict direction concerning investments, which did not necessarily marry well with long-term investments to improve efficiency and reduce emissions. A further problem faced by group-owned firms was that, due to their status, they failed to meet criteria necessary to qualify for funding or support. For example, SMEs that had been bought by a group often continued to operate without outside influence or funding but SME status and associated support structures were lost.

KEY POINTS: BUSINESSES NEED TO BE MADE AWARE OF ALL FUNDING SOURCES AND INCENTIVES RELATING TO CAPITAL EXPENDITURE ON ENERGY EFFICIENT SCHEMES AND TECHNOLOGY.

THE LONG-TERM ECONOMIC BENEFITS OF ENVIRONMENTAL INVESTMENTS REQUIRE PROMOTION AMONGST BUSINESSES IN THE REGION TO PREVENT SHORT-TERMISM AND ENCOURAGE INVESTMENTS ACROSS SUPPLY CHAINS. INTERVENTION FROM GOVERNMENT AND SUPPORT AGENCIES IS NEEDED TO SUPPORT THIS APPROACH TO LONG-TERM ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY.

ISOLATED SPECIALIST SUPPLY CHAINS AND DISTANCE FROM CUSTOMER

Several of the firms interviewed considered neither themselves, nor the supply chains in which they were embedded, at risk of losing business or decreasing profits from a failure to engage with the low carbon agenda. Despite the aforementioned trend towards environmental procurement, certain businesses claimed that they felt little pressure to invest in low carbon schemes as they had received no formal or informal requests to do so. In certain circumstances businesses had no choice concerning which suppliers they used and felt that they were unable to switch to a potentially more carbon efficient supplier. These firms were usually involved with specialist products that required specific raw materials or components only available from a limited number of suppliers.

“We use very specific raw materials, which come from a set amount of suppliers, so we are a bit limited to saying ‘I don’t like your green policy, I am not going to buy from you,’ we haven’t really got that luxury.”

(Food and drink, SME, North Yorkshire)

Firms such as this one are in the greatest need of developing relationships with suppliers to collaborate on lowering supply chain emissions. It is planned that the CLCF Low Carbon Supply Chain Project Decision Support Tool would help businesses understand and engage with their supply chain partners by assigning emissions totals to sources and suggesting methods that each company in the supply chain can use to reduce the emissions of their respective activities.

It was also disclosed that the further away from the product’s end user a firm and its contribution to products and services was, the less likely it was that they would face pressure to act in an environmentally responsible manner.

“No one has asked us about it [environmental impact in relation to carbon footprint]. I think the pressure is in a different part of the supply chain – we supply to food suppliers and food manufacturers and they are the ones who are more accountable to the supermarkets and their buyers.”

(Food and drink, large firm, East Yorkshire)

KEY POINTS: SOME FIRMS EXPERIENCE LITTLE PRESSURE FROM WITHIN AND BEYOND THEIR SUPPLY CHAIN TO ENGAGE WITH THE LOW CARBON AGENDA. THESE BUSINESSES AND SUPPLY CHAINS NEED IDENTIFYING TO FACILITATE THE CROSS-SECTOR TRANSITION TO LOW CARBON SUPPLY CHAINS IN YORKSHIRE AND THE HUMBER.

CURRENT METHODS OF CARBON FOOT PRINTING OFTEN EXCLUDE SCOPE 3 EMISSIONS⁴ THAT RESULT FROM THE ACTIVITIES OF SUPPLY CHAIN PARTNERS. ACTION IS REQUIRED TO ENSURE THAT FIRMS BEYOND IMMEDIATE CONSUMER GLARE ARE ACCOUNTABLE FOR THEIR RESPECTIVE SUPPLY CHAIN EMISSIONS.

⁴ While Scope 1 (also known as direct emissions) include emissions that occur onsite or from sources that a company owns and controls and Scope 2 are related to indirect GHG emissions from consumption of purchased electricity, heat or steam, Scope 3 emissions include other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities not covered in Scope 2, outsourced activities, waste disposal.

ORGANISATIONAL CAPACITY AND AWARENESS

The capacity of SMEs to facilitate the transition towards low carbon working and supply chains is often limited by a number of factors.

- **Manpower/time** – management staff employed in SMEs claimed that they often lacked the staff and administrative time needed to fully engage with the low carbon movement. In several cases, despite energy efficiency/low carbon opportunities being available, they were not implemented because of this.
- **Investment** – SMEs stated that funding energy efficiency projects was difficult due to limited resources and competing priorities for their available cash flow.
- **Expertise** – the installation and operation of certain low carbon schemes, notably onsite renewable, was felt to be beyond the expertise of the limited number of staff at some SMEs. This was regarded a barrier to considering many low carbon interventions that could potentially make big differences in terms of emissions and energy use.
- **Awareness** – related to staffing numbers and time, respondents from SMEs admitted to a lack of awareness of low carbon opportunities because they were unable to dedicate time for research.
- **Support** – there was a perception from some SME representatives that support with reducing emissions was targeted towards larger companies due to greater potential CO₂ reductions. Some felt they were missing out on support because of this perceived bias.

Although these factors are unsurprising, they emphasise the need to offer additional support to small business to facilitate the transition to low carbon supply chains.

Finally, it was apparent from several interviews that the Carbon Reduction Commitment was not broadly understood by the personnel responsible for managing and implementing emissions reduction schemes. There tended to be two reasons for this:

- firms were using external consultants or trade bodies to manage their CRC and CCAs; and/or
- personnel based within branch plants had few policy related dealings as they were dealt with elsewhere.

In both of these situations, firms were actively measuring and reporting emissions but were unsure of the implications of lowering or not lowering plant emissions.

KEY POINT: SMALL AND MEDIUM SIZED ENTERPRISES ARE FACED WITH MULTIPLE BARRIERS IN THE TRANSITION TOWARDS LOW CARBON WORKING PRACTICES. ALTHOUGH IT IS MORE LIKELY THAT THESE BUSINESSES QUALIFY FOR SUPPORT THEY ARE OFTEN UNAWARE OF WHAT IS AVAILABLE TO THEM.

LACK OF KNOWLEDGE, UNCERTAINTY AND RISK

A lack of awareness of all the options available to firms in their respective sectors was a significant barrier to low carbon working and supply chains. Firms tended to focus upon their main sources of emissions at the expense of other areas where improvements could be made. This had an economic stimulus as actions were focused upon areas with the greatest potential savings. Unless the company had multiple staff to focus upon different areas of the business this was the norm. Typically service sector firms would focus upon reducing emissions relating to building space (insulation, heating and lighting), ICT, and the use of environmentally friendly office supplies. Alternately, distributors of goods would focus upon transport interventions, such as telematics (ICT vehicle tracking and route optimisation systems). Industrial users and manufacturers would focus upon energy consumption processes and equipment on the factory floor. As a result of this low carbon strategies and activities often provided patchy coverage of overall business functions. Companies that successfully identified opportunities to reduce emissions across diverse company functions and departments had often, through robust corporate governance, built and embedded emissions reductions into everyday working practices.

Support agencies also identified an incongruity surrounding risk. It was argued that companies might delay or avoid low carbon opportunities because they were unsure about the risks involved in making such changes. For example, disruption to production and/or other operations, and the implications of new technologies that were potentially incompatible with existing systems were all cited as potential problems.

There was uncertainty concerning future policy direction, with several firms holding off from committing to onsite renewable projects until they were more certain about potential revenue streams from the FiTs scheme, or whether potential changes in ROCs would help reduce payback periods, making these schemes more economically attractive and viable.

In certain circumstances it was suggested that the uncertainty about low carbon projects extended to regulatory bodies. This was an evident barrier to low carbon working, particularly in regard to large-scale low carbon investments such as onsite renewables, but also with other types of interventions.

“The biggest problem was they [the local authority planning department] were not experienced in planning and technical regulations for wind farm sized turbines. So they just don't have the expertise to be able to make sensible comments.”

[Advanced manufacturing, MNE, South Yorkshire]

Some businesses were uncertain about the benefits of certain technologies and the disruption that would occur during installation. Firms reported aggressive sales tactics and a crowded market place, where the pace of change made it difficult to ascertain the most appropriate low carbon solution.

“There's so many people out there that are selling them [energy efficient lighting systems], it was draining so much time for us to look and go through all the sales bump, we just thought we can't continue like this.”

[Food and drink storage, large firm, West Yorkshire]

This company turned the competition in the market place to their advantage by asking for trial light fittings for an aisle within their storage facility. This immediately cut their costs and allowed them to select the best option for them.

KEY POINTS: ALTHOUGH IT IS IMPORTANT FOR COMPANIES TO PRIORITISE AND TACKLE THEIR LARGEST EMISSIONS SOURCES FIRST, ALL OPTIONS SHOULD BE CONSIDERED WHEN PRODUCING AND IMPLEMENTING AN EMISSIONS REDUCTION STRATEGY. APPROACHES TO CORPORATE GOVERNANCE THAT INTEGRATE ENVIRONMENTAL ACTIVITIES ACROSS FIRMS SHOULD BE PROMOTED TO REMEDIATE THIS PROBLEM.

THERE IS WIDESPREAD UNCERTAINTY ABOUT THE BENEFITS AND LOGISTICS OF INSTALLING AND UNDERTAKING CERTAIN LOW CARBON PROJECTS.

THE PACE OF TECHNOLOGY AND VARIETY OF LOW CARBON SOLUTIONS ON OFFER CAN DELAY OR PREVENT FIRMS FROM COMMITTING TO LOW CARBON INVESTMENTS IN TECHNOLOGY.

CONCLUSIONS

Businesses within the region are taking steps to reduce their energy use and associated emissions in the transition towards a low carbon economy. However, the development of low carbon supply chains remains the exception rather than the rule. Firms with EMS and accreditation such as ISO 14001 are generally further down the line towards developing supply chain collaboration regarding lowering emissions. The motivations for such action may result from policies or environmental permits as well as procurement contracts that stipulate a certain type of environmental accreditation.

Green procurement and the perception that it will increase in significance appear to be driving some businesses to lower emissions or at least record and monitor activities. Promoting the uptake of green procurement practices represents a useful tool in stimulating low carbon activities throughout the supply chain.

Firms involved with environmental indexes and league tables also appeared to be proactive in supply chain collaboration to reduce their products' life cycle emissions. These firms were often driven to enhance their green credentials by a sense that it was the right thing to do environmentally, as well as associated benefits such as reduced costs, the unique selling point and potential product premiums that their green credentials provided.

Sectoral collaboration is being effectively promoted through trade organisations – however, good practice in relation to low carbon working, despite press releases and website details, often goes unnoticed throughout the sector. Despite competition, some firms are happy to share information (even if this is post-first mover advantage).

"We are being philanthropic with our programme, we are keen to help the sector change and lead by example, change the ways things are done."

(Food and drink, PLC, East Yorkshire)

Events held by support agencies, universities and trade bodies represent effective vehicles to deliver examples of low carbon working. These work best when they are targeted towards a specific supply chain or sector to ensure relevance and to enhance networking opportunities.

SECTION 2: THE IDENTIFICATION AND DEVELOPMENT OF A RANGE OF KEY PERFORMANCE INDICATORS TO BE CONSIDERED FOR THE SUSTAINABLE BENCHMARKING OF SUPPLY CHAINS

INTRODUCTION

Long-term organisational competitiveness should not be evaluated solely in terms of financial measures. Investors, policy makers, and other stakeholders increasingly seek to evaluate performance with respect to sustainability – the environmental, social, and economic performance of an organisation.

Given new industry pressures, sustainability is placed high on the agenda of industry and other stakeholders to benchmark supply chain performance. There has been an emergent set of investigations related to benchmarking and performance measurement in relation to sustainability (Sarkis 2010). Most of this research is oriented toward improvement of individual firms or processes rather than toward analysis of entire supply chains. There have been attempts to measure sustainability but most of these efforts focus on firm or product-level performance, often just considering environmental performances due to the intrinsic challenge of measuring and improving the sustainability performance of supply chains.

As a part of the Low Carbon Supply Chain Project, funded by Centre for Low Carbon Futures, we have tried to develop a system for evaluating supply chains' sustainability, comprising the definition of a theoretical framework of KPIs that can be utilised by stakeholders at several levels.

SUSTAINABILITY AND PERFORMANCE MEASUREMENT: STATE OF THE ART AND OF THE PRACTICE

Before starting work setting up the evaluation system, an explorative survey has been launched in order to identify the main issues companies are facing in dealing with the decarbonisation process of their own supply chains.

Companies based in South Yorkshire have been targeted by accessing the databases of local Chambers of Commerce. Ninety-five companies have accessed the questionnaire. The survey is web-based and can be found at: www.surveymonkey.com/s/CLCF.

The sample composition according to the firms' size is reported in Figure 1 and the firms' classification according to core business is shown in Figure 2.

What is the total number of employees in the company?

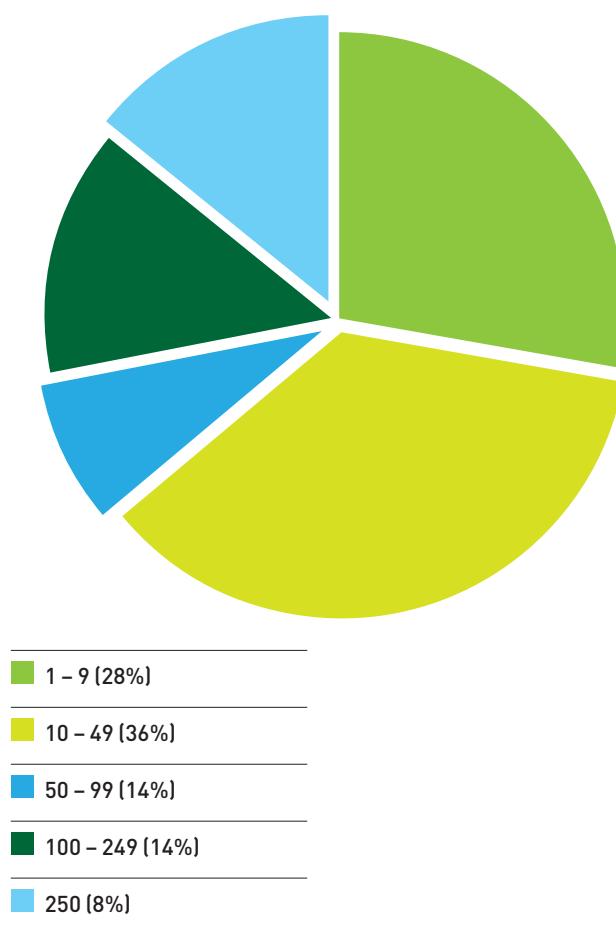


Figure 1: Firms sample composition

The survey has highlighted that awareness about sustainability issues is rising – 68% of the firms have an Environmental Policy Statement (see Figure 3) and 60% of the respondents claim to be taking interventions to reduce their carbon footprint. Respondents identify the following target areas for reducing carbon footprint:

- energy use (including renewable sources and more efficient use) – 44% of the firms are implementing some sort of energy use monitoring;
- transportation activities (52% of the firms are taking interventions to monitor business miles);
- production processes; and
- improving recycling performance.

However, cited interventions seem to be largely at the single firm level and disregard the supply chain. For example, most of the firms (around 90%) do not share energy consumption and utilities data with

supply chain partners, even though firms seem aware that the transition to a sustainable way of conducting business involves adopting collaborative approaches encompassing the whole value creation activity within supply chain scenarios (Vachon, 2007; Vachon and Klassen, 2007).

Moreover, 57% of the respondents have no formalised Supply Chain Performance Measurement System; and 53% of the respondents do not monitor the performance of their suppliers through a formalised supplier selection system. This provides further evidence that, although overall sustainability awareness is rising, benchmarking and performance management remain a huge challenge in supply chains. This aspect is crucial, as firms can often identify suitable interventions for lowering carbon emissions across their supply chains but, without appropriate benchmarking tools and partners' involvement, keeping track of progress can be difficult.

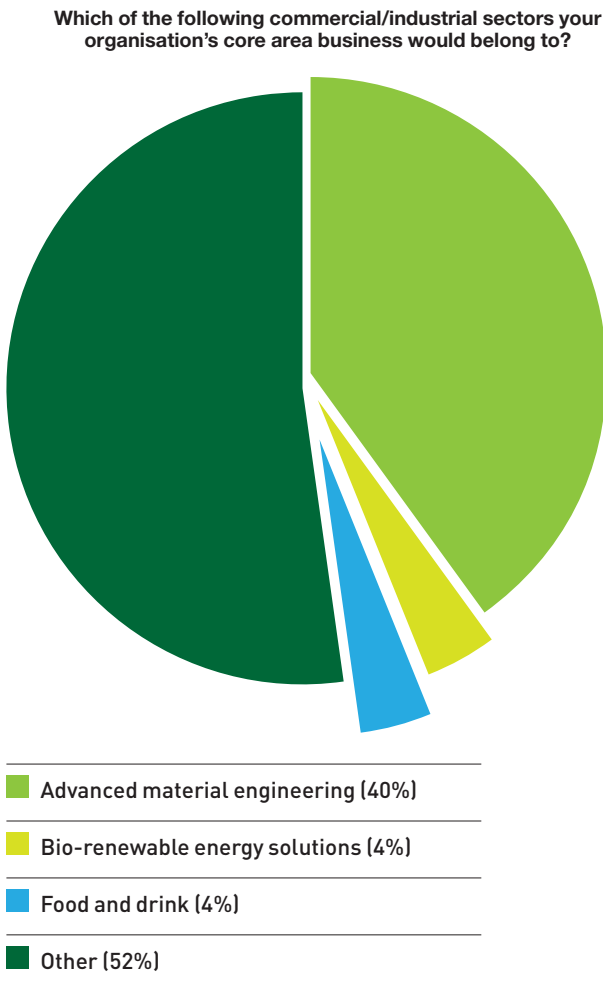


Figure 2: Firms sample core business classification

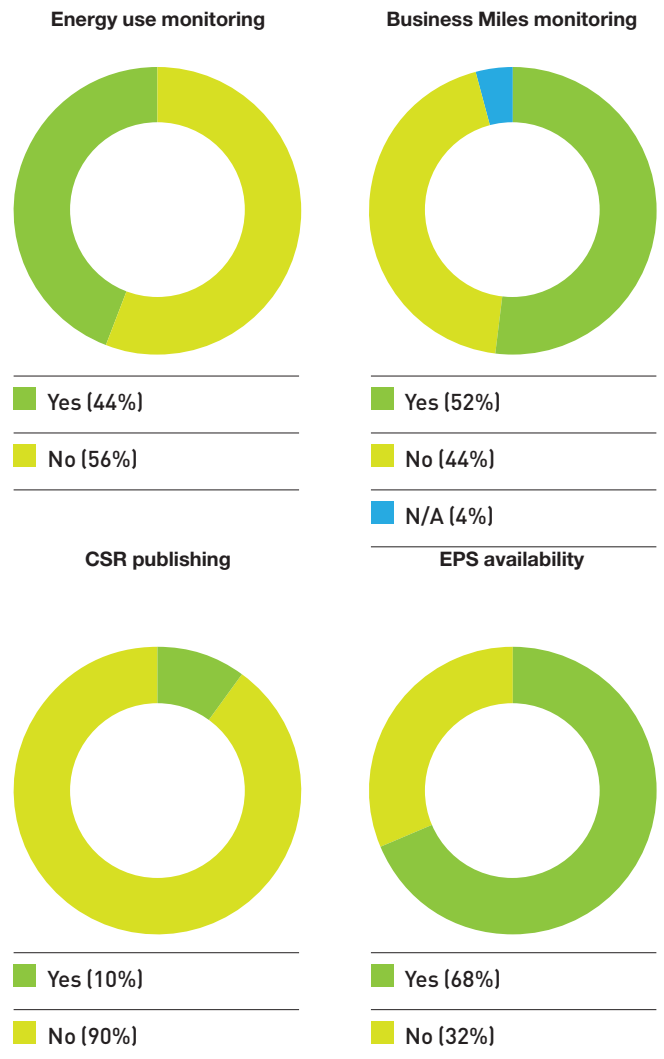


Figure 3: Interventions and report practices

Firms that employ formalised suppliers selection/ supply chain evaluation procedures were further asked to clarify, utilising a Likert scale ranging from 1 (meaning 'not relevant') to 9 (meaning 'extremely relevant'), the importance of environmental KPIs in their current evaluation system. Based on the 23 environmental indicators prescribed by the Green SCOR model⁵, just one indicator (waste production) was judged to be at least 'relevant' (a score equal to 5 in the Likert scale) by at least the 50% of the respondents to the survey (see Figure 4).

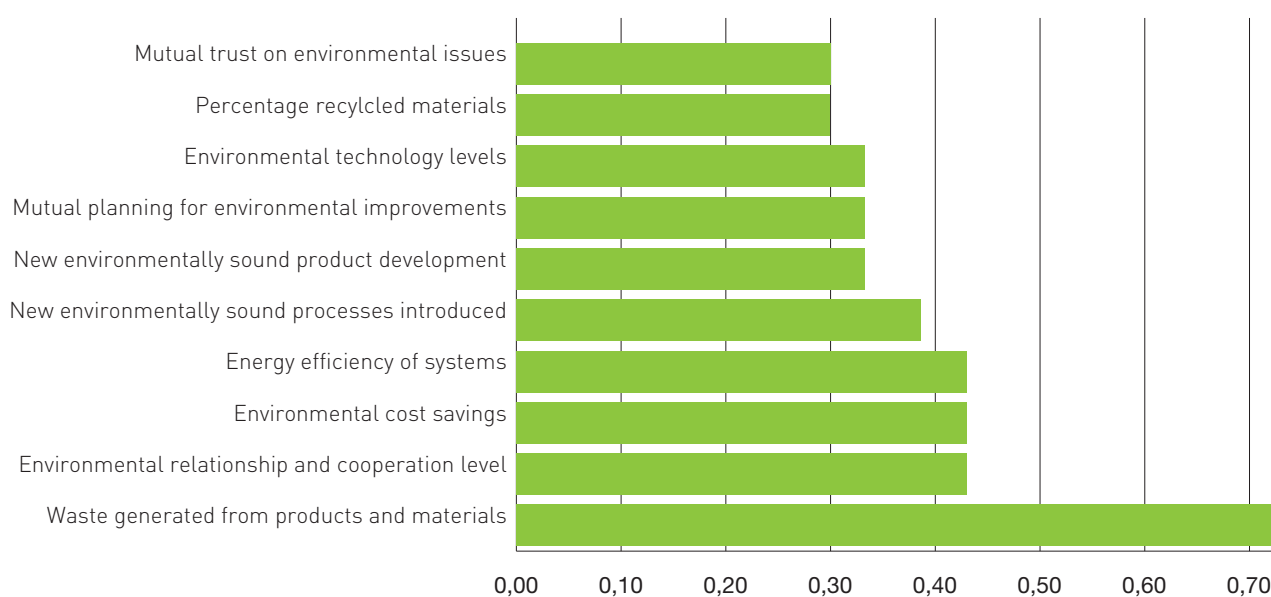
This means that firms are adopting a very traditional approach in supply chain evaluation with little focus on environmental issues from a supply chain perspective.

This result, consistent with previous studies (BPM Forum, 2009), highlights that while businesses understand the need to manage the sustainability of their supply chains, they are facing difficulties in keeping track of the results of the interventions. Firms pointed out the following points as critical in measuring sustainability performances of their own supply chain:

- lack of recognised and usable performance evaluation standards;
- huge number of dimensions to be taken into consideration for many available performance evaluation systems and lack of customisation possibilities;
- difficulties in supplier involvement; and
- accountability problems with data provided by suppliers.

Despite the fact that some 'off the shelf' standards exist, many large companies (e.g. WalMart, Skanska) are working on customised Supply Chain Evaluation Systems that include green dimensions.

Moreover, although there are examples when the three dimensions of sustainability (economic, social and environmental) have been incorporated to measure supply chain performance (Sarkis 2003), the majority of frameworks usually evaluate two dimensions of sustainability (economic and environmental) and very rarely embrace all three dimensions (Seuring and Müller 2008; Bai and Sarkis, 2010).



⁵ Supply Chain Operations Reference-model (SCOR) is a process reference model developed by the management consulting firm PRTM and endorsed by the Supply Chain Council (SCC) as the cross-industry de facto standard diagnostic tool for Supply Chain Management. For more details, see Poluha (2007).

Figure 4: Green SCOR indicators average scores

The performed survey and an analysis of the extant systems seem to suggest that both work by practitioners and in the scientific literature suffer from the following drawbacks:

- huge number of dimensions to be measured;
- intangible variables to be taken into account;
- no possibilities for score aggregation (just Balanced Score-Card Approach); and
- neglect of social dimensions.

A Performance Evaluation schema to be implemented in the Decision Support Tool being developed within the Low Carbon Supply Chain project run by CLCF, should have the following characteristics to help firms understand the impact of low carbon interventions on their own supply chains:

- reduced number of indicators/variables and flexibility in selecting a customised number of indicators;
- possibility of measuring any variable;
- possibility of calculating a final score for the whole supply chain (useful for decision making); and
- inclusion of social dimension.

Two workshops have been run in order to validate a performance evaluation framework emerging from the literature and from the preliminary results of the survey.

A KPI SYSTEM FOR SUSTAINABILITY BENCHMARKING

In general terms, a KPI is a quantitative or a qualitative measure derived from a series of observed facts that can reveal relative positions (e.g. of a country, a firm, an institution) in a given context. When evaluated at regular intervals, a KPI can identify the direction of change across different units and through time. KPIs are useful in identifying trends and drawing attention to particular issues. They can also be helpful in setting policy priorities and in benchmarking or monitoring performance. A KPI system is formed when individual indicators are brought together on the basis of an underlying model for measuring multidimensional concepts that cannot be captured by a single indicator. This is the case in sustainability issues.

For KPI systems, consideration needs to be given to the interrelationship of indicators in order to avoid having some over-weighted factors due to their correlation with other indicators (Saisana et al., 2005). For this reason, researchers have been encouraged to verify statistical relationships among indicators in order to select those which exhibit a low degree of correlation (OECD, 2008). OECD (2008) also suggests that minimising the number of variables in composite indexes and KPIs may be desirable for promoting transparency and parsimony.

Bearing this in mind, we have attempted to build a formal methodological framework to benchmark supply chains according to sustainability performance, based on a set of KPIs that have been identified for sustainability benchmarking of supply chains, especially for evaluating the impact of low carbon interventions on several dimensions.

Our framework aims to incorporate all the three dimensions of sustainability: economic, social, and environmental. The nature of these three dimensions can be obtained from the objectives of sustainable development outlined for industry by UNCSO (1998):

- within the economic dimension: promotion of economic growth, logistic efficiency, achievement of good quality levels.
- within the environmental dimension: reduction of resource use and protection of natural environment.
- within the social dimension: creation of productive employment, achieving equality.

Appropriate criteria for measuring the progress towards these objectives were selected and followed by the choice of appropriate KPIs. An attempt was made to select indicators that apply to all stages in the supply chain in order to compare the sustainability performance between the stages. The indicators in this study are purposefully generic, which enables comparison between the stages and between different products.

Initially, more than 50 indicators from different sources in the literature (Veleva et al., 2003; Hervani et al. 2005; Yakovleva, 2007) were brought together. Through a series of workshops, involving experts from academia and industry, correlations among selected indicators and their interdependencies have

been highlighted. This has resulted in a simplified framework with 26 indicators.

It has to be highlighted that all the measures can be monitored with a numerical indicator; moreover, due to the flexibility of the framework, indicators can be used as a composite framework for measuring overall performance at several levels: firm, product supply chain and industry.

The utilisation of some popular methodology for data rescaling and aggregation, like Analytic Hierarchy Process (Saaty, 1996), can allow the formulation of a synthetic score starting from the above-mentioned KPI system. In the future, case studies will illustrate this process in detail.

In the context of the Decision Support Tool under development, the KPI system will be utilised to keep track of the effectiveness of low carbon interventions from a wide range of dimensions, including but not being limited to carbon reduction. Indeed, for achieving the transition towards a balanced low carbon supply chain, carbon reduction cannot happen at the expense of social and economic performances.

KEY POINTS: FIRMS ARE ADOPTING A VERY TRADITIONAL APPROACH IN SUPPLY CHAIN EVALUATION WITH LITTLE FOCUS ON ENVIRONMENTAL ISSUES FROM A SUPPLY CHAIN PERSPECTIVE.

WHILE BUSINESSES UNDERSTAND THE NEED TO MANAGE THE SUSTAINABILITY OF THEIR SUPPLY CHAINS, THEY ARE FACING DIFFICULTIES IN KEEPING TRACK OF THE RESULTS OF THE INTERVENTIONS BECAUSE OF THE DIFFICULTY IN MEASURING IMPACTS.

ECONOMIC AND EFFICIENCY MEASURES	INDICATOR
LABOUR COST	Labour cost as percentage of product unit cost
PROFITABILITY	Focal firm net profit
THROUGHPUT TIME	Total supply chain throughput time
ON-TIME DELIVERY TO CUSTOMERS	Late order lines as percentage of total order lines
ON-TIME DELIVERY FROM SUPPLIERS	Late order lines as percentage of total order lines
BUYER FIRST TIER SUPPLIER PARTNERSHIP LEVEL	Ownership percentage
LEVEL OF DEFECT-FREE DELIVERIES TO FINAL CUSTOMERS	Defect free order lines as percentage of total order lines
LEVEL OF DEFECT-FREE DELIVERIES FROM FIRST TIER SUPPLIERS	Defect free order lines as percentage of total order lines

Table 1: Economic and efficiency measures and indicators

ENVIRONMENTAL MEASURES	INDICATOR
USE OF RECYCLED MATERIAL	Recycled material utilised in the production process as a percentage of total material (in weight or in value) per unit of product
MATERIALS SENT TO LANDFILL	Waste sent to landfill resulting from the production process as a percentage of total waste (in weight or in value) per unit of product
RECYCLED WASTE (PER UNIT OF PRODUCT)	Recycled waste resulting from the production process as a percentage of total waste (in weight or in value)
CO ₂ EMITTED (PER UNIT OF PRODUCT)	Kg of CO ₂ emitted per unit of product
ISO 14001 STANDARDS	Percentage of ISO 14001 certified facilities (across product Supply Chain)
WATER USE	Litres of water utilised per unit of product
ELECTRICITY USE	KWh of electricity utilised per unit of product
TRANSPORTATION USE	Mileage in km (or, alternatively, fuel use in litres; or, alternatively, vehicle movements) per unit of product
ENERGY USE	Energy (KWh) utilised per unit of product
PERCENTAGE OF ENERGY USE FROM RENEWABLE SOURCES/ENERGY RE-USE	Energy (KWh) use from renewable sources/energy re-use as a percentage of total energy utilised per unit of product
ENVIRONMENTAL PENALTIES	Total amount of environmental penalties and fines across product supply chain

Table 2: Environmental measures and indicators

SOCIAL MEASURES	INDICATOR
DEGREE OF JOBS LOCALISATION	Regional-based jobs as a percentage of total jobs (measurable both at focal firm and across product supply chain)
JOB SECURITY	Permanent jobs as a percentage of total jobs (measurable both at focal firm and across product supply chain)
CSR EXPENDITURE	Expenditure on CSR projects (measurable both at focal firm and across product supply chain)
DEGREE OF PURCHASING LOCALISATION	Regional-based purchases as percentages of total purchases (measurable both at focal firm and across product supply chain)
COMMUNITY	Percentage of facilities with community complaints (measurable both at focal firm and across product supply chain)
REPORTING	Percentage of firms publishing a CSR report (measurable both at focal firm and across product supply chain)
EMPLOYEE CSR TRAINING	Percentage of employees with CSR training (measurable both at focal firm and across product supply chain)

Table 3: Social measures and indicators

SECTION 3: LOW CARBON INTERVENTIONS/TECHNOLOGIES EVIDENT IN THE TRANSITION TO LOW CARBON SUPPLY CHAINS IN YORKSHIRE AND THE HUMBER

This section covers the most prevalent carbon reduction technologies and interventions disclosed within the survey and interviews. The first five interventions are related to methods of reducing supply chain emissions through collaborative working. The final five represent technologies and interventions that were disclosed as effective methods to reduce lifecycle emissions. Many other interventions were disclosed but those detailed below had, according to the company representatives consulted, returned greater reductions and were deemed extremely successful.

KEY INTERVENTIONS AND TECHNOLOGIES

The following key themes will be discussed:

1. Supply chain restructuring interventions
2. Logistics and fleet management
3. Virtual meeting systems
4. Green procurement
5. Behavioural interventions and awareness campaigns
6. Energy/resource management systems
7. Onsite renewable energy generation
8. Variable speed drives
9. Voltage optimisation
10. Heat recovery/exchange
11. Building interventions

SUPPLY CHAIN RESTRUCTURING INTERVENTIONS

WHAT IS IT/ARE THEY?

Adopting a holistic approach to supply chain redesign can help firms improve overall emissions profile and avoid trade-offs between different stages.

Indeed, implementing low carbon interventions at a firm level could result in a sub-optimal supply chain performance. Supply chain restructuring interventions include:

- **Optimising sourcing** – rather than just considering the traditional supplier selection criteria (mainly based on cost and quality parameters), firms should choose product sourcing considering suppliers' environmental performance profiles.
- **Supply chain 'de-speeding'** – the concept is based on the assumption that planned and slower transport makes for fuller and greener vehicles. The use of alternative transport modes (e.g., ships and rail) is encouraged. These objectives are achievable thanks to the optimisation of lead time requirements and delivery speed across operations. Effort in terms of demand analysis, data sharing, implementation of decision support systems and communication among supply chain actors are required.
- **Packaging reduction** – reducing the amount of packaging involved in product delivery, or adopting more environmentally friendly packaging materials, can provide several benefits, both in terms of waste creation and loading optimisation.
- **Increase reverse logistics and recycling** – this intervention is based on the improvement of returns and waste management, by integrating recycling philosophy into customer-supplier relationships throughout the supply chain. The adoption of a goods lifecycle monitoring approach and customer incentives, the replacement of raw materials with recycled ones and the design of recyclable products are key issues.
- **Develop remote shopping solutions** – through the development of e-commerce solutions, firms can achieve optimal inventory management and automate goods re-supply operations.

WHAT ARE THE BENEFITS?

All these approaches can help firms reporting carbon emissions reductions. Obviously, it is hard to quantify the impact of these interventions in terms of CO₂, as these are highly customisable and dependent on their specific contexts. The benefits include the following:

- Mitigation of price increase from suppliers who rely on fossil fuel consumption and anticipation of potential upcoming environmental tax and penalties on carbon intensive suppliers can be achieved through a more careful selection of supply chain partners.
- Reduction in fuel consumption and in transportation usage can derive from supply chain de-speeding and improved planning.
- Supply chain integrated planning, de-speeding and remote shopping solutions can result in improved demand fulfilment, reduced costs for warehousing and retailing activities and facilitate customer delivery requirements.
- Packaging reduction and introduction of reverse logistics cycles will also have the effect of reducing waste sent to landfill.

THE YORKSHIRE AND THE HUMBER CONTEXT

Specific examples from the region of firms implementing holistic supply chain restructuring interventions include:

- At **Unilever's** (a large MNE) Leeds site concerned with deodorant production, it has started to implement a supplier environmental management programme.
- **Muntons**, the leading UK malt producer based in Bridlington and Stowmarket, restructured their supply chain by developing a barley growers' cooperative with centralised collection, drying and storage facilities. The centralised collection has saved 1,700 vehicle movements and the dryer has reduced CO₂ emissions by 650 tonnes. The economic and environmental sustainability aspects helped Muntons lever £3.2 million investment from regional and European sources.
- A large retail supermarket chain based in the region, **Morrisons**, has implemented a sourcing scheme that only allows the use of certified suppliers for fresh produce.

Examples from other contexts include Carrefour France: through a programme of supply chain de-speeding it is shipping almost 50% of its merchandise by river and rail, dramatically cutting the number of trucks on the roads.

KEY POINT: ADOPTING INTERVENTIONS THAT ARE AIMED AT RESTRUCTURING THE WHOLE SUPPLY CHAIN REQUIRES THE INVOLVEMENT AND AVAILABILITY OF ALL SUPPLY CHAIN PARTNERS. THIS MAY BE CHALLENGING, EVEN IN THE FEASIBILITY STUDY PHASE, IN TERMS OF DATA AVAILABILITY AND COMPLEXITY.

LOGISTICS AND FLEET MANAGEMENT

LOW CARBON INTERVENTIONS

WHAT IS IT/ARE THEY?

Emissions from freight movements arise mainly from road transportation. Heavy Goods Vehicles (HGVs) and vans account respectively for 24% and 12% of total greenhouse gas emissions from transportation activities.

It is worth considering a broad range of low carbon interventions and technologies suited to reducing the costs and emissions associated with the transports of goods and delivery of services. These can include:

- **Aerodynamics improvement interventions** – these include add-ons to trailers and cabs based on simple cab deflectors, trailer side skirts and cab collars or more complex full-vehicle packages.
- **Tyres interventions** – as approximately 5–15% of the fuel consumed by a typical vehicle may be used to overcome rolling resistance, low-rolling resistance tyres have been designed to offer better performances and minimise rolling resistance. This category of interventions also includes the replacement of dual tyres with single wide tyres and the implementation of automatic tyre pressure adjustment monitors that can be employed to improve the vehicle efficiency in the case of long-haul vehicles operating under different load conditions and on different road profiles (Baker et al., 2010).
- **Smart driving interventions** – predictive cruise controls use electronic horizon data and GPS to improve fuel efficiency of vehicles, without any safety implications. Another option is the implementation of the so-called ‘vehicle platooning’ techniques. For companies that have large fleets, huge advantages can be achieved by adopting a driving style in which vehicles are really close to each other, in such a way to create a kind of ‘train effect’. Advantages can also be achieved by implementing drivers training schemes, such as SAFED.

- **Powertrain technologies** – this category includes a wide spectrum of hard interventions to improve technical performance of vehicles, such as: combustion systems optimisation, engine friction lowering, electrification of engine components, exhaust gases recovery systems, hybrid powertrains (capable of stopping the engine running whenever the vehicle is stationary), fuel cells and electrical engines (Baker et al., 2010).
- **Biodiesel and alternative fuel** – first generation biodiesels can be derived from vegetable oils, animal fats and alcohols. They are thought to be economically viable if oil is \$80-100 per barrel. Second generation biodiesels can be obtained from biomasses and run in any diesel engine, even though the production process is more intensive. Other viable options include alternative fuels such as hydrogen and biogas (Baker et al., 2010).

WHAT ARE THE BENEFITS?

Benefit of these approaches include:

- **Reduced emissions** – derived from better fuel consumption. Recent studies have confirmed that reduction can reach a maximum value of 6.5% in the case of simple fairings and even 10% in the case of more complex packages. Similar figures (a maximum 7% value) can be obtained with tyres interventions. It is hard to quantify CO₂ reductions achievable through smart driving systems in a precise way, due to behavioural issues involved. As regards biodiesels and alternative fuels, their impact can range in the 50-90% range (Baker et al., 2010).
- **Positive impact on vehicle safety** – as interventions improve or do not alter driving conditions.
- **Increased monitoring** – derived from use of smart systems.
- **Increased vehicle lifespan.**

THE YORKSHIRE AND THE HUMBER CONTEXT

All firms with their own fleet of delivery vehicles or haulage contract should be aware of low carbon developments relating to fleet management. Specific examples from the region include:

- **Optare** – a bus and coach manufacturer that has developed an eco-drive dashboard that is able to provide up to 15% fuel cost saving.
- **Brocklesby Ltd** – an SME based in East Yorkshire that has hugely benefitted from the implementation of fleet management reducing both costs and emissions. Fuel costs have been cut by 10% since the installation of the system, driving styles and routes can be monitored whilst their drivers are rewarded for economical and low impact driving that has the potential to increase the lifespan of their delivery fleet.

KEY POINTS: GREEN INNOVATIONS IN AERODYNAMIC DESIGN AND LOW ROLLING RESISTANT TYRES WILL GRADUALLY REPLACE THE LESS EFFICIENT CURRENT STANDARDS AS AWARENESS AND ADOPTION INCREASES; MOREOVER, COSTS FOR ALTERNATIVE FUEL ENGINES ARE LIKELY TO DECREASE WITH TIME.

FIRMS THAT UTILISE EITHER THEIR OWN FLEET OF VEHICLES OR SUBCONTRACT TO HAULIERS CAN REDUCE EMISSIONS. AS WELL AS INVESTMENT IN TECHNOLOGY, BEHAVIOURAL INTERVENTION CAN ALSO MAKE A DIFFERENCE.

DESPITE THE MOST EFFECTIVE INTERVENTIONS BEING HIGH COST (ALTERNATIVE FUELS AND BIODIESEL VEHICLES, HYBRID ENGINES), SOME OF THE INTERVENTIONS THAT FLEET MANAGEMENT CONSIDERED CAN BE CHARACTERISED BY LOW COST AND HIGH IMPACT.

FOR INSTANCE:

AERODYNAMICS INTERVENTIONS CAN BE IMPLEMENTED WITH LIMITED AMOUNT OF MONEY (£250 FOR TRAILER ROOF TAPERING TO £1,700 FOR CHASSIS PANELS).

LOW ROLLING RESISTANCE TYRES ARE AVAILABLE AT NO ADDITIONAL PURCHASE COST.

COST PER ECO-DRIVING SESSION IS AROUND £250.

THESE INTERVENTIONS SHOULD BE CONSIDERED NOT ONLY AT A FIRM LEVEL – FOCAL FIRMS SHOULD ENCOURAGE SUPPLY CHAIN PARTNERS TO ADOPT THEM WITHIN THEIR OWN OPERATIONS.

VIRTUAL MEETINGS: SUITES AND TECHNIQUES

WHAT ARE THEY?

Virtual meetings via conference calling, video conferencing or web-based applications have been introduced to complement and sometimes replace the requirement of face-to-face meetings. ICT based systems include the use of WEBEX, Skype or Microsoft Office Live Meeting. Some companies also have dedicated video conferencing suites that mimic the traditional round table business meeting.

WHAT ARE THE BENEFITS?

The benefits associated with moving to virtual conferencing are multiple, fulfilling social, economic and environmental ends.

- Reductions in the costs and emissions associated with business travel.
- Reductions in the costs relating to venue hire, catering and hotel accommodation.
- Decrease in staff fatigue due to reduced travelling load.
- Reduction in staff down time whilst travelling to and from meetings.
- Wider availability for participation.
- Greater flexibility to meet up with staff and supply chain partners in different locations.
- Automated record keeping from meetings on some applications.

Video conferencing is available at low cost to a wider range of organisations – the increased use of virtual meetings and web-based communication in general also allow workers greater flexibility, such as home working. It also helps businesses establish and maintain relations with distant supply chains, which is important given the trend for domestic and international out-sourcing evident across all sectors.

THE YORKSHIRE AND THE HUMBER CONTEXT

The use of virtual meetings was commonplace amongst interviewees throughout firms in Yorkshire and the Humber. There was an economic motive to the switch from face-to-face meetings but there was also a strong awareness of the staff time that could also be saved. The regional examples below demonstrate this.

- **Wardell Armstrong** – increasingly used their virtual meeting suite for intra and inter-firm meetings. Further benefits were gained by using the system as a means of delivering training to staff spread out amongst the firm's national offices. This saved money from the reproduction of training sessions and/or the cost of personnel travelling to training events.
- **Northern Foods PLC** – the corporate and social responsibility director was keen to reduce the costs, environmental impacts and burden of the multiple inter-site meeting. In order to do this, more meetings were undertaken via conference calling or web-based meeting software. A business case was proposed using calculation on average costs, distances driven, and time lost and from these calculations the following potential (per annum) impacts were produced:
 - 2.4 million road kilometres saved
 - 12.8 years of work time saved across the organisation
 - £240,000 money saved
 - 380 tonnes of carbon saved – 1.5% of overall emissions.

KEY POINT: THERE REMAINS A CULTURE WITHIN SOME BUSINESSES THAT FACE-TO-FACE CONTACT IS ALWAYS NECESSARY. BUSINESSES SHOULD BE ENCOURAGED TO TRIAL VIRTUAL MEETING TECHNIQUES BECAUSE IT IS ONLY THROUGH USING THESE APPLICATIONS THAT AN APPRECIATION OF THEIR EASE OF USE AND COMPARABILITY TO FACE-TO-FACE BUSINESS CONTACT CAN BE GAINED.

ENERGY AND CARBON AWARENESS CAMPAIGNS

WHAT ARE THEY?

Energy awareness campaigns are synonymous with attempts to reduce emissions across all sectors of the UK economy and are often seen as the low cost option to initiate a CO₂ reduction strategy. However, the success of such approaches hinges on several factors: the resources dedicated to starting and maintaining the campaign, the effective engagement of staff and building energy awareness/behaviour into the everyday working practices of staff.

WHAT ARE THE BENEFITS?

The benefits of energy awareness campaigns can be difficult to quantify as behavioural changes and their motives are notoriously difficult to meaningfully measure. Despite this, energy awareness campaigns can be a low cost and low risk method to initiate or consolidate a carbon reduction strategy. Benefits include:

- cost savings relating to energy efficiency;
- CO₂ emissions reductions;
- enhanced corporate image and green credentials;
- motivated staff and enhanced communication via cross department collaboration; and
- the identification of further CO₂ reduction opportunities by staff involved.

THE YORKSHIRE AND THE HUMBER CONTEXT

There were several firms within the sample who had embedded their energy awareness campaigns within structures of corporate governance and the everyday working practices of personnel throughout the organisation. Companies with successful awareness schemes had a strong recognition that behavioural changes in the workplace could lead to significant reductions in energy usage and their associated emissions. The following examples emphasise this:

- **Northern Foods PLC** had a commitment to promoting energy awareness. Feedback from staff as well as their energy management system had helped them identify a number of opportunities to reduce energy consumption. One of these utilised traffic light stickers on machinery to inform staff whether it should be turned off. The awareness campaign and stickers reduced energy consumption by 28% at this branch.

- Operating out of multiple global offices, **DLA Piper** had embedded low carbon practices in most areas of work. Supported by a motivated executive board, an environmental policy and strategy is in place governing environmental procurement, sustainable travel, environmental awareness and the energy efficiency of buildings and equipment.
- The maltster **Muntons PLC** have hosted several supply chain events dedicated to their goal of producing 100% low carbon malt within five years. These events have attracted interest from international buyers, fertiliser producers, barley growers and cooperatives and represent a good example of what is possible when time is taken to engage supply chain partners. The events had enhanced relations throughout the supply chain and prompted interest in the benefits and opportunities of low carbon working.

KEY POINTS: TO MAKE AN ENERGY AWARENESS CAMPAIGN EFFECTIVE ACROSS THE SUPPLY CHAIN REQUIRES THE INVOLVEMENT OF SUPPLY CHAIN PARTNERS AND PERHAPS OTHER STAKEHOLDER ORGANISATIONS THAT CAN HELP ORGANISE EVENTS AND DISSEMINATE INFORMATION REGARDING EMISSIONS REDUCTIONS IN SECTORS THAT MAY VARY WIDELY.

INTERVIEWEES OFTEN REFERRED TO 'SIMPLE THINGS' SUCH AS TURNING OFF LIGHTS AND REDUCING ROAD EMISSIONS. HOWEVER, FEW POLICED THESE ISSUES UNLESS ENERGY CONSUMPTION WAS MONITORED ON A REGULAR BASIS TO IDENTIFY WASTE. THERE WAS OFTEN A FAILURE TO EMBED AWARENESS CAMPAIGNS WITHIN ORGANISATIONAL STRUCTURES, WHICH MEANT IMPACT FADED POST-CAMPAIGN.

AWARENESS CAMPAIGNS WERE REGARDED BY SOME AS A SERVICE SECTOR FIX. HOWEVER, EVIDENCE FROM COMPANIES IN INDUSTRIAL AND MANUFACTURING SUGGEST THAT AWARENESS CAMPAIGNS CAN LEAD TO ENERGY SAVINGS OR THE IDENTIFICATION OF ENERGY SAVING OPPORTUNITIES IN OTHER SECTORS.

ENERGY/RESOURCE MANAGEMENT SYSTEMS

WHAT IS IT/ARE THEY?

Energy Management Systems (EMS) are a combination of software, data acquisition hardware (for example, smart meters) and communication systems to collect, analyse and display information to aid commercial building energy managers, facility managers, financial managers and utilities companies in reducing utilities usage and costs. Originally designed for the automated control and monitoring of the heating, ventilation and lighting needs of a facility/building (or group of them), most of these Energy/Resource Management Systems also provide readings of electricity, gas and water meters and others also measure waste produced.

WHAT ARE THE BENEFITS?

This technology helps performing key energy management functions such as:

- Facilitating the management of energy usage in the building or facilities.
- Managing energy costs, by avoiding unnecessary consumption.
- Trending and monitoring energy consumption.
- Identifying energy consumption anomalies.
- Facilitating automated and consistent reaction to events.
- Providing a means to gather and view information quickly.

Reductions in energy use will also result in CO₂ reductions – the specific figures will vary based on the context and on the kind of implementation.

THE YORKSHIRE AND THE HUMBER CONTEXT

Energy/Resource Management Systems are most effective in businesses with a variety of energy consumption processes that require monitoring to ensure environmental KPIs are met. They are also suited to firms with branch plants as they can be used to monitor and compare energy and resource use between locations.

Northern Foods' Head of CSR explains the situation prior to the installation of the resource management system:

“Before we had the energy management system in place it was just too difficult to see the big picture... now we operate on a principle of what gets measured, gets done. As soon as the system was implemented, plant management found it a really useful tool with practical energy savings applications. In most cases, this intervention alone has produced a four per cent reduction in energy costs without further investment.”

(Northern Foods, PLC,)

KEY POINTS: DURING RECENT YEARS NUMEROUS DEVELOPERS AND VENDORS HAVE BEEN DEVELOPING THESE PRODUCTS IN A HIGHLY COMPETITIVE MARKET. COSTS FOR SUCH SYSTEMS MAY VARY GREATLY DEPENDING ON SYSTEMS CAPABILITIES, HOW THEY ARE MARKETED AND IMPLEMENTED. HOWEVER, BESIDES COST ASPECTS (MANY SYSTEMS CLAIM TO HAVE VERY SHORT PAYBACK PERIODS) THE IMPLEMENTATION CAN BE CHALLENGING IN TERMS OF DATA COLLECTION, ESPECIALLY IF FIRMS HAVE A DISTRIBUTED STRUCTURE (ACROSS MORE FACILITIES).

OF COURSE, THE IMPLEMENTATION OF SUCH SYSTEMS CAN FACILITATE ENERGY BENCHMARKING, OPTIMISE UTILITY PROCUREMENT, AND HELP MANAGE OVERALL ENERGY COSTS. MOREOVER, EMS ALLOW FIRMS TO MONITOR BRANCH PLANTS' RESOURCE CONSUMPTION: THEY CAN EXAMINE DATA FOR DIFFERENCES, TRIAL INTERVENTIONS AT DIFFERENT SITES, EXAMINE OUTCOMES AND CREATE COMPETITION BETWEEN DIFFERING LOCATIONS. EMS CAN ALSO IDENTIFY UTILITIES CONSUMPTION HOTSPOTS AND IMPLEMENT SUITABLE INTERVENTIONS.

ONSITE RENEWABLE GENERATION

WHAT IS IT?

Onsite renewable energy generation, such as wind, solar, biomass and air/ground source heating, can provide power to a business while reducing its reliance on fossil fuels and minimising CO₂ and other greenhouse gas emissions. Onsite renewable generation benefits from government incentives such as FiTs, which provide a fixed rate for renewable energy that is generated and used by businesses and households in the UK.

WHAT ARE THE BENEFITS?

Businesses installing onsite renewable energy generation capacity can benefit from reduced energy bills and CO₂ emissions. Onsite renewable energy projects can be cost-effective and have the following benefits:

- Provide security against rising energy costs.
- Provide a certain amount of energy independence (dependent upon scale of the scheme/investment).
- Reduction in business related CO₂ emissions.
- Provide a source of income through ROCS and FiTs.
- Attract incentives such as Enhanced Capital Allowances that reduce initial capital costs.
- Can be used to generate positive publicity.
- The energy produced in time may facilitate the incorporation of other environmental schemes not presently deemed to be viable – e.g. onsite water treatment and recycling.

THE YORKSHIRE AND THE HUMBER CONTEXT

The installation and use of onsite renewables by companies within Yorkshire and the Humber was the exception rather than the rule. However, even with the long-term payback, firms that had invested were certain that their decisions would return economic payback as well as significantly reducing emissions. For example, Croda Chemicals manufacturing facility in Hull has reduced the site's imported electricity demand by 40% by installing a 2MW wind turbine, which at full output will exceed the site requirements allowing them to export electricity back to the grid. Other firms that had considered onsite renewables had been delayed or put off by planning disputes as well as the large amounts of investments needed with relatively long paybacks in comparison to other carbon reduction interventions.

KEY POINTS: THE WIDESPREAD ADOPTION OF ONSITE RENEWABLE ENERGY GENERATION THROUGHOUT SUPPLY CHAINS REPRESENTS AN OPPORTUNITY FOR ALL BUSINESSES TO REDUCE CO₂ EMISSIONS ASSOCIATED WITH THE CONSUMPTION OF GAS AND OR ELECTRICITY.

AT PRESENT, FIRMS ARE HESITANT TO COMMIT TO ONSITE RENEWABLE ENERGY DUE TO THE UPFRONT COSTS, LONG PAYBACK PERIODS, UNCERTAINTIES (CONCERNING THE TECHNOLOGY AND INCENTIVES), AND LACK OF EXPERTISE.

VOLTAGE OPTIMISATION

WHAT IS IT?

Voltage optimisation refers to reducing the electricity voltage supplied to a site in order to reduce losses in equipment. Voltage optimisation has recently received increasing interest from business as an effective means of reducing electricity bills, with savings of up to 15% being realised on many sites and up to 20% on others. Savings are accrued because the voltage supplied to many business sites is presently much higher than required, leading to excessive losses in many types of equipment. Voltages may be higher than necessary because of the need to allow for voltage drops across the supply network, but it is also a consequence of the harmonisation of supply voltage throughout Europe. European voltage harmonisation means that most equipment sold in the UK will work on 220v whilst the UK national grid operates at around 240v. That means most businesses are using 20v that they don't need whenever they use electrical equipment. This over-voltage increases energy consumption and decreases the life of electrical equipment.

WHAT ARE THE BENEFITS?

- Financial savings due to a reduction in energy consumption.
- CO₂ saving relating to the increased energy efficiency.
- Savings on equipment and maintenance as the lifetime can be extended due to running at a reduced voltage.
- Protects electrical equipment from energy spikes and surges.

THE YORKSHIRE AND THE HUMBER CONTEXT

The company quoted below was a clear example of the benefits that voltage optimisation can offer. This firm received a guarantee from the device installer ensuring that if savings (a guaranteed reduction in consumption of 9% in this specific case) were not realised, the device would be removed and payment reimbursed.

“The voltage here is around 252 Volts. Basically we don't need that much to run this plant, so the voltage optimiser will drop our demand from the grid down to meet exactly what the plant requires, and if there's any fluctuations or modulations in the power, then it will read those and all the harmonics and take them out, so you are basically just providing exactly the right amount of power to run the plant efficiently.”

(Food and drink, SME, West Yorkshire)

Despite the fact that voltage optimisation is proven technology, others in Yorkshire and the Humber are unsure about its viability and cost saving potential. In these circumstances firms should talk to a specialist consultant but may be put off by aggressive sales tactics.

Voltage optimisation is not bespoke to any one firm and there are a number of suppliers and installers on the market. The savings for such technology is dependent upon the type and size of firm as well as the voltage supplied to their site/s. Interviewees claimed paybacks between one and five years, backed up by a savings/money back guarantees for the first year of operation.

KEY POINT: MANY FIRMS IN YORKSHIRE AND THE HUMBER CONSIDER EMISSIONS REDUCING TECHNOLOGICAL SOLUTIONS SUCH AS VOLTAGE OPTIMISATION TO BE NOVEL AND RISKY. PROVEN TECHNOLOGY THAT GENERATES SAVINGS IN ENERGY CONSUMPTION AND ASSOCIATED EMISSIONS REQUIRES PROMOTION. THIS WOULD SUPPORT THE BUSINESS DECISIONS OF THOSE WHO ARE UNCERTAIN OF THE BENEFITS AND FACILITATE THE ONGOING TRANSITION TOWARDS LOW CARBON SUPPLY CHAINS.

HEAT EXCHANGE/RECOVERY

WHAT IS IT?

Heat exchange or recovery refers to the collection or recovery of heat from an industrial process. The technology is able to reduce process emissions, provide the heat required in other processes, or re-circulate heat on the site as an efficient source of heating. The Carbon Trust suggests that efficiency savings of up to 30% can be made through heat recovery technologies.

WHAT ARE THE BENEFITS?

Energy recovery can be used in relation to many different processes and the payback on each installation is likely to vary. However the likely benefits are:

- Payback period of two to five years.
- Energy/emissions saved by utilising waste heat.
- Cumulative efficiency as other heating systems are downgraded or made obsolete.

Savings and payback are greatest for firms with long operating hours who have a stable potential heat source as well as a demand for the recovered heat produced.

THE YORKSHIRE AND THE HUMBER CONTEXT

Heat recovery systems were used by a range of businesses but were most common within the food and drink sector where constant sources of heat were available as well as other demands for heat sources. Installations occurred in SMEs and larger enterprises although some smaller companies were unsure whether they would benefit from investment in heat recovery plants. An example from the region includes:

- **Boormalt** in Knapton uses a large amount of energy during the malting barley production process. In the past the heat generated from the kilning process was lost from the system. Boormalt now employs heat exchange technology that allows them to save energy by utilising what was waste heat and in doing so have reduced their comparative gas consumption by 25%.

KEY POINT: ALTHOUGH MANY FIRMS ARE TAKING ADVANTAGE OF THE BENEFITS OFFERED BY HEAT RECOVERY IT WAS FELT THAT IT REMAINS UNDER-UTILISED ACROSS SECTORS AND SUPPLY CHAINS DUE TO LACK OF AWARENESS OF THE OPPORTUNITIES AND/OR THE CAPITAL REQUIRED FOR INSTALLATIONS.

VARIABLE SPEED DRIVES

WHAT ARE THEY?

A variable speed drive is a piece of equipment that regulates the speed and rotational force, or torque output, of an electric motor to make it more energy efficient. Several of the firms interviewed during this project had switched, or were in the process of switching, to variable speed drive motors to power their processes.

WHAT ARE THE BENEFITS?

The main benefit of installing a variable speed drive is the savings that are made on energy consumption. The Carbon Trust estimates that motors and drives, used for processes including compressed air, pumping water, and extraction fans, consume two thirds of the energy consumed by UK industry. The running costs of inefficient drives and motors represent an unnecessary drain upon finances as well as needless emissions. According to ABB a variable speed drive can reduce energy consumption by as much as 60% – for a 90 kW motor in continuous duty, this can mean over £9,000 per year. This is because the variable speed drive reduces the amount of energy drawn by the motor and even a small reduction in speed can give significant savings. For instance, a centrifugal pump or fan running at 80% speed consumes only half of the energy compared to one running at full speed. The benefits are:

- Reductions in energy consumption.
- Tighter control of processes.
- Extended equipment life and reduced maintenance.
- Reduction of problems relating to full voltage start-up of motors.

THE YORKSHIRE AND THE HUMBER CONTEXT

Variable speed drives were cited regularly by manufacturing companies as a popular method of improving energy efficiency. Although they were considered more expensive than traditional drives, the savings and payback usually outweighed the investment barrier. Examples from the regions include:

- International specialist valve manufactures **Broady Flow Control Ltd** has recently installed variable speed drives on its factory air compressor, reducing energy consumption by approximately 30%. Broady levered 50% of the funding from the Carbon Trust significantly reducing the payback period. Overall the project will reduce their emissions by an estimated 20 tonnes/CO₂.
- Stainless steel producer **Outokumpu**, based in Sheffield, has reduced its annual energy expenditure by £300,000 by installing of variable speed drives on extraction fans. The installation achieved comparative savings of 15% against the previous extraction plant and accounted for half of the site's CO₂ reduction for 2010.
- Wire producer **Bridon International** has installed variable speed drives on water extraction pumps. The system has been in operation for several months and, despite a few minor teething problems with blockages, early calculations suggest a 20% saving due to the plant's greater efficiency, not including savings on water and the costs associated with the downstream chemical treatment of the effluent.

KEY POINT: LIKE VOLTAGE OPTIMISATION, VARIABLE SPEED DRIVES ARE PROVEN TECHNOLOGY WITH THE ABILITY TO IMPROVE ENERGY EFFICIENCY DRAMATICALLY. DESPITE THIS SOME COMPANIES REMAIN UNAWARE OF THE BENEFITS AND POTENTIAL SAVINGS THAT THEY OFFER.

CONCLUSIONS

To conclude, there is a great deal of commendable work being undertaken in Yorkshire and the Humber by firms and their respective supply chains seeking to lower the CO₂ emissions of their products, processes and services. There are examples where firms have developed strong and effective working relations with partners to promote and implement supply chain wide emissions reduction. Despite widespread evidence of intra-firm emissions reduction activities, inter-firm supply chain activities to reduce emissions is less common.

However, because there are fewer examples of joined-up effective supply chain working to reduce emissions we can draw clear comments concerning the methods that these exceptional firms use successfully. These are listed below.

The first is the importance of multi-agency involvement. Firms that had successfully engaged with their supply chain partners to reduce emissions had done so with the support of outside agencies. Universities, trade bodies, CO₂ reduction support agencies and consultants had all been drawn upon successfully. The use of external bodies increased firms' capacities to engage with suppliers and provided further guidance and help with the logistics of getting relevant parties together from differing businesses and sectors. The presence of an outside agency often helped to provide credibility to projects and, in certain circumstances, enhanced firms' ability to lever external funding to support emissions reductions expenditure within their supply chains.

Developing a forum for supply chain communication relating to CO₂ emissions reductions was also a vital component of successful emissions reduction initiatives. These forums were often set up to discuss supply chain issues more widely, but could also be used to share information and promote low carbon initiatives throughout the supply chain. Events required a high degree of organisation and promotion to ensure supply chain-wide, cross-sector involvement. The benefits of such events not only enhanced low carbon knowledge and action across the supply chain, they also created a useful forum for networking and other business collaborations.

Carbon footprinting and lifecycle emissions investigation were of vital importance to establishing and sustaining low carbon supply chain collaboration and action. Companies keen to reduce supply chain emissions had often undertaken initial investigations concerning the lifecycle emissions of their products and services. The very nature of such an examination led them to consider the emissions of their supply chain partners and often led to them establishing contact with firms throughout their supply chain. Such investigation facilitated communication and dialogue between firms as well as sharing information concerning emissions reduction activity and potential. Most of the firms interviewed during this project had received enquiries about their emissions and/or the carbon footprint of their products and services from companies within their respective supply chains and this had stimulated consideration of the need to reduce emissions to safeguard future contracts.

During the interviews with firms, personnel disclosed that supply chain partners were increasingly introducing environmental assessment into their procurement contracts and/or that they were considering how best to do so. Despite the interest in green procurement criteria, companies across all sectors were finding it difficult to establish a weighting system for environmental aspects in procurement against traditional criteria such as cost, quality and the reliability of supply. Companies that were required to meet green procurement criteria often acted accordingly to meet them, where possible and practical. Within companies not subject to green procurement contracts, there was a growing perception that they should seriously consider their environmental impact to futureproof both their economic and environmental sustainability in light of increased attention due to the transition towards a greener economy.

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APPENDIX 1: LIST OF ABBREVIATIONS

BAT – Best Available Techniques
CCA – Climate Change Agreement
CCC – Committee on Climate Change
CCL – Climate Change Levy
CLCF – Centre for Low Carbon Futures
CRC – Carbon Reduction Commitment
CSR – Corporate Social Responsibility
ECA – Enhanced Capital Allowance
EFFP – European Farming Foods Partnership
EMAS – Eco Management and Audit Scheme
EMS – Environmental Management System
EST – Energy Savings Trust
EU ETS – European Union Emissions Trading Scheme
FDF – Food and Drink Federation
FITs – Feed-in Tariffs
FOE – Friends of the Earth
ICT – Information Communication Technology
IPPC – Integrated Pollution Prevention Control
KPI – Key Performance Indicator
MAS – Manufacturing Advisory Service
MNE – Multi-National Enterprise
PLC – Public Limited Company
ROCs – Renewable Obligations Certificates
SCC – Supply Chain Council
SME – Small to Medium Sized Enterprises

APPENDIX 2: INTERVIEW LIST: STAKEHOLDER ORGANISATIONS AND AGENCIES INVOLVED IN THE TRANSITION TOWARDS LOW CARBON SUPPLY CHAINS IN YORKSHIRE AND THE HUMBER

Business in the Community
Carbon Ready Ltd
Carbon Trust
CO₂Sense Yorkshire
EEF: The Manufacturers' Organisation
Energy Saving Trust
Food and Drink Federation
Friends of the Earth
Manufacturing Advisory Service
Renewable Energy Association

APPENDIX 3: FIRMS CONSULTED VIA INTERVIEW

Associated British Ports
Atlantic Fresh Ltd
Bericap UK Ltd
Black Sheep Brewery
Boortmalt
Bridon International
Broady Flow Control Ltd
Brocklesby Ltd
Cranswick PLC
DLA Piper LLP
Donaldson Filtration Solutions
GWE Biogas
Heron Foods
Marr Group
McCain Ltd
Muntons PLC
Northern Foods PLC
Outokumpo
Sheffield Forgemasters International Ltd
Theakstons
Vivergo BP
Wardell Armstrong LLP
Wold Top Brewery

APPENDIX 4: BUSINESS ADVISORY GROUP ORGANISATIONS

Barnsley and Rotherham Chamber of Commerce
Brocklesby Ltd
DLA Piper LLP
Doncaster Chamber of Commerce
Manufacturing Advisory Service
Muntons PLC
NAMTEC
Rolls-Royce PLC
Sheffield Chamber of Commerce
Sheffield Forgemasters International Ltd
TATA STEEL
Unilever

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ABOUT US

The Centre for Low Carbon Futures is a collaborative membership organisation that focuses on sustainability for competitive advantage. Founded by the Universities of Hull, Leeds, Sheffield and York, the Centre brings together multidisciplinary and evidence-based research to both inform policy making and to demonstrate low carbon innovations. Our research themes are Smart Infrastructure, Energy Systems and the Circular Economy. Our activities are focused on the needs of business in both the demonstration of innovation and the associated skills development. Registered in the UK at Companies House 29th September 2009 Company No: 7033134.

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