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CARBON-FOOTPRINT REPORTING AS A TOOL TO SUPPORT SUSTAINABLE PRACTICES FOR SCOTTISH SMEs

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ABSTRACT

Construction Small and Medium Sized Enterprises (SMEs) in Scotland significantly contribute to the local and regional economy, however, their economic performance and business competitiveness lags behind other regions in the UK and EU. This paper reports on the general awareness of Scottish construction SMEs on a spectrum of sustainability issues and the legislation that impacts their business processes. We pose the primary research question; 'What awareness do Scottish SMEs have of sustainable practices and how are they addressing their carbon-footprint?' The research proposition is that construction SMEs are no different to the vast majority of other Scottish SMEs which currently, have little knowledge of sustainable business practices and are unaware of how they can improve to become more sustainable resulting in more competitive practices.

The research examines knowledge of sustainability and factors relating to carbon-footprinting. The research work involves a case study. The case study work has been undertaken on a construction SME eager to improve their carbon-footprint. The research will give an indication of the value of a carbon-footprint as an empirical measure of sustainable function within organisations. The paper is

concluded with recommendations on how SMEs may improve their sustainability by managing their carbon-footprint based on the findings from the case study work undertaken.

Keywords: Carbon-Footprint, Construction, SMEs, Sustainability

1. INTRODUCTION

Increasing significance has been associated with the terms “sustainability” and ‘climate change’ over recent years (United Nations, 1992). Human activities contribute to global warming through the release of greenhouse gases which are directly linked to energy use (IPCC, 2007a). Carbon dioxide emissions are on the increase and it is for this reason that their relation to sustainability issues has become increasingly apparent (IPCC, 2007b). Sustainability encompasses three broad principles; achieving a sustainable economy, environmental protection and social development (Brundtland, 1987). By addressing sustainability, local and global action can be taken to reduce the negative impacts of climate change (United Nations, 1992b).

Climate change is now a very important issue both environmentally and economically for businesses in Scotland (The Scottish Parliament, 2005). With the facts of climate change widely accepted by the scientific world, and increasingly by the political world, the potential impacts both from and for business are serious (IPCC, 2007c). With general consensus that greenhouse gas (GHG) emissions from human activity are shifting the planet’s balance and driving climatic change, there is now, more than ever, increasing pressure from the Government and consumers to reduce them (HM Government, 2006).

The main greenhouse gases, sometimes known as the “Kyoto basket of six” are

1. Carbon Dioxide (CO_2)
2. Methane (CH_4)
3. Nitrous Oxide (N_2O)
4. Hydrofluorocarbons (HFCs)
5. Perfluorocarbons (PFCs)
6. Sulphur Hexafluoride (SF_6)

By calculating the amount of these greenhouse gases that a business produces whilst undertaking its day to day operations, it is possible to understand the contribution made by that business to climate change (HM Government, 2006).

For the sake of clarity, in this study the amounts of all the GHG emissions are converted first to CO_2 equivalents and then tonnes carbon.

1.1 The Cost of Carbon

Progressively more governments around the world are taxing and regulating GHG emissions, with potential serious financial implications for businesses (Trucost, 2006). As a result carbon emissions carry a real financial impact. This has been highlighted by the introduction of the EU Emissions Trading Scheme in January 2005, which has been responsible for approximately 50% of the remarkable price increases in electricity prices in Europe (Netregs, 2005a). Current predictions for the price of carbon in the European market place suggest values in the region of US$ 25 per tonne carbon (Harris, 2006). This is likely to remain fairly stable, for at least the first commitment period of the Kyoto Protocol (2008 to 2012), as long as the current legislative instruments remain in place. Introduction of more ambitious reduction targets and technologies could change this value and its subsequent impact on Scottish SMEs (DEFRA, 2007). The increasing numbers of regulations, now implemented in Europe and elsewhere,

which seek to control the GHG emissions of companies present both opportunities and challenges for businesses (Carbon Trust, 2006).

1.2 Carbon-footprint

For a business to understand how financial performance may be affected in the future, it is important that those accountable for the business understand the impact of the GHG emissions that their business produces. Economic activity and carbon emissions are closely correlated. This means that as companies grow economically, the associated increase in carbon emissions results in a greater impact on climate change (Carbon Trust, 2006). Thus, the carbon-footprint can be used as a business performance indicator and by monitoring the carbon-footprint it is possible to provide an ongoing understanding of a business' sustainability and competitiveness.

2. RESEARCH METHODOLOGY

The aim of the research was to answer the research question; 'What awareness do Scottish SMEs have of sustainable practices and how are they addressing their carbon-footprint?' The research proposition was that construction SMEs are no different to the vast majority of other Scottish SMEs which currently, have little knowledge of sustainable business practices and are unaware of how they can improve to become more sustainable and, consequently, more competitive. The findings of the study conducted by Netregs shows that levels of environmental awareness among SMEs across the UK concur with this proposition (Netregs, 2005b).

2.1 Case Study

'A case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context' (Yin, 2003). A case study is described by Creswell (Creswell, 1998) as; 'an exploration of a 'bounded system' or a case (or multiple cases) over time through detailed, in depth data collection involving

multiple sources of information rich in context.' The case study used in this study is focused on a 'live' company that has been able and willing to provide 'multiple sources of information' in relation to their energy consumption, transport use, and waste generation with a view to improving their carbon-footprint.

2.2 Types of Case Studies and Sources

There are a number of different sources of evidence that may be used in case study research, these are; documentation, archival records, interviews, direct observations, participant observations and physical artifacts and a number of strengths and weaknesses have been identified for each (Yin, 1994). This study has used 'documentation' in a variety of forms including electricity and gas bills, fuel use accounts, and waste transfer tickets. A site visit also provided interviews and direct observations of operational practices. The case study provides an excellent starting point for this research and as a basis for generalisations to be made in identifying what recommendations can be made that is transferable to other companies of a comparable size with similar operations.

2.3 Strengths and Weaknesses of Case Study Research

There are a number of strengths and weaknesses associated with the use of documentation in the case study method, highlighted by Yin (1994); these are outlined in Table 1.

Table 1 – Strengths and Weaknesses of Documentation in Case Study Research (Yin, 1994)

Strengths	Weaknesses
Stable – can be reviewed repeatedly	Retrievability – can be low
Unobtrusive – not created as a result of the case study	Biased selectivity if collection is incomplete
Exact – contains exact names, references, and details of an event	Reporting bias – reflects (unknown) bias of author
Broad coverage – long span of time, many events and many settings	Access – may be deliberately blocked

The research has attempted to address these weaknesses by ensuring high retrievability in the sense that as much information as possible relating to the data used to calculate the carbon-footprint has been obtained whilst also preventing any biased selectivity. The work has been undertaken by the Sustainability Centre in Glasgow at Glasgow Caledonian University which is independent from the case study company preventing any reporting bias, and finally access was not an issue in this study as the company was willing to share this information to obtain an accurate representation of their carbon-footprint at the end of the study.

2.4 The Case Study Carbon-footprint

For the research study, the team identified a company to be used as a case study and also as a baseline for future carbon-footprinting calculations for SMEs [the European definition of an SME has been used which are those companies which have fewer than 250 employees and less than £26m turnover p.a. It should be noted that this covers a range of companies from micro companies with one to nine employees to the medium sized company which may have 200 plus employees]. The company chosen is a Scottish based construction SME which is eager to improve their company's carbon-footprint.

The case study company is a small company with a staff of 65, who manufacture and install joinery products and manage fit-out projects across a range of sectors. The company participates in the 'Promoting Sustainable Business Competitiveness in Construction SMEs' programme, run by the Sustainability Centre based in Glasgow Caledonian University.

For this study, the Sustainability Centre in Glasgow calculated the carbon-footprint in terms of carbon emissions from the case study company's activities during the month of October 2006. This carbon-footprint covers the day to day running of the company in pursuit of a viable commercial operation. The figure is expressed in tonnes carbon rather than GHG emissions or CO_2 equivalents. Emission factors recognised by the UK Government and used for international reporting to the United Nations were used in the calculations.

It is useful for companies to refer to their carbon-footprint in terms of output of the company as this builds a sustainability measure. For example, the total carbon produced in one month in comparison to the profit of the company in that month. Other indicators can be linked to numbers of staff or man hours worked.

3. THE METHODOLOGY FOR CALCULATING THE COMPANY'S CARBON-FOOTPRINT

3.1 Electricity

Carbon emissions were calculated directly from the electricity bill which was provided for the time period of one month. Carbon is calculated by the kilowatt hour usage based on the average amount of fossil fuel burnt in the electricity generation mix on the National Grid annually. This figure is maintained by DEFRA and the latest (2005) emission factor for UK Grid electricity has been used (DEFRA, 2006). These factors are used for international reporting to the

United Nations (UNFCCC, 1992). The UK grid electricity emission factor is currently 0.43 kg CO_2 per kilowatt hour (DEFRA, 2006). The CO_2 is converted to carbon in tonnes for the purposes of the footprint by molecular weight calculation.

3.2 Gas

The gas bill provided did not indicate the time period of usage; however it was assumed that it represented one month. The emission factor (DEFRA, 2006) is 0.19 kg CO_2 per kilowatt hour. This figure has been converted into tonnes carbon.

3.3 Transport

Fuel use accounts were used to calculate the overall carbon emissions for the Company's fleet of 13 vehicles during October. The majority of the vehicles are diesel fuel vans and there are two petrol vehicles. The company also provided fuel data for September 2006, which, in addition, had mileage logs for the majority of the vehicles. The emission factor for diesel is 2.63 kg CO_2 per litre and for petrol it is 2.30 kg CO_2 per litre (DEFRA, 2006). Again for clarity, these figures have been converted to tonnes carbon.

3.4 Solvents

The case study company provided information on the quantity of solvents used for the October period. Solvents are not currently known to produce direct CO_2 emissions. However, they remain part of the international GHG emissions reporting requirements, as they produce compounds known as Volatile Organic Compounds (VOCs). VOCs are considered to be "GHG - precursor gases" as they break down in the upper atmosphere to produce greenhouse gases. The rate and certainty is still under international scientific debate, and there is no agreed CO_2 emission factor. As a result, this study omits this element from the overall footprint.

3.5 Waste

The case study company provided waste transfer tickets and weighbridge receipts detailing the weight of waste collected from the premises during the month of October. Calculating emissions from waste is complex because emissions produced will depend on the type of waste management procedure used in processing. The company uses a well-established waste management service provider who has significant recycling operations. However, due to the fact that much of the wood waste is mixed with Medium Density Fibreboard, the assumption is made for this study that this material is put in landfills. Therefore, a generic IPCC[1] formula has been applied, including the removal of 50% of the landfill gas (Methane[2]) for energy recovery purposes. The GHG emission is converted to tonnes carbon for comparison.

3.6 Wastewater

Using the water bill provided, an estimate of the wastewater emissions was made. These GHG emissions consist of nitrous oxide and methane produced in the sewage works process. For comparison purposes these are also converted to tonnes carbon.

4. RESULTS OF THE CASE STUDY CARBON-FOOTPRINT

As part of the project, the staff at the Sustainability Centre in Glasgow Caledonian University have estimated the Carbon-footprint of the company's activities for a business period of one month. This report detailed the findings of the study and offers some practical suggestions for both "quick win" and long term actions that can be taken to reduce the carbon-footprint of the company.

The table below summaries the company's operational carbon-footprint for October 2006, as calculated from the data provided. The total carbon-footprint

[1] IPCC – Intergovernmental Panel on Climate Change – the International Federation of scientists that have agrees on emissions calculations methodology.
[2] Methane is a GHG currently estimated to be 23 times more potent than CO_2.

for the company in October 2006 was estimated to be 12.09 tonnes carbon (Table 2). The majority of carbon emissions are from three areas: waste (73%); electricity (13%); and fuel for transport (12.5%). Projected over one year, this amounts to 145.2 tonnes of carbon to the atmosphere or 532.4 tonnes CO_2[3]. This is equivalent to the quantity of carbon stored in an area of 1.26 hectares of mature softwood plantation forest.

Table 2 – The Case Study Company's Carbon-footprint (October 2006)

Service	Carbon (tonnes)
Electricity	1.57
Gas	0.17
Transport	1.51
Waste	8.84
Wastewater	0.01
Total	**12.10**

The carbon-footprint highlights where most of the carbon-intensive activity occurs in the company. A substantial proportion of the company footprint arises from waste production in comparison to its use of other services. The carbon-footprint also clearly indicates that there are implications in the company's level of electricity use. These issues and recommendations are discussed below.

4.1 Electricity

Electricity is the company's main energy source and over the month produced 1.57 tonnes carbon (C) at a total cost to the company of £1,253.23 (Table 3). This comprises £1,195.49 payment to Scottish Power and a further £57.74 to the Government Climate Change Levy[4] (Table 4). The company has not undergone

[3] Carbon is calculated from CO_2 by multiplying CO_2 figure by molecular weight ratio 0.273

[4] The levy was introduced on 1st April 2001. Rates of levy are 0.15p/kWh for gas, 0.15p/kWh for coal, equivalent to 0.07p/kWh for liquefied petroleum gas (LPG), and 0.43p/kWh for electricity. The levy package is expected to lead to reductions in carbon dioxide emissions of at least 2.5 million tonnes of carbon a year by 2010. There are also several exemptions from the levy, including electricity generated from new renewable energy (e.g. solar and wind power) and fuel used by good quality combined heat and power schemes. For more information, visit http://www.defra.gov.uk/Environment/ccl/intro.htm and http://www.sepa.org.uk/wastemin/legis/climate.htm

an audit from a Carbon Trust accredited firm, and although the building is only six years old, it is very likely that potential efficiency solutions resulting in energy savings would be identified by undertaking a more detailed energy efficiency audit.

Table 3 – Electricity Emissions and Cost (October 2006)

Emission Type	Emission Value (£)	Units
CO_2	5.77	tonnes
Carbon	1.57	tonnes
Cost	£1,253.23	

Table 4 – Cost Breakdown including Carbon Charge

Charging Breakdown	Cost	%Tax
Scottish Power	£1,195.49	
Government CCL	£57.74	
Company pays	**£1,253.23**	**4.61**

As electricity usage is the second largest element of the carbon-footprint, there are a number of advantages in seeking a reduction target. The bill provided was for October and projections of potential savings are provided. This table does not include increases in inflation or potential tax or energy market increases which are completely feasible. However the savings would be in line with such changes as the basis of the following table is actual energy unit savings. Table 5 illustrates both the cost saving and carbon reduction in the carbon-footprint. An initial figure of 10% is suggested as an achievable target. The savings are not insignificant and would certainly impact the company's bottom line.

Table 5 – Potential Electricity Savings – Annual Cost Savings and Carbon Savings

Savings	Electricity Daily Use kWhr	Cost Savings daily	Cost Savings Annually	Daily Carbon Saving tonnes	Annual Carbon Saving tonnes	Monthly Carbon Saving Tonne
1%	474.78	0.43	£158.41	0.06	0.21	0.02
2.5%	467.58	1.09	£396.04	0.05	0.51	0.04
5%	455.59	2.17	£792.07	0.05	1.03	0.08
7.5%	443.60	3.26	£1,188.11	0.05	1.54	0.13
10%	**431.61**	**4.34**	**£1,584.14**	**0.05**	**2.05**	**0.17**
15%	407.64	6.51	£2,376.22	0.05	3.08	0.25
20%	383.66	8.68	£3,168.29	0.04	4.11	0.34
25%	359.68	10.85	£3,960.36	0.04	5.13	0.42
30%	335.70	13.02	£4,752.43	0.04	6.16	0.51
35%	311.72	15.19	£5,544.51	0.04	7.18	0.59
40%	287.74	17.36	£6,336.58	0.03	8.21	0.67
45%	263.76	19.53	£7,128.65	0.03	9.24	0.76
50%	239.79	21.70	£7,920.72	0.03	10.26	0.84

4.2 Gas

The total quantity of gas used by the company is fairly low and further understanding of the reasons underlying the company's use of gas is needed, e.g. in ensuring that doors are opened and closed quickly uses results in reduced heat loss relative to leaving doors open constantly. It is likely that monitoring such behaviour over several months would provide better insight into improvements that could be made to achieve carbon savings in this element of the footprint (Tables 6 and 7).

Table 6 – Gas Emissions and Cost (October 2006)

Carbon (tonnes)		Cost (£ sterling)	
Daily	4 week	Daily	4 week
0.01	**0.17**	£3.57	£104.98

Table 7 – Cost Breakdown for Gas Use (October 2006)

Charging Breakdown	Cost	%Tax
British Gas	£99.98	
Government VAT	£5.00	
Company pay	**£104.98**	**4.76**

4.3 Transport

Transport carbon emissions are a major element of the company's carbon-footprint. In the audit, only actual fuel emissions have been factored into the footprint. There are other carbon emissions involved in running vehicles, but they are out with the scope of the footprint at this stage (Table 8).

Table 8 – Transport Emissions (October 2006)

Totals	Fuel (l)	Cost	Total CO_2	Total C tonnes	C t/day
Diesel	**1800.8**	**1635.31**	**4.84**	**1.32**	**0.04**
Petrol	**297.63**	**255.73**	**0.68**	**0.19**	**0.01**
Total		**1891.04**	**5.53**	**1.51**	**0.05**

4.4 Waste

A Carbon-footprint of 8.84 tonnes carbon was calculated for October 2006 (Table 9). This is equivalent to 73% of the company's total carbon-footprint.

Table 9 – Waste Emissions from tonnage waste produced (October 2006)

Waste emissions	Emission Value (tonnes carbon)
Methane (CH_4)	1.54
CO_2	32.42
Total	**8.84**

Due to the nature of the company's activities, wood waste production is high. As the wood waste is not segregated and a range of wood types are disposed of together in the same skip i.e. sawdust, wood, MDF and others, it has been assumed that it is consigned to landfill. The figure shown represents the lifetime degradation of the mix of waste produced by the company when disposed of to landfill. Whilst an estimated 50% does not degrade, the anaerobic conditions in the landfill result in the remaining 50% breaking down to form mostly methane gas. Methane gas has more than twenty times the global warming effect of carbon dioxide resulting in a higher relative carbon equivalent. With modern landfill technology, approximately 50% of the methane is captured and used as a fuel. However, capture is not 100% and the figure presented in the carbon-footprint represents the associated "escape" of landfill gases to the atmosphere.

4.5 Wastewater

The water use appears to be quite high although it seems to be only "domestic" use and not from factory/industrial use. The emissions figure is calculated per capita staff rather than actual water usage. This means that approximately 1000 litres of water are used by the company a day. It is also costing the company about £80 per month in water charges (Table 10).

Table 10 – Wastewater Emissions (October 2006)

Waste emissions	Emission Value	Units
N_20	**0.10**	kg
CO_2	0.03	tonnes
Carbon	0.01	tonnes
Cost	£81.06	

5. THE CASE STUDY RECOMMENDATIONS

The recommendations are derived through the review of the case study of the company's carbon-footprint. These are categorised as either quick win or longer term recommendations.

5.1 Quick Win Recommendations

Energy

It was recommended that the company undertake the following:

- A full energy audit and create an inventory of the energy profile of usage in the company and set a reduction target mandated by the Chief Executive of the company.
- Check the temperature setting for the gas heater thermostat and reduce by at least 1^oC.

Transport

For transport emissions minimisation the recommendations were:

- Invest in a transport management system as such a system is not evidently in place.
- Set a transport emissions target in relation to output. Aim to reduce emissions by 10% on the basis of business taken. This will give realistic and achievable results.

Waste

Waste was the largest element of the company's carbon-footprint and the recommendations were:

- Disposing of wood waste to landfill makes a considerable contribution to the footprint. In addition, gate fees for such disposal will continue to increase in line with projected increases in landfill tax. Therefore waste minimisation will result in cost savings, benefiting the economic bottom line of the company. Waste minimisation can be achieved with the following actions:
- The company should undertake a materials inventory to balance resource input with waste output. This would highlight areas where over-ordering of materials for specific jobs is occurring. Remedying such problems will result in double savings with a reduction in spend on materials and a concurrent reduction in waste costs.
- The environmental manager should undertake a waste audit to produce a waste management action plan (if the company has no environmental manager, then there are government supported services that currently offer a free audit service). This would identify such issues as:
    - Potential waste segregation to allow waste to be collected for recycling or reprocessing rather than disposal.
    - Collection of only partially filled skips by waste managers resulting in unnecessary accrual of costs and carbon management issues regarding the transportation involved.

5.2 Longer Term Recommendations

Energy

The following recommendations were made for long term energy emissions reduction:

- Undertake an energy efficiency audit and introduce practices ensuring equipment that uses electricity is not kept running when not in use. Early reductions can be made by ensuring all PC monitors are switched off at night. Energy Efficiency light bulbs be installed as necessary.
- As the company is using a domestic rate, it seems likely that with correct maintenance of gas heaters and preventing heat loss from the building in winter months particularly is advised.

Transport

This particular element of the carbon-footprint is the most likely element to significantly increase with increased business.

- It is recommended that a survey of fuel efficiency (fuel use by mileage) be carried out to identify actions the company can take to save money through increased fuel efficiency. It is also worthwhile requesting from vehicle fleet providers the best fuel efficiency vehicle.

Waste

The following recommendations are made:

- Waste reduction over the long term will be even more important to the company financially therefore these recommendations were made:
    - Review where and how materials are being used.
    - Purchase briquetter or pelletiser – these are machines that can manufacture a fuel from residual sawdust and MDF material that could then be used in a wood boiler to provide heating.

Wastewater

Although a small proportion of the carbon-footprint, the following recommendation is made:

- Undertake a survey of water use in the company and monitor it over a year to assess seasonal adjustment.

6. CONCLUSIONS

The research study on carbon-footprinting has identified a methodology for use in calculating a company's carbon-footprint. By adopting this methodology for the construction company used as a case study in the research work, it is concluded that this is a logical method that has been tried and tested to produce a carbon-footprint reflective of the company's operations and business practices.

A series of recommendations have been made that may be applicable to other companies, however, monitoring will give an indication of the correlation between the range of sustainability issues faced by Scottish construction SMEs and the use of a carbon-footprint as an empirical measure of sustainable function within organisations.

The study identifies how the company's current practices in relation to energy consumption, travel and waste generation are highlighted by carbon footprinting, ensuring that undertaking a carbon-footprint is a valuable tool to foster the adoption of more sustainable business practices.

SME-nvironment 2005: Scotland (www.netregs.gov.uk) reports that whilst 42% of Scottish businesses report taking action to reduce their environmental impact, their level of legislative awareness remains low, with only 14% able to name a piece of environmental legislation. Therefore, it is proposed that there be a second strand to the research, to be conducted at a later stage in the programme, to evaluate the level of awareness of sustainable practices throughout Scottish construction SMEs. The study, involving an online and telephone questionnaire, would seek to identify current management practices, resource use levels and utilisation of sustainability tools by Scottish construction SMEs. The research will give an indication of the correlation between the range of sustainability issues faced and the use of a carbon-footprint as an empirical measure of sustainable function within such organisations.

7. REFERENCES

Brundtland, G. (1987), *Our Common Future: The World Commission on Environment and development*. Oxford: Oxford University Press. ISBN 0-19-282080-X.

Carbon Trust (2006), Carbon Footprints in the Supply Chain: The Next Step for Business. http://www.carbontrust.co.uk/Publications/publicationdetail.htm?productid=CTC616.

Creswell, J. W. (1998), *Qualitative Inquiry and Research Design, Choosing Among Five Traditions*, Sage Publications, London.

DEFRA (2006), *Climate Change – The UK Programme 2006*, Department of Environment, Food and Rural Affairs.

DEFRA (2007), *Draft Climate Change Bill*, March 2007, Department of Environment, Food and Rural Affairs. TSO. ISBN 978-0-10-170402-1.

Harris, E (2006), *Working Paper on The Voluntary Carbon Market: Current and Future Market Status and Implications for Development Benefits*, Elizabeth Harris (October 2006), IIED and nef Roundtable Discussion: Can Voluntary Carbon Offsets Assist Development?

HM Government (2006), Climate Change – The UK Programme 2006. ISBN 0-10-167642-5.

IPCC (2007a), Intergovernmental Panel on Climate Change Working Group 1: Assessment Report 4: *The Physical Basis of Climate Change*. http://ipcc-wg1.ucar.edu/wg1/wg1-report.html.

IPCC (2007b), Intergovernmental Panel on Climate Change Working Group 3: Assessment Report 4: *Mitigation of Climate Change*. http://www.mnp.nl/ipcc/docs/FAR/Approved%20SPM%20WGIII_0705rev5.pdf.

IPCC (2007c), Intergovernmental Panel on Climate Change Working Group 2: Assessment Report 4: *Impacts, Adaptation and Vulnerability*. http://www.ipcc.ch/SPM13apr07.pdf.

Netregs (2005a). Climate Change Levy and Emissions Trading. http://www.netregs.gov.uk/netregs/275207/1018642/?version=1&lang=_. Accessed October 2006.

Netregs (2005b). SME-nvironment 2005: Scotland. http://www.netregs.gov.uk/commondata/acrobat/2005_scot_summary_v3_1170114.pdf. Accessed October 2006.

http://www.netregs.gov.uk *NetRegs, Guiding Small Businesses through Environmental Regulations*, Accessed 29/01/07.

The Scottish Parliament (2005), Report on Inquiry into Climate Change, Environment and Rural Development Committee Report. 5th Report 2005 (Session 2); volume 1.

Trucost (2006), *Carbon Counts: The Trucost Carbon-footprint Ranking of UK Investment Funds*, June 2006, Trucost Plc.

United Nations (1992a), Rio Declaration on Environment and Development. Report of the United Nations Conference on Environment and Development, A/CONF.151/26 (Vol. I). http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm

United Nations (1992b). Agenda 21: Chapter 30: Strengthening the role of business and industry. United Nations Conference on Environment and Development. http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter30.htm.

UNFCCC, (1992), The United Nations Framework on Climate Change, Article 4.

Yin, R. K (1994), *Case Study Research, Designs and Methods*, 2nd Edition, Sage Publications, London.

Yin, R. K (2003), *Case Study Research, Designs and Methods*, 3rd Edition, Sage Publications, London.