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# Engaging small and medium-sized enterprises (SMEs) in the low carbon agenda



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## Abstract

**Background:** Often perceived as a key step towards reducing the ecological impacts of business, interest in carbon management has grown in recent years. Most studies into carbon management have concentrated on large firms. This study assesses the current level of engagement by small and medium-sized enterprises (SMEs) situated in Derbyshire, UK, in carbon management and determines their perceived barriers to (further) adoption of such activities.

**Methods:** A questionnaire was sent to SMEs in Derbyshire to determine their engagement in four low carbon activity areas and their perceived barriers to (greater) adoption of such initiatives.

**Results:** One hundred forty-one respondents across 64 different Standard Industry Classification (SIC) codes were obtained. Whilst the majority has taken steps to reduce their carbon impact, most do not monitor or set targets for managing carbon usage. Very few choose to publicise their activities, despite some successful results. Respondents cited resource constraints and a lack of relevance to the business as the most common barriers to low carbon engagement. Many are keen to adopt further measures but require targeted support to do so.

**Conclusions:** SMEs are prepared to engage with low carbon agenda, given appropriate support. This paper helps to fill a gap in the literature on SME engagement with low carbon initiatives. It demonstrates both the current areas of engagement and the perceived barriers to further engagement. These findings could inform policy makers in directing support to SMEs to reduce their ecological impacts.

**Keywords:** SMEs; Low carbon; Environmental management; Carbon management

## Background

Small and medium-sized businesses (SMEs) represent the dominant form of business organisation globally. Within Europe, they represent more than 97 % of businesses and more than 67 % of employment; of these, 92 % of businesses fitted the definition of micro enterprises, employing less than 10 people [1]. In the UK, in 2013/4, 99 % of the 4.9 million private sector businesses in the country were SMEs, providing 60 % of private sector jobs [2].

Small and medium-sized businesses are defined in various ways due to their diversity although a very commonly adopted definition is from the European Commission [3] which sets out the following and which is the definition used in this study: (Table 1).

With their level of impact on the business and social environment, it would be remiss to discount the work SMEs do and the potential they have for employment and economic growth [4–6]. Jenkins and Gibb assert that most attempts to engage SMEs in the low carbon economy or in wider corporate social responsibility activities fail because of a misunderstanding of their specific needs both in policy setting and in implementation [7, 8].

This exploratory study assesses the level of engagement of SMEs in the Derbyshire county and Derby City boundaries in the low-carbon economy. Much work has been done with larger ‘exemplar’ companies and with SMEs in the broader context of corporate social responsibility (CSR) [9–11]. However, there is a relative lack of academic research focusing specifically on SMEs and low carbon activities [5, 10].

This paper also highlights any perceived barriers to adopting low carbon business practices in the smaller

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**Table 1** Adapted from the European commission [3]

Company category	Employees	Turnover or balance sheet total	
Medium-sized	<250	≤€50 m	≤€43 m
Small	<50	≤€10 m	≤€10 m
Micro	<10	≤€2 m	≤€2 m

business. This has implications for policy makers in that they can learn from those businesses that are for the most part already engaged in the low carbon economy how best to build on that foundation and to encourage other SMEs to start their own low-carbon initiatives.

**What is meant by a low carbon economy?**

In literature, low carbon reporting is generally interpreted as a facet of environmental monitoring and reporting, which is usually seen as one of the three pillars of triple bottom line reporting (TBL) [12] or part of the ‘responsibility’ elements in CSR [7]. However, much of the activity around TBL and CSR has been centred on large corporations.

The terms ‘low carbon’ and ‘low carbon economy’ have not been universally defined; their origins lie in the 1992 United Nations Framework Convention on Climate Change (UNFCCC) adopted in Rio de Janeiro [13]. In it, a low carbon economy was deemed to be characterised by activities which emit low levels of carbon dioxide ((CO<sub>2</sub>) a major greenhouse gas associated with global warming). This concept has filtered down into government action plans and policies across many countries in the world, such as the Carbon Reduction Commitment, EU-Emissions Trading Scheme and Climate Change Agreements [14]. Some governments, such as the UK, have recognised the importance of the low carbon economy by instilling it in its ‘Plan for Growth’ [15] and ‘Sustainable Development Plan’ [16]. It has positioned UK economic development plans in tandem with reductions in carbon emissions, for example, through the more efficient use of existing fossil fuels, the prevention of carbon dioxide emissions or supporting the use of less carbon intensive activities [17].

These policies then inform the work of local government organisations, such as the councils [14, 18, 19]. The councils in turn are keen to promote low carbon activities to industry to reduce emissions such as carbon dioxide, where 42 % of end-user CO<sub>2</sub> emissions in 2012 were attributed to industry [20]. Local government is also keen to investigate the possibility of increased employment which low carbon development can bring [18, 19]. SMEs are seen as key to this as they are regarded as more innovative, competitive and the source of significant job creation.

This study uses the definition of low-carbon activities as ‘economic activities that actively seek to reduce

carbon through products and services, their design, manufacture and delivery’. It focuses on how SMEs in Derbyshire use and measure energy use, generate low-carbon energy alternatives and use other methods to reduce carbon. This definition is quite broad, as the nature of the work is exploratory in nature and designed to assess current levels of engagement and potential future directions of support required to continue further work.

**SME engagement with the low carbon economy**

Most research into business engagement in the low carbon economy has centred on large companies [6, 7, 10, 11], often through the broader themes of corporate social responsibility. Large corporate CSR activity has been driven largely by investor demand or regulation.

Due to their size, many SMEs are exempt from some of the mandatory legal requirements placed on larger companies [14, 20], especially with regard to environmental legislation, unless they are engaged in a particular industry sector. That notwithstanding, there is increasing pressure for SMEs to engage in the low carbon economy. This is due either through economic pressures, increased energy costs or through changes in social norms in areas such as the environment or in the wider range of corporate socially responsible activities (CSR) of which low carbon activities is a part of [6, 21–23].

Whilst less subject to institutional pressures than their large corporate cousins [24], SMEs are often loathe to go beyond regulatory compliance and invest large sums in some initiatives in fear that their competitors will then undercut them or because they lack the environmental awareness to know the best actions to take [11, 25]. However, it is acknowledged by some SME managers that some form of regulation would create a more level playing field for all [5] and would encourage greater involvement in environmental initiatives [26]. There is some concern that without an element of ‘coercion’, voluntary engagement or self-regulation will not bring about the level of engagement governments wish to see [27]. Regulators such as the UK Environment Agency complain that SMEs are unresponsive to the adoption of regulations and concede that due to the sheer numbers of SMEs relative to numbers of inspectors available, compliance inspection rates are low [28]. They also recognise the need to improve their own staff’s abilities to ‘understand the nature and needs of the SMEs that they regulate’, to ‘reduce compliance burdens by changing regulations or regulatory policy’ [28]. This would facilitate better communication and cooperation between SMEs and regulators. Encouraging change in this way is especially important as legislators and regulators recognise the importance of engaging SMEs in carbon reduction [29].

SMEs possess certain characteristics which can enable them to proactively create new products and processes

(and hence competitive advantage in some cases) at a faster rate than larger companies [30]. These characteristics can include flexible organisations with low levels of hierarchies, strong local/regional focus on their closest customers, less bureaucracy, quicker responsiveness to the environment, more dynamism [31] and the presence of a founder's vision, an entrepreneurial outlook and a flexibility in managing external relationships [21]. Typified as they are for these less formal and more inclusive management styles, with faster and more open communications, SMEs can be quicker to react, more flexible in approach and often more innovative in outlook [10, 24], more customer-focussed and attractive to better quality labour [32]. This is often the result of having to be adaptable to survive and thrive in a fast-changing and competitive environment. This agility may enable them to take advantage of low carbon/environmental initiatives quicker than larger companies [24, 31, 33]. However, despite this flexibility, Uhlaner et al. [34] found that overall SMEs at the larger end-of-the-size scale are actually more likely to engage in environmental management. Equally, higher levels of adoption were found in those firms who are involved in tangible products (as opposed to services), have family influence in their day-to-day running, are oriented towards innovation or who perceive financial benefits in engagement in environment.

The personality of the (owner)-manager in an SME is often key to the firm's adoption of low carbon initiatives and CSR in general [6, 22, 24, 35, 36]. However, this can also result in an ad-hoc approach to their implementation [5, 6, 32]. For those SMEs who are owner-managed or family owned, there is less pressure from the traditional shareholder (as in larger companies) to react to specific issues, such as low carbon [25, 37]. However, many owner-managers feel a heightened sense of responsibility to be more aware of their environmental impacts because of their size and dependency on their local community around them [24] (a form of legitimacy theory [38–40]), and this will also tailor their reaction to low carbon initiatives. In order to gain legitimacy in the local community and to attract/retain employees or to improve their reputation management [32], an SME may well be more attuned to their employee/local community stakeholder group than a large company [24].

SMEs' reactions to change, like those of their larger corporate cousins, may be reactive or proactive [41] depending on their interpretation of potential pressures, be they regulatory (present or anticipated regulation), customer-led, market-driven, technology-facilitated or as a reaction to increased costs [42, 43]. The main stakeholder pressure for SMEs often comes from the supply chain in which it operates [27, 32, 44]. This is particularly moot in certain industries such as automotive [27] or where there is a particularly dominant customer [6].

Van Hemel et al's study [30] found that Dutch SMEs were more influenced by governmental legislation and industrial sector initiatives. However, Demirel and Kesidou's study [45] found that whilst regulation is effective in stimulating end-of-pipe solutions to eco-innovations (so-called 'quick-fixes' to environmental emissions, for example) and environmental R&D, internal drivers, such as efficiency, were more responsible for increased investment in cleaner production technologies through equipment upgrades. This is clearly a longer term view but one which requires more financial and organisational investment. The regulation-push was also found in Porter and van der Linde's research [46] but stressed as a 'win-win' solution to both business and the economy.

Whilst certain characteristics of SMEs may act as enablers for them to be more innovative, others may act as a brake on their low carbon ambitions. SMEs are more likely to face resource constraints (such as time, financing, technical skills or organisational capacity) [4, 32, 43]. Given this, engaging in CSR or even the environment/low carbon element of it can be challenging and less compelling than if mandated by regulation [47]. The very fact that many of these SMEs are key economic foci within their communities as discussed earlier and responsible for a certain amount of emissions (albeit not easily quantified [48]) means that encouraging these firms to adopt sustainable business practices is of particular importance at a local level [49].

It is often thought that due to their resource constraints [25, 41], 'selling' the business or economic case for investment in environmental/low carbon initiatives will be an impetus to adoption for SMEs [27, 50]. Certainly, the argument for cost-savings through more efficient use of material or energy resources can be compelling for SMEs [41, 43]. This could be further leveraged by the idea that some competitive advantage may accrue for those firms that do so versus those that do not [11], such as being able to label their goods as 'eco-products' [37, 43]. However, Figge and Hahn argue that the 'green business case' should also be a win-win where both environmental protection and financial benefit accrue, hence maximising their contribution on both levels rather than just the purely financial alone [50]. For some SMEs though, the motivations for engaging in low carbon initiatives or 'ecological responsiveness' [37] often stem not from any regulatory compulsion or the business case but from either stakeholder pressures or ethical preferences and may equally be a combination of several of these influences [37].

In the main, most SMEs will tend to adopt a more reactive and incremental environmental management approach which reflects more rapidly in improved financial performance [21, 41], particularly at the start of their adoption of low carbon activities. This focus on the

more short-term activities was also found by Smith [51]; this allows SMEs to see any financial benefits quicker and reduce the potential risk of uncertain outcomes. Having then experienced some positive results, this may later develop into a more rounded, proactive strategy. Some SMEs perceive certain low-carbon initiatives to have high costs and commercial risk [4] where payback on investment is unattractive [14]. This may particularly be the case for micro SMEs whose overall energy consumption is low, so unless the business is motivated for other non-financial reasons to adopt low carbon initiatives, the business case for large investment is not compelling. There is evidence that those SMEs who are willing to go beyond the bare minimum do perform better financially [34, 50, 52] or are more successful in product and process innovation [49], and therefore, this in theory offers the greatest incentive to adopt those techniques which specifically have a greater perceived financial payback.

Although there are many criticisms of both CSR and the environmental component of it in terms of costs to implement for the SME, there is now increasing acceptance both that SMEs require a different approach than large corporations to educate and support adoption and implementation of low carbon initiatives [6, 7, 25, 53, 54]. There is little doubt that over time, and given the increased governmental focus on the low carbon economy, pressures are increasing on all firms, not just SMEs, to be engaged in activities such as low carbon initiatives, beyond their purely economic remit [11, 50]. However, there is some evidence that uptake has been much slower in SMEs than in large companies [27, 35]. It remains low down on the priority list as where resources are scarce, the economic will always win out over the environmental [11, 26]. Clearly, whichever initiatives a firm chooses to adopt, they need to be relevant to the firm's own business strategy and context [37], and they will prioritise different activities depending on their own standpoint or industry [24], be that economic, ethical or regulation-driven [37].

Against the backdrop of the previous literature findings, the aim of this study is to ascertain the current levels of engagement in the low carbon economy amongst the SMEs in the Derbyshire County and Derby City boundaries in the UK. Its secondary aim is to discover what impediments (if any) managers and owner-managers perceived regarding further engagement in low carbon activities and initiatives, such that it could inform policies at the local government level (Derby County and Derby City). The study was carried out in conjunction with both local authorities.

## Methods

The purpose of the study was exploratory in nature, and therefore, it was important to encourage participation

from as many different types of businesses in the Derby County/Derby City geographic area so that the findings would be meaningful.

A short questionnaire was emailed out to all SMEs businesses identifiable from a range of national and regional databases, namely FAME, MINT and a Trusted Trader listing maintained by the local council. Due to the very broad diversity of SMEs, both in size, industry and form (e.g. sole trader through to limited company), the questions chosen had to be suitably worded to enable completion by a wide variety of potential respondents. Questions were mainly of the multiple choice 'closed' variety, to facilitate responses. However, space was included to encourage respondents to add comments or additional responses if their choice of answer was not included in the multiple choice listing.

The questionnaire was devised to cover different areas of possible engagement in reducing carbon, based on the following four elements of:

1. measuring and reducing energy consumption;
2. generating low carbon energy alternatives;
3. other methods of reducing carbon emissions and
4. barriers to (greater) adoption of low carbon initiatives in a business.

The primary participant selection criterion was the fact that the business had a trading address in Derbyshire; the secondary criterion was the number of employees, which to comply with the European Commission definition of SME being less than 250 and the third was the availability of a contact email address. The survey was then sent by email to 5538 contacts. This method was chosen due to its wide reach, low cost, relative speed of response and ability to follow up non-respondents quickly.

## Results and discussion

In general, response rates on web-based/email surveys are low, and rates as low as 2 % are not uncommon [55] particularly when using generic databases. This can be problematic if one wishes to extrapolate findings to a wider population, as high response rates provide some measure of reassurance about the validity of the findings and without a large response rate, it is difficult to assess how non-respondents differ from respondents [56]. However, Archer [57] asserts that certain types of questionnaires such as needs assessments, naturally elicit lower responses. This is because not all the people contacted would be the appropriate ones to respond, the questionnaire was not felt to be relevant to the particular person receiving the questionnaire, or they were perhaps uncomfortable with or unable to respond given the nature of some of the questions [57].



In total, 141 usable responses were obtained (a 2.5 % response rate). Reminder emails were sent which did increase the responses slightly, but the effort and cost to try to increase participation beyond this rate was not deemed justifiable. However, as Archer states, 'if the primary goals of these types of surveys are to gain suggestions for direction and improvement or obtain a measure of quality, then the responses are just as meaningful when a breadth and range of response is obtained, even with lower response rates' [57]. This is particularly pertinent with this sample as despite the low overall response rate, a wide range of enterprises was represented in the sample, which helps to provide a higher confidence rate regarding possible wider extrapolation of the data. It was not possible to determine the Standard Industry Classification (SIC) code of all respondents, but of those where it was possible, 64 different SIC codes were represented.

Respondents represented all the main forms of business structure, from sole trader, partnership and limited company. They also ranged from single owner-managers (micro enterprises), those employing only a few employees (small enterprises), to companies employing over 200 people (but within the threshold of medium-sized enterprises).

Clearly, those that responded to the questionnaire self-selected on the basis of their interest in the subject matter of the questionnaire. This undoubtedly creates bias in the sample (although some respondents recorded zero engagement, they were in the minority). However, the research aim was not to determine how many SMEs were engaged in low carbon activities but to determine the scale and scope of their engagement and perceived barriers. By so doing, this would inform further local government action to increase engagement.

### **Section 1: measuring and reducing energy consumption**

In this section, respondents were asked whether they collect or set targets for their energy consumption and whether they have introduced efficiency projects/measures. Sixty percent of respondents have introduced efficiency projects or measures, but only 32 % have actively set targets or are measuring the results of such projects, which is in line with Worthington's findings that few measure the effectiveness of their projects [5].

The reasons for this are varied as follows: for the larger companies in the sample a lack of resources (both time and cost) to set up measurement systems was cited. For the smaller companies (e.g. sole traders), a lack of relevance was the main reason; given that most of their impacts and hence savings would be small, a measurement system was inappropriate. Most companies also wanted to get started on projects in order to reduce costs on trust that it will generate some benefit without the need for expensive monitoring. Some measures may

be very modest, such as using low energy light bulbs, so there is little value in monitoring such benefits. By not being compelled to have environmental management systems (such as ISO14001) as many larger corporations are, SMEs will avoid such costs or at most, adopt a smaller system (such as European Commission Eco-management and Audit Scheme (EMAS)) where compelled to by their supply chain. Otherwise, monitoring systems remain beyond the realm of most SMEs [41].

Firms were also asked to specify what activities they do carry out, and the responses revealed a wide range. These included simple recycling measures (113 responses) and low-energy lighting (90 responses), heater controls (72 responses), efficient boilers (45), heat recovery systems (8) and the use of hybrid company vehicles (2). The social impacts were also not ignored, as 25 respondents stated they had adopted an employee awareness scheme to encourage employees to switch off machinery, lighting and control heat and ventilation more efficiently. Two of these measures (recycling, low energy consumption) were also found in van Hemel et al.'s study of 77 Dutch SMEs to be the most frequently suggested and most successful ones for SMEs [30]. Another European study by Bos-Brouwers also found that waste separation and recycling were the commonest themes [31].

Some companies were in leased premises or listed buildings and were therefore restricted in their ability to make significant investments in their buildings, and others operated from only a small office from home, and therefore, there were few possibilities to utilise some methods. Other measures used included tracking idle minibuses (from a transport firm), planning the most efficient delivery routes and salary sacrifice schemes for low CO<sub>2</sub> vehicles.

Firms were then asked if they have recorded their energy consumption, and if so, whether they have demonstrated savings. Whilst less than 18 % of businesses have recorded their energy consumption reduction (if any had been achieved), those that do had generally saved modest amounts (80 % had saved less than £1000), with the remaining 20 % having recorded savings in excess of £5000 over the past year. Despite these modest amounts, the savings were not necessarily insignificantly relative to the size of some of the businesses involved. Obviously, as with all measurement systems, there has to be a clear cost-benefit analysis in order to ascertain the costs of implementation versus the benefit of the measurement system. For the majority of SMEs in this study, the cost (beyond standard utility metre readings) was not worth the savings.

### **Section 2: generating low carbon energy alternatives**

This section was designed to find out to what extent SMEs are utilising low carbon power sources and so

were asked if they generate on-site renewable energy. The initial investment costs associated with some of the alternative energy sources can be quite high for SMEs, and so whilst unsurprisingly, the level of respondents using alternatives was low (18 %); there was a broad range of sources used. These included wind turbines (8 % of those who use alternative power sources), solar (46 %), biomass (15 %), fuel cells (4 %), ground source heating (4 %), air to air (4 %), wood waste (8 %) and biodiesel (4 %). This demonstrates that despite the size of some businesses, there are some innovative methods of reducing carbon output even on a small scale. Given the rural nature of a significant part of Derbyshire, some respondents were in farming and allied land use, which explains the wide variety of methods used (in particular wind turbines, biomass, wood waste and biodiesel). For the more urban respondents, the main reasons for not using alternative power sources were the size of the business (some were sole traders) or the fact they were in leased or listed buildings.

### Section 3: other methods of reducing carbon emissions

This section addressed any other areas where businesses might be incorporating low carbon concepts into their businesses. Participants were asked whether they have redesigned their products or services in order to reduce their impact on the environment. Thirty-eight percent of respondents stated that they have done so, which given the range of activities and industries represented was quite high as many will be limited in the possibilities for redesign. This finding is replicated in other studies such as van Hemel [30].

Next, firms were asked if they measure and/or set targets for waste and waste reduction, and if they have, whether any savings have been recorded. In response, 37 % measure and/or set targets for waste management; this may range from very simple targets for electricity consumption to full waste management systems. Without effective management/tracking and budgeting systems, it is not possible for the majority of firms in the sample to record any savings through their activities. Whilst in the case of the single sole trader, the costs of such a system would outweigh the benefits derived, some have recorded savings; 31 % have recorded modest savings of less than £1000 per annum, whilst 6 % have recorded over £5000. Clearly, when measurable results are achieved, it can feedback into a virtuous circle of then undertaking additional activities or at least acting as a catalyst to become a 'champion' to then encourage other SMEs to adopt similar measures [24].

Participants were then asked whether they communicate their energy and waste management activities and results externally. Despite some successes, very few firms in the sample (9 %) disseminate information about their activities externally to the firm, whether that is on a

website or in any other forum. Clearly, the downside to this approach is that without active communication, there may be an assumption that SMEs are not engaged with low carbon activities, which may belie the actual level of engagement occurring. This lack of external communication found in this study confirms Jenkins' and similar studies' findings [5, 7, 22, 25]: many SMEs do not feel 'comfortable' with 'marketing' their activities, even when they are successful. They do not wish to be seen to be 'profiting' from being ethical as this is something that 'large companies do' [7]. This is despite the agreement that the best way to encourage other SMEs to adopt measures was to publicise success stories or even 'war' stories in informal networking sessions [24, 58]. This reticence to publicise their activities may mean that many of their good works are unnoticed and therefore perceived as not occurring. It equally means that unless consumers are aware of their engagement, they may be losing out on competitive advantage as it may be a source of enhanced image and reputation [43].

### Section 4: barriers to (greater) adoption of low carbon initiatives

The final section of the questionnaire asked respondents to consider what prevented them from either engaging further in low carbon initiatives or becoming involved in the first place. The most commonly cited reason (63 % of respondents) for not doing any or further investment in low carbon initiatives was lack of relevance to the business. This may be a function of the size of the business (micro enterprises have often less scope in which to exploit such initiatives or the payback may not be justifiable) or the nature of them; office-based service providers often have lower scope for investments or indeed could already have carried out the most readily applicable initiatives for their business.

Lack of funds to invest in some of the more expensive initiatives was also a major impediment (60 % of respondents); as one participant stated:

'Given funds I would like to explore heat pumps for extracting ground source heat, windpower and solar panels, but in our case it is not possible to fund it'.

This finding is also noted in previous studies [5] but is an area which would benefit from greater research to determine what means of support (e.g. grants, loans) could be best promoted by governments to enable this investment.

In terms of policy development and support for SMEs to adopt low-carbon initiatives, it is important to recognise that SMEs are neither large companies scaled down [11] nor are they a homogenous group of firms who share the same characteristics [10, 24, 35]. It is perhaps a lack of understanding of this factor which has caused many such

support programmes to fail [24, 32]. Within this study, despite most respondents having adopted some low carbon measures, 'lack of relevance to the business' is the main perceived barrier to further engagement. This was equally a finding in van Hemel et al.'s study of 77 Dutch SMEs [30]. Therefore, it is critical to ensure that policy makers need to comprehend these varied 'sub-cultures' in order to create suitably differentiated tools to those used in large corporates for use in SMEs [10, 22, 35]. There cannot be the assumption that all SMEs are profit-motivated and economically rational in the same way as many corporates are due to shareholder pressures since their motivations are often much more subtle and varied [10, 36].

Other resource constraints were highlighted, such as lack of time (54 %) which supports previous findings that many SMEs, particularly those at the smaller end-of-the-size spectrum and that are often sole traders or owner-managed, do not have the dedicated manpower to investing in what is often perceived as a non-core activity.

A significant but far smaller number of respondents (28 %) found that lack of knowledge of alternatives or initiatives and suitably qualified manpower was an impediment. This supported Jenkins' finding that even if firms do find sufficient information about options, the practical and financial help to then implement those options is lacking [24]. He also remarked that it is essential that that support is then tailored for the SME, rather than merely an extension of a large company tool [24].

Other impediments given were time to implement, long paybacks, or paybacks that were too difficult to calculate, constraints on buildings, such as being in a leased or listed building, or being only in a short-hold tenancy from which the occupants may not gain any benefit from installing new equipment such as solar panels. One respondent noted:

'it is very difficult to reduce the carbon footprint of old buildings without huge expense and on Listed Buildings the conservation officers resist any low carbon measures'.

Others felt that they had done the most they could with the size of their business as one of the participants stated:

'We've done all the common sense items and some that need a bit of thought but when the time to implement increases and the savings diminish then the interest in further implementation also decreases'.

## Conclusions

This study was explorative in nature, to ascertain current engagement with low carbon activities by SMEs in the

Derby City and Derbyshire County boundaries. Although the questionnaire did not have a large response rate, its broad industry representation does to some extent validate its findings in terms of applicability to wider extrapolation.

SMEs in the Derby City and Derbyshire County boundaries are engaging with the low carbon economy, despite the fact that many are not compelled to by regulation. Their motivations range from the business case through to wanting to 'do the right thing'. There did not appear to be any evidence that the respondents acted as a result of the need to gain legitimacy in its local community [32, 38–40]. There is a lot of empirical evidence from this study and from others (such as van Hemel et al. [30]) that SMEs are more compelled by either current or potential regulation to invest in low carbon activities as a way to move beyond the perceived 'lack of relevance' of some measures to SMEs. Whilst the reaction to this may be for increased regulation, which many SMEs view as both an opportunity and a threat, policy makers need to be mindful of the characteristics of SMEs (both restrictive and enabling) [59] before introducing more regulation.

There are some good exemplars in this study who have invested large sums of money in infrastructure and are convinced of the business benefits of doing so, which supports Torugsa et al. and Uhlener et al.'s findings [34, 52].

Whilst this study did not specifically measure firm size beyond employee numbers, some micro enterprises do try to engage in reducing their carbon output, if only to reduce cost, which appears to reinforce the Uhlener assertion [34] that firm size itself is not the main determinant of likelihood of engagement in environmental management practices but that there are other factors, like the ethos of the (owner)-manager or pressures from the supply chain. Although many of their activities are relatively modest, it is their combined impact which should not be underestimated.

SMEs do note frustrations about restrictions on further engagement in the low carbon economy, principally around resources (time and money) which again have been identified in previous studies. However, some also highlight regulatory constraints or building restrictions to enable them to engage further. This is obviously an issue which policy makers need to address in order to move the low carbon agenda forward. Additional research could be undertaken to understand more precisely how targeted support to SMEs could change this situation.

The wide array of responses from SMEs in the study regarding some of the activities they undertake is quite surprising given some perceptions that SMEs are not engaged in the low carbon economy. The broad scope and innovative approaches taken by some SMEs to reduce

their carbon output and often reduce cost is testament to their creativity, competitive drive and/or concern for their wider environmental responsibilities. Even very small businesses are actively engaged with a range of alternative fuel sources, such as solar, biodiesel, wood waste products, ground source heating and waste oil use.

What is also evident is that unlike in larger companies, there is little measurement or target setting in either energy consumption or waste outputs and still less reporting externally to the organisation about their activities. In terms of encouraging wider adoption of low carbon activities amongst fellow SMEs or indeed in promoting their responsible business practices to wider communities, it would appear that this is an untapped opportunity; to promote exemplars of current good practice on even relatively small scales could further encourage wider engagement in the low carbon agenda. This is again an area in which local government can assist in supporting local business networking forums where the success stories are communicated to other SMEs in the local business environment.

#### Competing interests

The author declares that she has no competing interests.

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EC is a senior lecturer in accounting and finance at the University of Derby, UK. She is a Fellow of both the Chartered Institute of Management Accountants and the Higher Education Academy and a member of the Chartered Institute of Marketing, Chartered Institute of Public Finance and Accountancy and Chartered Management Institute. She currently serves on the board of the East Midlands branch of the Chartered Management Institute and is an examiner for the Institute of Financial Accountants.

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