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The development of commercial local area resource and emissions modelling – navigating towards new perspectives and applications

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ABSTRACT

Meeting near future UK greenhouse gas (GHG) emissions targets will require all parts of the UK economy to contribute, and in particular significant changes in business practices are required at the local level. From review it was found that there is a lack of detailed business accounting and reporting of GHG emissions at the local level, especially concerning supply chain impacts and small and medium sized enterprises. This paper presents a framework model to generate detailed benchmark estimates of GHGs (both on site and supply chain related) for individual businesses and all businesses of a sector within an area. The model makes use of available economic and environmental data, and, with similar datasets existing in other parts of the world, such models may be used elsewhere. The framework model is applied to an empirical case study. Estimates from such a framework can be used in a step-by-step approach to move businesses and local areas towards improved accounting, reporting and sustainability (including procurement). The model makes use of two different accounting perspectives: the production perspective (on site GHGs) and the provision perspective (supply chain GHGs attributable to purchased inputs of a business or sectors production). The new provision perspective and its consequences are explored and explained.

1. Introduction and background

If the UK is to meet its challenging environmental targets, which include, for example, a reduction of greenhouse gas emissions (CO_2e) of at least 80% on 1990 levels by 2050 (Committee on Climate Change, 2008), it is vital that all parts of the UK economy contribute. Forum for the Future (2009) state that an understanding of the contribution that a company (and its sector) is making towards achieving GHG reduction/stabilization targets (both local, national and global) is essential for leadership on climate change.

The progress made by large organizations in estimating and reporting emissions is demonstrated by reports from the Carbon Disclosure Project (CDP) that over 3000 organizations in some 60 countries around the world now measure and disclose their GHG emissions, water management and climate change strategies, a rise from just 235 organizations in 2003 (CDP, 2012). Another example of progress is the groundbreaking Environmental Profit and Loss Report produced by Puma in 2011 which valued the company's environmental impact for the key areas of GHG emissions, water use, land use, air pollution and waste, generated through the operations and supply chain, at € 145 million in 2010 (PUMA, 2011).

In the UK, 47% of turnover and 48% of jobs are due to small and medium companies[1] (SMEs) however, and progress in these types of companies is less good. This is due to many factors, such as lack of in-house expertise, lack of financial resources to pay consultants and lack of awareness of environmental problems (Defra, 2010, Carbon Neutral 2006 as seen in Oakdene Hollins (2011), Institute of Directors, 2006). And yet without information on the emissions and other environmental impacts of SMEs, it is hard for UK-wide progress in achieving reductions to be made and assessed.

Overall, it is clear that currently, businesses are still not reporting in a clear, consistent, comparable and transparent manner "*en mass*" in the UK and some other countries,[2] as was reported in early studies (Gerbens-Leenes et al., 2003; OECD, 2001).

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[1] Employment less than 250, based on SME statistics from UK Department for Business Innovation and Skills (BIS) 2009.

[2] From a review in 2009, the Environment Agency found that 62% of FTSE listed companies report climate change related disclosures in some form (Environment Agency, 2010), but from inspection however, often quantitative reporting (if provided) is not in a consistent, comparable and transparent form. Similar recent findings for other countries are seen in Clément Roca and Searcy (2012), Skouloudis et al. (2010), Downie and Stubbs (in press, p. 7) and Collinsa et al. (2007).

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From the literature, there are gaps in both environmental reporting and environmental accounting. Viere et al. (2011) find that most studies dealing with implementation of environmental management accounting (EMA[3]) apply environmental cost accounting applications. The latter authors identify that employing just environmental cost accounting is unsatisfactory from a supply chain perspective and that life cycle assessment (LCA) and environmental life costing have become very important EMA tools. LCA can however, be very time consuming and expensive.

A range of top down GHG estimation models exist and can provide information on company GHGs. A study by King and Tsagatakis (2006) models carbon dioxide emissions directly produced by SMEs to geographic location (local authority level and 1 km grids), but the method used means that aggregation is relatively high, the study does not attempt to estimate indirect[4] GHGs or GHGs of individual businesses. Bradley and Jackson (2007) develop a model to estimate direct commercial and industrial waste that uses methods similar to those of King and Tsagatakis (2006).

In terms of indirect GHGs, the early work of Mathews and Lave (2003) shows benefits of a sector level environmental input–output (EIO) GHG tool for screening applications and benchmarking corporations, but business specific estimates are not provided. With regards to business estimation and 'state of the art' the methods of Lenzen et al. (2006) are believed to be some of the most accurate in terms of 'top down' models, as the model allows companies to choose their own sector and incorporate financial accounts of businesses and other organisations into the national I–O tables (used in the model) as an additional sector before estimation. This model however, and the other most applicable and useful methodologies found (Foran et al., 2005; Trucost, 2008[5]) for estimating indirect GHG emissions of business are, unable to estimate emissions for a large number of businesses of a local area, without excessive and unrealistic amounts of time or a reliance on companies coming forward with data. The same is true for a range of online tools available and government datasets, which generally do not provide the accounts required (see Bradley et al., 2010). This is a key gap that the current paper attempts to address.

This paper describes the methodology of a novel framework designed for estimating the GHG emissions for an individual business of a specific sector, or all businesses within a defined geographical area: the framework is specifically designed to provide support to SMEs. Importantly, the framework does not require informational input from the company(ies) in question and hence overcomes the problem caused by lack of resources within SMEs as well as issues with current estimation models described above. The approach leads to GHG estimation with lower data collection requirements from business, whilst at the same time enabling full coverage of all businesses. This can lead to improved accounting, strategy and prioritisation at the local level. The approach uses one framework and consistent data across businesses, to ensure consistency and the framework bridges the gap between 'micro' and 'macro' level top down models by allowing estimation of the carbon(e) added[6] at the level of a city, local area and individual businesses by postcode in a consistent and comparable way. This is in line with the principle of multi-scale reporting by Foran et al. (2005). The case study for the paper is GHGs (CO_2e) for the Hospitality sector in Southampton. The framework can, however also be applied to other emissions, such as waste, or resource use such as water, and for any part of the UK and possibly other countries (if similar datasets exist). In this paper we refer to such work at certain points.

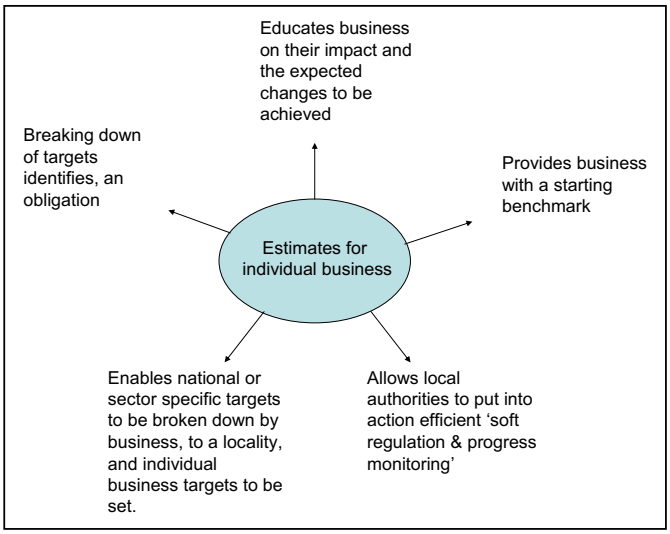

Fig. 1. Use of GHG estimates for individual.

The framework developed is called the Commercial Local Area Resource and Emissions Model (CLARE). It builds on and is informed by a number of previous studies such as: Matthews and Lave (2003), Foran et al. (2005), Lenzen et al. (2006), Jackson et al. (2007), Bradley and Jackson (2007), Druckman et al. (2008), Bradley et al. (2009), Albino et al. (2002), Gerbens-Leenes et al. (2003), Kytzia et al. (2004), Sinclair et al. (2005), Xue et al. (2007) Kagawa et al. (2007), Trucost (2008), and King and Tsagatakis (2006) amongst others.

Some uses of CLARE estimates are provided below in Figs. 1 and 2.

It is the intention that local government and NGOs will be able to access estimates from CLARE to inform and help businesses, and to prompt businesses into action to recognise their obligation to act to reduce emissions and water use to help achieve national targets. Producing detailed CO_2e estimates for individual business and groups of businesses will help enable local government, NGOs and businesses lead action towards GHG reduction. All implementation is local, and in practice, localities can become leaders as they can be less constrained in leadership than central government.

The paper is structured as follows. The methodology of CLARE is described in Section 2. Section 3 discusses the use of CLARE in a step-by-step approach and presents application of the theoretical framework. Discussions and conclusions are conducted in Section 4.

2. Methodology

The model CLARE is composed of two sub frameworks: CLARE-direct for direct emissions and CLARE-indirect for indirect emissions. The development of CLARE-indirect requires an

[3] "*EMA is broadly defined to be the identification, collection, analysis and use of two types of information for internal decision making:*

- *physical information on the use, flows and destinies of energy, water and materials (including wastes) and*
- *monetary information on environmental-related costs, earnings and savings.*" (International Federation of Accountants, 2005).

[4] In this study direct emissions are the emissions that occur from processes owned, operated or controlled by a business of concern. Indirect emissions are defined as those emissions associated with processes that occur in the life cycle of a product prior to the processes owned, operated or controlled by the business of concern. The indirect definition corresponds with the upstream GHG emissions definition by British Standards Institution, Publicly Available Specification 2050 (BSI, 2008).

[5] Further detail on Trucost methods can be seen in Crummey (2008).

[6] Carbon(e) added = CO_2(equivalent) added, Term.