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CARBON LABELLING: EVIDENCE, ISSUES AND QUESTIONS

Briefing Paper for the Tesco-ECI
carbon labelling workshop
3-4 May 2007

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Introduction

The proposal is that our carbon intensive goods and services should contribute to lower carbon emissions and be redefined in light of climate change. A carbon label has the potential to be an important part of this redefinition, but should be built on a successful consensus about what a carbon label should do, how and how this is best delivered. This briefing paper provides a broad review of evidence and poses pertinent questions surrounding the development of carbon labelling.

The issues raised will be discussed, along with others, at the Tesco-ECI carbon labelling workshop on the 3rd-4th of May 2007 hosted by the UKERC Meeting Place. This workshop will cover the key issues that developing a carbon label involve, driven primarily by what the carbon label aims to achieve. These issues include: who the label is intended to influence, what stages of the life cycle are covered, transparency of assumptions, verifiability and ease of implementation.

The paucity of good quality, UK relevant research on embodied carbon of products means that there is often no substantial evidence to support decision making. 2006 saw a large increase in output in this area, from both the UK and Europe, which reflects the growing importance of this area and the focussing of attention on the environment in production and consumption. The development of a label would require much more research and will contribute to building up a solid foundation of data and experience.

This report is split up into a series of questions, each of which includes relevant research findings, key issues and questions and implications of these for further work or labelling. They are highly interactive, as a decision on one has considerable influence on other factors. This report is accompanied by an appendix that contains more in-depth explanations and reviews of pertinent studies, papers and protocols. Although a carbon label may apply to all consumer goods, this report is focussed on food.

It is hoped that this will be a thought-provoking read that encourages you to deliberate the issues and further develop your opinions.

Which greenhouse gases (GHG) should be included in a label?

Key research findings

The UK's climate change emissions are dominated by carbon dioxide with relatively small contributions from methane, nitrous oxides, HFCs/PFCs and sulphur hexafluoride (it is less than 1 so has been rounded down in Figure 1). This is likely to be relatively representative of most UK production sectors. However if we consider food emissions specifically the emissions profile changes significantly as can be seen in Table 1.

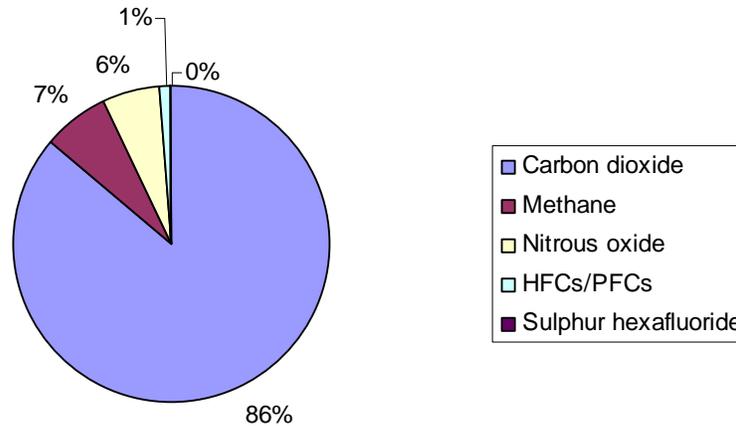


Figure 1: UK Greenhouse gas emissions by global warming impact

Source: HM Government 2006

Table 1: Food related greenhouse gas emissions expressed in terms of carbon equivalent for UK emissions, sources and strengths

Emission	Source	GWP 100 yrs	% of UK's food emissions
Carbon Dioxide CO ₂	Fossil fuel combustion	1	60
Methane CH ₄	Landfills, coal mines, natural gas leakage, ruminant livestock, rice production, animal waste management	23	} 35
Nitrous Oxides N ₂ O	All soils (increased by fertilizer application), biomass burning, cattle and feedlots, industrial processes (such as fertiliser production)	296	
HFCs	Refrigerant, air conditioners, blowing agents, semi-conductor production, spray propellants	120-12,000	} < 5
PFCs	Refrigerants	5,700-11,900	

Sources: IPCC Third Assessment report (2001), HM Government (2006) & Tara Garnett (2006)

Note: GWP: Global Warming Potential – a measure of greenhouse gas strength. This shows the proportional absorption of warming that a given mass of gas can achieve relative to CO₂ with a GWP of 1 over a set amount of time. Carbon equivalent (CO₂e): a common denominator measurement that encapsulates all the GHG in proportion to their mass and global warming potentials.

Food related methane emissions from landfill are under-represented in the table above and so the proportional contribution of methane and nitrous oxides is likely to be larger still.

Nitrous oxide and methane are mainly emitted during the primary production stage of food production and are the predominant climate impact of farming. For arable farming nitrous oxide emissions are the main impact, exceeding 80% for wheat production (Williams et al 2005). Nitrous oxides and methane are the main impact in animal rearing, with methane dominating for ruminant animals (sheep and cattle) and nitrous oxides for non-ruminant (swine and poultry). The majority of rice production impacts arise from anaerobic respiration in rice paddies and so omitting methane would distort the relative impact of this food considerably.

The uncertainties associated with measuring different gases vary. At the national level these are particularly high for nitrous oxides, and generally higher for all gases other than carbon dioxide. The quantity and rate of methane and nitrous oxide emissions are a consequence of a complex interplay of variables and so are more difficult to sample and measure (Eggleston et al 1998). However there are IPCC guidelines available for measuring direct emissions or national inventory guidelines (for the UK). These are regularly used in LCA studies (Saunders et al 2006, Williams et al 2005).

Were carbon alone to be represented on a carbon label some products would be affected more than others. Meat and dairy production would still be represented by a high number but the difference between these sectors and others would be less than if all GHG were included. Foods that use a lot of fossil fuels in production would come out relatively less well, for example fruit and vegetables grown in greenhouses and highly processed foods.

Carbon emissions from electricity and heating dominate any indoor grown crops' impacts (see Appendix section 1 for carbon intensities of different energy carriers).

Refrigerant leakage adds 15% to refrigeration climate impacts from electricity use (Garnett 2006). Excluding this would benefit retailers, storage and refrigerated transport sectors. Chilled and frozen foods would be advantaged by a system excluding HFC and PFC emissions.

Key questions and issues

- Is this just carbon (from carbon dioxide), initially. With the other gases (eg methane) and the other environmental impacts (eg water) to be undertaken later? Altering what is included will lead to changing labels over time which has implications for consumer understanding and trust.
- If so, then the most obvious effect is that animal products (particularly from the ruminants, such as cattle and sheep) will be shown as having less impact. It might not alter their ranking as the most carbon-intensive food products.

System boundaries

Key research findings

Differing levels of carbon are saved through recycling depending on what material is used. Recycling aluminium rather than using virgin aluminium saves on average 10 tCO₂e/tonne aluminium. Recycling glass saves 0.75 tCO₂e/tonne on average and recycling paper saves 1.9 tCO₂e/tonne (Wenzel 2006). Choice of packaging material therefore affects the level of avoided carbon emissions.

What happens post retailer shelf has a large impact on the carbon footprint of the product. In studies reviewed by Foster et al (2006) the contribution of the household stage to overall carbon footprint was between 3-64%, and to the energy footprint between 5-32%. Food storage (how and for how long) and cooking (how and for how many) is critical in influencing household impacts, as is food waste levels. Andersson et al (1998) found that storage of tomato ketchup for one year compared to one month increased the ketchup's embodied energy use at the household stage by over 90%. Storing ketchup for a year meant the household stage became the most energy intensive of all stages.

UK based research suggests about 1/3rd of the food we buy is thrown away, half of which is edible and that this varies by age group (WRAP 2007). A study based on 284 food diaries found that the most commonly wasted edible foods were (in descending order): fruit and vegetables, bread and cakes, raw meat and fish and ready meals/convenience food (WRAP 2007). Sonesson et al (2005) found that food wastage from the home varies hugely but can be very significant. This Swedish study reports that dairy was the most wasted food followed by vegetables, fish, meat and eggs.

The creation of a Walkers crisp packet contributes 15% to the total embodied carbon of that product (Carbon Trust 2006), whilst studies reviewed by Foster et al (2006) found that packaging contributed between 2-68% to the carbon footprint of products (although 2% is small, as it is relative to the contribution of other stages, the emissions can still be significant).

Per unit weight food served, smaller portion sizes are more carbon intensive than larger ones as they require more packaging (Kooijman 1996, see Innocent smoothies example Table X). However smaller package sizes are preferable for single person households as they lead to less food waste. A carbon label might lead to more purchasing of larger pack sizes.

Carbon emissions from all stages were favoured in 8 (x 8-10 adults) consumer focus groups over those that showed just one stage of production – such as transport (Dragon 2007).

Life Cycle Analysis (LCA) boundaries are highly dependent on the question being asked and so generally little guidance is provided. Approaches to defining what is included and what is excluded include:

- Using weight (Carbon Trust 2007): The embodied carbon of 90% of the weight must be measured.
- Using a screening LCA (Astrup Jensen et al 1997): a simplified LCA is carried out accounting for all stages of production but using mainly secondary data sources to determine what should be included and what excluded. The Carbon Trust suggest stipulating 95% of emissions be covered with the remaining 5% comprising ingredients that contribute no more than 1% each (Carbon Trust 2007).
- Using a tiered rule (Product Ecology Consultants 2006): (i) only production of materials and transport are included (ii) All processes during the life cycle are included but capital goods are excluded (iii) All processes and capital goods are included, capital goods are quantified according to tier 1.

Products with different functional roles may have different 'product category rules' as to how LCA is carried out and results presented (ISO14025). This will include system boundaries – for example all animal based products will have different boundary issues compared with home appliances (see also Appendix section 4).

Key questions and issues

- If the objective is to only include in the carbon label those stages that can be influenced and monitored, does this mean that the label should only cover the carbon emissions until the product gets into the shopping basket?
- Beyond this, the actions by the consumer, re transport, energy use in the home and disposal or recycling of waste cannot be accurately measured (for the label). They would have to be covered by other policies, for instance personal carbon allowances or local authority recycling targets.
- Is the accepted aim that all carbon inputs are accounted for by the carbon in all sales to consumer?
- If so, then all the waste in the system has to be reflected in the carbon that is allocated to the product.

Who puts the label on what?

Key research findings

There is very little information available on retailer waste.

Retailers have a large influence on the distance food moves post manufacture with the advent of more centralised Regional Distribution Centres (RDCs), wider sourcing and Just in Time delivery (JIT) (AEA Technology Environment 2005). This is also an emotive issue for the UK public under the guise of 'food miles'. It is estimated that supermarket distribution fleets are responsible for 25% of all UK HGV vehicle Km but only 3.2% of total UK tonne km (Annex 1: AEA Technology Environment 2005).

If all parts of the food system are included (plough to plate), retailers are responsible for about 4.8% of the UK's food consumption based carbon emissions (so taking into consideration production abroad) (Garnett 2006). It is likely that the impact of particular shops or chains varies due to situation, niche market, age of building stock, refrigeration stock age and replenishment rate and proportion of flagship zero carbon stores etc. RDCs will also have an impact, but there is little research as to what this is.

Key questions and issues

- Does the producer put the label on the product, before it gets to the retailer? This is the approach used by the Carbon Trust. This excludes detailed, accurate energy consumption and waste at the retailers, post manufacture storage and transport.
- A producer label means that wherever you buy this branded product (Walker's crisps) it will have the same label, with the same value on it.
- Does the retailer put the label on, perhaps on the shelf, rather than actually on the product? This would include accurate figures on the retailer's own energy consumption and waste. If not on the product however there is less opportunity to read information once at home – reading the cereal box over breakfast etc.
- A retailer label would mean that a branded product would have a different number in each outlet.
- Is the label provided by an independent body, for instance on the web? This could include detailed, accurate information on all retailer carbon, as well as producers.
- The use of the web would allow carbon comparisons between retail chains, but it limits the number of people who have access to the information and it is not present in the retail store, where the purchase is made.

How are the data collected and verified?

Key Research Findings

There are a number of existing reporting frameworks around greenhouse gas emissions. Two in particular are relevant: the IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1996) and the Greenhouse Gas Protocol (Ranganathan et al 2004). Both have been developed with stakeholders, have extremely clear instructions, rules and alternatives where the preferred approach is not possible, and provide a lot of support material.

Suppliers will not benefit from this label unless they can gain market advantage, which in turn relies upon a good understanding of their impacts. A data collection structure that allows for supplier learning is key. A devolved data collection approach (collection, aggregation and translation to carbon) leads to better understanding of impacts at a facility level than if an external agency collects or interprets data (Ranganathan et al 2004) (see Appendix section 7).

Verification or regulation can take many forms and apply to different things:

- Specifications and standards used for annual inspection and certification by approved certification bodies (Organic)
- Internal industry regulation via companies challenging others if they disbelieve claims. A third party carries out tests and the 'loser' pays for all costs incurred (EU White Goods Energy Label).
- Verification of methods/ processes and/or documents and/or numbers/outcomes by independent validator and dispute resolution process (FSC, project carbon finance).

There are likely to be carbon literacy issues for suppliers (Ian Walsh & Nicky Chambers pers.comm 21/03/07 and 11/04/07). Significant lead-in times are therefore likely to be necessary and additionally useful from a consumer education/ understanding perspective.

The appropriate approach may be sector or product functional group specific depending on existent in-house and regulatory monitoring already occurring.

Confidentiality is an issue – need suitable communication metrics (Ian Walsh pers. Comm. 21/03/07).

Key questions and issues

- Is information, in carbon terms, passed **along the supply chain**, increasing at each stage? A bit like VAT.
- This would require each component of the supply chain, from small farmers upwards, to be able to convert the information on say, fertiliser per hectare, into carbon per tonne of potatoes sold. This could be based on an official, issued spreadsheet with conversion factors, to minimise errors.
- The opportunities for confusion seem rife (or is this only initially?), and opportunities for verification seem minimal. The problems with verification may be the most important.
- This process would be highly educative for the personnel involved and might be the best way to focus producer interest on carbon.
- Each member of the supply chain would have to accept that this carbon information is not confidential to them.
- This approach would be more open to mistakes.
- The alternative is that data are sent to a central depository by each component of the supply chain. This centralised collection point could either be the **individual retailers** (in which case the potato farmer has to know that Tesco have bought Walker's crisps using his potatoes, which sounds complicated) or an independent body (only one set of returns per producer).
- The use of an **independent collection agency** would be most likely to ensure consistency between different brands for the same product (all crisps have a label within a few % of 75g), avoids confidentiality problems, limits feedback and is probably (not certain) the most cost-effective solution, per label issued.

- An independent collection agency would be accessible by small shops and retail chains alike.

Data allocation and aggregation – or when to use averages?

Key Research Findings

Whether an average or specific figure is used for an LCA can be significant for LCA outcomes (Wenzel 2006). This is the case when an average is used to represent a process that has a large impact on the overall life cycle footprint. Sensitivity analysis and coefficients of variation can help determine whether an average can be used or whether primary data are preferable.

Carbon emissions reported from farming should reflect longer term averages over a cycle. Long term soil fertility strategies and rotation systems mean that inputs from one year to the next will vary (Williams et al 2005).

The same procedures carried out by different farmers can lead to large variations in energy consumption. Mila i Canals et al (2003) found that energy use in apple orchards varied by between 30-50%.

A number of databases exist containing life cycle inventory data. These focus on building materials, fuels and packaging materials primarily, but each database has a number of other materials and processes included. Many have been developed in Europe, but these are poorly harmonised (Curran and Notten 2006) and are not based on UK data. However, some numbers from these are used in UK based life cycle studies. There are variations in how 'fit for purpose' data from databases is depending on what material/process is being studied as well as in what form the numbers are required (Nicky Chambers pers. comm. 11/04/07).

Storage period has a large impact on the carbon footprint of a good. Williams et al found that chilled potato storage for 6 months increased global warming impacts by about 15% at the primary production stage (2005) (see Appendix section 5).

Different varieties of crop can have very different yields, input requirements, storage requirements and infrastructure (Williams et al 2005) and so should not be generalised (see Appendix section 5).

The carbon intensity of electricity is a powerful multiplier, particularly for industries that are heavily dependent on electricity and for retail outlets. There is a variation of 42% in the carbon intensity of electricity sold to the UK domestic sector (Boardman in press), but the range for commercial customers is not known. The range across the world is even greater: it varied by a factor of over 24 in 1995 in Europe (Sweden to Greece). Should the label reflect this level of detail, as it is easy for companies to switch electricity suppliers in a liberalised market? (see Appendix section 1)

Key questions and issues

- Is the aim for an accurate label and process, based on actual consumption and emissions? Actual, real-time (by some definition) measurements, not something based on last year's averages? Or should it be based on a model that can take temporal and spatial aspects into consideration?
- Linked to the debate about data collection are issues to do with the detail of the data. For instance, if Farmers A and B both provide apples to Bulmers for cider, then the carbon figure from Bulmers will be an average of these different carbon inputs. Would we expect all the liquid cider from Bulmers to have the same average carbon intensity, or would Bulmers be entitled to provide a range of numbers, with the same average?
- If the same two farmers provide apples directly to a supermarket, then the carbon labels on the apples are probably going to be a direct reflection of the carbon intensity of the two farmers, separately, this is because we want to encourage consumers to buy the least carbon intensive apples. This will, in turn, result in the retailer purchasing less from the more carbon intensive Farmer B and giving him/her an incentive to change.
- If the only reason that Farmer B is more carbon intensive is that the farm is further away, then is this an acceptable reason for their apples to have different carbon values? Is the answer the same, whether Farmer B is in Scotland or in New Zealand? How does this interact with wanting consumers to buy local produce?
- How frequently does the label change? Do the apples have the same label in October, when they are freshly picked, as in the following April, when they have been chilled for 6 months? To encourage consumers to buy seasonal produce, the labels have to reflect seasonality.

Time and monetary costs and who pays?

Key Research Findings

Life cycle analyses can take varying amounts of time depending on the level of detail required:

- Saunders et al (2006) NZ study – 6 months, 4 commodities, P/T involvement 3 people, much data secondary sourced and with half the data available already.
- Boots – 3 months, 2 shampoos, P/T involvement of 8 people
- Cadburys – 6 months, 2 products (although work carried out on a part time basis and not a top priority)
- Glaxosmithkline - 2 studies – head-office footprint (building to business travel) & 7 drinks products: 2-4 weeks for a site based study (although now systems have been set up this would now take a week) and all product studies took 4-6 months. F/T internship of 4 months plus day or two from 6-10 others.

Costs will be acquired in understanding and mapping the production process, measuring throughputs and buying the equipment to weigh inputs and outputs, buying meters, longer term monitoring, buying access to databases, filling out documentation and databases, verification and certification (see Appendix section 4).

Key questions and issues

- What cost, per product, would be too much money? Has it got to be less than 1% of the purchase price?
- Does this have implications for the method of data collection? For instance would a centralised, independent body really be the cheapest, over what timescale?
- Are there certain, up-front development costs (research, software development, etc) that have to be accommodated? Is this a Government or industry expenditure and how is it recouped? Or isn't it?
- It is assumed that costs will fall over time, as the database is assembled, people get familiar with the system, etc. What are the predictions for cost reductions, over what timescale? Are these acceptable?
- Do we start with software and spreadsheets for all? Is the development of these one of the first tasks?
- How to minimise costs for:
 - Small producer
 - Overseas producer
 - Small retailer

What type of label?

Key Research Findings

There is a very large range of embodied carbon emissions amongst food goods – according to various data reported (see table 2). This has implications for granularities were a banding system to be used – each band might need to be so large as to obscure any variation within goods of the same functional type (such as fresh fruit).

Table 2: Embodied carbon of products sold in the UK*

Product	Carbon CO2e	Method	Source
Apple	26g	Unknown	Innocent press release
Organic Grapes 400g	2.8kg 7gk/kg	Seed to shelf	Organic Farm Foods
Innocent Smoothie, mangoes and passion fruit 250ml	294g 1.2kg/l	Carbon Trust	Innocent
Innocent Smoothie mangoes and passion fruit 1L	760g approx	Carbon Trust	Innocent
Innocent Smoothie mangoes & passion fruit Kids 180ml carton	190g 1.1kg/l	Carbon Trust	Innocent
Beefburger	4.5kg	Unknown	Innocent press release
Packet of Walkers Crisps 35g	75g	Carbon Trust	Pepsico
12 roses from Holland	35kg	Seed to UK Distribution Centre	Ashridge report
12 roses from Kenya	2.2kg	Seed to UK Distribution Centre	Ashridge report
Boots Botanics Shampoo	161g	Carbon Trust	Carbon Trust
Cheese	9-26kg/kg	Plough to plate	Foster et al (2006)
Carrots: 1 kg fresh bunched	241g	Plough to landfill (excl home use)	Foster et al (2006)
Carrots: 1kg frozen bagged	1.2 kg	Plough to landfill (excl. home use)	Foster et al (2006)
Carrots: 1 kg canned	1.4 kg	Plough to landfill (excl. home use)	Foster et al (2006)
Fishfingers 1kg	3.7 kg	Sea to retailer	Foster et al (2006)

* This table contains data from very different sources with different assumptions and boundary conditions. These figures are indicative of the general spread of carbon impacts between goods and the relatively more and less intensive foodstuffs.

The embodied carbon of fifteen Boots shampoos has been quantified and the difference between the carbon content is minimal – 6% (Andrew Jenkins, pers comm. 18/04/07). However these do all have quite similar production chains as they are own brand. It was pointed out that were the packaging materials different, a larger variation would have been found.

A common per kilogram measurement can help consumers make like-for-like comparisons across products in different forms. For example drinks in different portion sizes (see Innocent Smoothies in table 2), foods in different forms – such as a whole apple versus a chopped apple. This highlights the different food to

packaging ratios. There is also an issue of portion sizes – comparing 1kg of cheddar with 1kg of parmesan will not reflect the different way these cheeses are eaten.

Food Standards Agency research carried out in 2004-2005 found that consumers are better able to use a colour coded than number based system for making decisions between goods with different nutrient content (FSA 2007) (see Appendix section 9).

Both award labels and banding labels have been used for choice editing: Sainsbury’s with Marine Stewardship Council and Fair Trade (award labels) and the European Council with white goods energy labelling (banding label).

A comparative metric was favoured by Dragon focus groups for carbon labels (8 x 8-10 self selected environmentally concerned participants) (Dragon 2007) (see Appendix section 9). A carbon daily allowance would provide some reference against which to measure a product’s embodied carbon. Below is a table of the variation in allowances that arise using different figures that estimate the UK’s carbon footprint. The first uses our national emissions figures and so reflects the UK’s ‘production’ emissions, but not consumption, whilst the other two are consumption based.

Table 3: Carbon allowances depending on data sets and assumptions

Emissions coverage	Total national MtCO2e	Annual allowance* tCO2e	Daily allowance Kg CO2e
All UK GHG emissions including emissions we export as goods & not including emissions we import as goods	655	10.9	29.9
Carbon emissions including imported emissions and excluding exports (WWF). Carbon only, not all GHG	714	11.9	32.6
Carbon emissions including imported emissions & excluding exports (Carbon Trust). Carbon only, not all GHG	646	10.8	29.6

* Assumes a UK population of 60 million

Sources: HM Government 2006, WWF 2006, Carbon Trust 2006

The WWF and Carbon Trust numbers have high uncertainties associated with the emissions associated with goods imported from abroad which are estimated to constitute 32.5% of our consumption footprint (although a proportion of our imports may well be re-exported after value adding in this country, so the actual figure may be a bit lower). These uncertainties exist because we do not have a clear method for accounting for the carbon intensity of products that are imported.

It seems that neither the WWF nor the Carbon Trust include direct greenhouse gas emissions – from livestock, farm practices and HFC/PFCs. Therefore both are likely to be underestimates. The difference between the numbers is due to different assumptions around the carbon intensity of imports.

Were a GDA for carbon to be used, it would be unclear what proportion of this would be allocated to food, travel, household needs, clothes etc, or whether it would be a baseline comparative number. Another issue is how this would change over time, whether a 60% by 2050 target would be used to guide this, or whether this would simply reflect our national emissions.

Key questions and issues

- This debate is at the interface between levels of detail and levels of influence.
- An award label, (ie it is either there or not) has little meaning to consumers on its own, but can become to be seen as having status, if it is applied only to the 'best' brands.
- If the label has some detail, such as the number included in the Carbon Trust label, it still provides some challenges to the consumer to make a comparison and therefore change their purchasing patterns.
- A comparative label identifies where a brand comes in the range, without the other brands sitting beside it.
- Even if it is a comparative label, is it a number on the label, which consumers have some difficulty remembering, or is it like the A-G EU energy label, which is easier to remember? The latter requires defined, and agreed, bands, in turn is likely to require the embodied carbon of a large range of goods within that functional group being calculated before banding can be assessed (see Appendix section 11).
- With comparative labels in particular, is there one scale across all products (ie all meat is G) or is there an A-G distribution across each of several sectors (eg meat, dairy, fresh fruit). In which case, there could be some 'A' labelled meat (see Appendix section 9).
- Both award and comparative labels provide several opportunities for retailers to build on, for instance double points on all 'A' and 'B' labelled vegetables this week.

Which products?

Key research findings:

From a European perspective, the top 4 food groups in descending carbon intensity are: meat and dairy > fats and oils > bottled and canned soft drinks > bread, cakes and related products (Tukker 2006) (see appendix section 2).

Within meat, and assuming that post farm the supply chains are very similar, the ratio of difference between the least carbon intensive meat (chicken) and the most (lamb) is: 3.8 times (Williams et al 2005).

Other important consumer products that are not currently covered by a label are: clothes >ITC> Household audio & video equipment (although TVs with integrated digital decoders are included under the Energy Saving Trust label) (Tukker 2006).

It has been argued that there are competing social, economic and environmental issues around products and that a carbon label only tackles part of this. Fair Trade goods, wood and fish products are three examples where a carbon label will only represent part of a broader, more complex mesh of impacts that involves livelihoods and resource depletion. The relationship between carbon and issues like resource depletion need further investigation, but this line of argument also supports labelling goods where carbon, and not other variables is the primary concern (see Appendix section 9).

Key issues and questions

- The assumption is that we will have to prioritise action in some way. So far, the process has been driven by interested producers nominating products.
- Should carbon labelling ignore energy-using products, as these are mainly covered by the EU Energy Label? Though this only covers energy in use, not energy in production.
- Should we leave clothes, cosmetics, newspapers to later? The advantage of some of these products is that they may have (a relatively) long shelf life, don't need chilling, etc, so some of the complexity is excluded from these products (see Appendix section 2).
- If the focus is mainly on food, what would this mean? Should we first deal with products that are the:
 - Least processed?
 - Have the biggest potential for savings – how do we identify?
 - Most carbon intensive, which means meat and dairy?
 - Where consumers are most likely to switch and change the market – again how would we know?
 - Components of a standard shopping basket, like the retail price index, to give a carbon content index?

Links with other policies

Key Research Findings

The energy source used is very influential on the final LCA results (Wenzel 2006, Williams et al 2005, Foster et al 2006, Williams 2007, Carbon Trust 2006, Andersson and Ohlsson 1999). In the UK electricity is the most carbon intensive energy carrier. The Carbon Trust has disallowed the carrier of a carbon label from benefiting from the use of renewable energy unless the Renewable Obligation certificate or Climate Change Levy Exemption Certificates have been retired. If the energy is used outside the UK similar additionality criteria must be met. In other words, if the renewable energy source used was going to be brought into the national electricity generation portfolio anyway, the company cannot benefit from the reduced carbon on the label (see Appendix section1).

Reducing carbon emissions can lead to trade-offs with other environmental or animal welfare factors: organic beef production leads to a trebling in nitrate leaching and increase in land-use requirements according to the Silsoe-Cranfield environmental burdens model (Williams et al 2005), whilst organic and free-range chicken rearing leads to increases in carbon emissions (Williams et al 2005) (see Appendix section 5).

There are problems with comparing 'like with like' within a food group, such as meat, as the rearing of those animals can fulfil different functions (Williams et al 2005). The rearing of sheep on unimproved upland pastures in the UK is a land management and conservation activity. Chickens could not use this land effectively (see Appendix section 5).

The use of reference systems can have a significant impact on the result of an LCA (Wenzel 2006) in the case of wood. A reference system is used in LCA to take into consideration any environmental impacts (in this case carbon emissions) that have resulted from land-use change caused by the production of the good in question. For example, if previously forested land is deforested and ploughed for food production, the carbon lost from the system in the form of trees and soil exposure can be counted towards the embodied carbon of the food grown. Some products in which a reference system might be preferable include wood, crops grown on peat soils, Amazonian beef and soya production, palm oil production and particularly biofuel production.

Fish consumption is relatively carbon intensive compared to other food stuffs (Carlsson-Kanyama 2003 and Foster 2006). However it is not clear whether there are synergies between carbon intensity and rarity of fish species or fishing method.

Green consumers on their own are not able to change mainstream product markets (Sustainable Consumption Roundtable 2006). Neither is labelling for the most part. Minimum standards, choice editing, consistent quality of products, fiscal incentives, voluntary initiatives and awareness raising all contribute to pushing for market change (Sustainable Consumption Roundtable 2006 & Boardman 2004) (see Appendix section 9).

A quarter of Fair Trade consumers are altering their purchasing decisions because of food miles (Thottathil 2006). Therefore, there is reason to be wary that niche ethical markets that support production abroad may be negatively affected by a carbon label.

Key questions and issues

- There are a variety of other policies that the carbon label interacts with, both present and future. These interactions, generally, will depend upon the design of the carbon label and process that is decided upon, so cannot be identified yet.
- Are there certain policy objectives (eg Fair Trade, encouraging seasonal / local purchases) that have to be protected and not harmed by the carbon label? The evidence from the NZ study (see appendix) is that NZ lamb is

less carbon intensive than UK lamb, in which case there would be a conflict between buying local produce and the carbon label.

- The extension of the EU Emissions Trading Scheme will encourage participants (major retailers in future?) to reduce their in-house carbon emissions. Could this be extended to the produce that they sell, without too much double counting?
- What else would encourage retailers to sell different products and brands? Would the carbon content of a standard shopping basket, regularly monitored and advertised by Government, be sufficiently influential?
- How to encourage suppliers to change? Is this all dependent on the retailer's purchasing policy, or should the data collection system be open and public, to enable suppliers to benchmark themselves?
- How to encourage consumers to change? Is this just dependent upon retailer policy, for instance in relation to double points? What else would work?
- How to take stakeholder engagement forward so that issues around social justice (such as fair trade) and other environmental issues (such as wood harvesting) are managed?
- Can this label help with government sustainable procurement? What would this mean for how the label is developed and where it is used?

Collaboration

- If we are to work together, what is the best way to collaborate? (see Appendix section 8 for brief overview of other projects/strategies around the area of sustainable production and consumption).
- There has been some mention of a Carbon Stewardship Council, is this the best route?
- Who would be responsible for setting this up and appointing the Council members? Would this be DEFRA?
- When Tesco set up an independent Sustainable Consumption Institute, to facilitate the development of a universal carbon labelling scheme, amongst other things, should this been seen as the secretariat for the Carbon Stewardship Council?
- It is hoped that there is general agreement that the aim is to have a universal carbon label, not several different schemes.
- Do we want to launch the label on the public only, when it is effectively final, so that they do not get used to one label and then find it is changing?
- What does this mean for the Carbon Trust label?

Acknowledgements

Kevin Ramm - ECI, Polly Erikson – Global Environmental Change and Food Systems, Tara Garnett – Food Climate Research Network, Steve Reeson – Food and Drink Federation, Ian Walsh – Cadbury's Schweppes, Matthew Wenban-Smith – One World Standards <http://www.oneworldstandards.com>, Claire Nuttall at Dragon Brands, Caroline Storey – Glaxosmithkline, Andrew Jenkins – Boots and Nicky Chambers – Best Foot Forward and Marisa Vaughn – The Soil Association.

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