

Fuel Poverty Carbon Footprint

Evaluation Report

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Fuel Poverty Carbon Footprint is a research project looking at the carbon footprints of private householders who have received energy saving measures under a local authority scheme in the East of England. The survey was carried out in the period February to June 2008 by

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Evaluation Report
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The project report and a summary report are available from www.pett-projects.org.uk and from the Eaga Partnership Charitable Trust website.

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Introduction

The project 'Fuel Poverty Carbon Footprint' aimed to compare the carbon footprints of selected fuel poor and/or formerly fuel poor households with the national average.

The study attempted an initial quantification of the carbon emissions of a number of households that had received measures through fuel poverty programmes. It used a publicly available carbon footprint calculator (Act On CO₂), to compare the emissions of the group that have received measures with the UK average. The intention was to provide information as to whether the "post-fuel poverty programme footprint" is detrimental to carbon saving programmes, or whether, in general, solving fuel poverty is an equitable step towards lower UK carbon emissions. It aimed to provide information about the carbon benefits of fuel poverty programmes looking at household, appliance and transport use, in order to demonstrate that tackling fuel poverty is consistent with, or at least not a threat to, tackling climate change.

Main aims of the project

The aim was to provide policy makers with information about the carbon impact from the lifestyles of households in fuel poverty and those which have been removed from it through fuel poverty programmes. This in turn aimed to assist those making decisions on priorities for funding and delivering programmes to understand the potential conflict between climate change (carbon reduction) programmes and fuel poverty (social equity and energy efficiency).

Main objectives of the project

The objectives were:

- to carry out a quantitative survey of the carbon emissions of a number of households that met the criteria of the research (the subject group). These were categorised, in general terms, as having qualified for fuel poverty programmes by being in or near fuel poverty or in receipt of triggering benefits.
- to carry out a case study of the lifestyles of at least five of the subject group to provide information of the changes in lifestyle and carbon implications of removal from fuel poverty
- to report on the research to key organisations and individuals that influence the policy agenda for fuel poverty and climate change

Report structure

The report begins by considering the design and implementation of the project, highlighting difficulties encountered and discussing the solutions found. It does not readdress issues of measurement that were discussed in the project report, but does discuss problems with the data themselves. There follows a chapter on the results, evaluating the validity of the results and the concerns of the author on the reliability. This includes a critique of the methods used to assess the impact of the measures on the risk of the householder being in fuel poverty, and the difficulties overcome in managing the effects of price rises. The next chapter evaluates the case studies and their role in the project.

An assessment of the findings of the project is presented together with recommendations were the exercise to be repeated. Finally there is a carbon footprint for the project.

Methodology

Overall design

Householders that had (any) energy efficiency measures installed as a result of their authorities' fuel poverty programme were interviewed to establish their carbon footprint according to the Government's Act On CO₂ calculator. They received feedback on the result, both at the end of the interview and a follow-up report based on the Act On CO₂ report tailored to their situation. Five households were selected for a second, more in depth interview, about their lifestyles, what has changed since measures, and their carbon footprints, to provide narrative case studies. They were asked to monitor their food, public transport, waste and water usage in a four week period prior to the second interview. These were to be compared with other footprint case studies and studies such as family expenditure surveys.

Subjects' carbon footprints were compared with:

- Their LA averages
- Households of similar composition within the interview group (e.g. all pensioners, all one adult families with children etc)
- National averages
- A control group who have used the Act On CO₂ calculator or one of the clones from the engine provider d-gen.

Conclusions were drawn about the carbon footprint of the sample leading to theories or hypotheses about footprints of households in or near fuel poverty and the interaction of fuel poverty programmes and climate change (carbon reduction) programmes.

Project organisation

The project was carried out by the author with a grant from the Eaga Partnership Charitable Trust. The idea had been developed in conjunction with Ian Bradley, NEA-Eastern Region as a response to a perceived issue voiced by Local Authority officers at the HEON-E (HECA Officer Network-East) meetings which both attended as Associates. As the project gained its funding, it was announced that funding for Ian's post was being cut back and therefore his involvement in later stages was much reduced.

A Steering Group was recruited which consisted of Virginia Graham (for Eaga PCT Trustees), David Lynch (NEA), Bruce Pittingale (Chair of HEON-E), Dr John Turnpenny (UEA), to give experience of fuel poverty, local authority issues, and research expertise including carbon footprinting issues. John Davis, HEON-E secretary and consultant in domestic energy efficiency was invited to join the group as the project progressed.

Setting up the interviews

The original duo developing the programme worked well together as one was optimistic about the numbers that could be engaged in the project, and one was pessimistic. What was needed were local authorities who had recently instituted a programme of energy efficiency improvements for the purpose of reducing fuel poverty in their areas and who were willing to invite these householders to take part in the interviews. The subjects therefore qualified for and benefited from these programmes (the criterion for selection) whether or not they were in fuel poverty beforehand. It was envisaged that as many as ten LAs could show interest, which was indeed the case before the project gained funding, and that obtaining about twelve interviewees from the programmes of each was likely. However, without additional personnel to carry out interviews, this was felt to be too many, and an upper limit of 40 was envisaged, as engaging a second interviewer could introduce variability in interview quality.

Once funding was achieved, the LAs were invited to participate. Some were able to commit straight away, others were reluctant to do so due to other commitments or to the progress of projects underway needing their full attention, and in one case long term sickness prevented the LA from participating. This caused delays and also caused the interview period to be spread out, whereas the original concept had been for all interviews to take place in the January to March period.

Three LAs were able to commit before Christmas, two of whom sent out letters based on a model provided by the researcher soon after Christmas. The third intended to involve households who were currently being retrofitted with energy saving measures, determining that the 'pre' meter reading required could be done by their contractor, and the 'post' interview carried out by the researcher would double as feedback and satisfaction survey. While this was an excellent idea, and ideal for a real 'pre' and 'post' survey, the logistics failed as other work and difficulties with the LA project put this on hold. Two further LAs were engaged by mid-February; Kings Lynn gave an added incentive of four free energy efficient lightbulbs to participants. In the event many of those interviewed said they had enough already (supported by the questionnaire response), and the 'spares' were given to the case study participants. These last two were joined by the earlier LA in sending out letters in March.

For all but one LA group, the interviews were arranged by telephone with a letter confirming the details and also the interviewers photograph for security. This enabled the subjects to set a day and time that suited them, to establish the need to take meter readings and to answer any initial questions they had. At this stage there was a small drop out, with people who decided not to take part because it seemed too much bother, or because of recent publicity about lost data from the Benefits Agency, which generated concern about being asked personal questions. On the whole, the researcher managed to get the interviews scheduled in a way that minimised car travel.

An error in the letter sent to their candidates meant that Kings Lynn and West Norfolk had not obtained phone numbers. One or two were found in the directory, but most were ex-directory or not on the phone. A letter was sent to all these candidates proposing a date and time and asking them to telephone to confirm. Approximately 50% were re-arranged, either immediately or subsequently, as it appeared that a surprisingly high number had been invited for long-awaited hospital appointments at Addenbrooks the same week as the interviews! One person dropped out after receiving the letter, two did not respond to the letter, one of whom was not in when visited (and a note left for them in case they wanted to proceed, which was not acted upon).

The breakdown of interviews, together with the number of letters sent out by the local authorities is shown in Table 1:

Table 1: Interviews secured from LA contacts

LA area	Initial Letters sent	Contacts supplied	Interviews arranged	Interviews done
Suffolk Coastal	50	10	9	8
Norwich City	22	8	7	5
Kings Lynn & W Norfolk	26	12	11	7
Huntingdon	18	6	6	6
Broadland	40	6	5	5
Totals	156	42	38	31

The spread in times when LA send out their initial letters meant that the interview period spread from February to May so that two heating seasons were involved. This meant that measuring the ambient temperature during the interviews was useful for the first two LA subjects interviewed in February and March, but not for the others, when outdoor temperatures were warm to hot.

The majority of interviews took place as planned. One was aborted when it emerged that the householder had not taken or kept any meter readings that could be used in the interview. Two further interviewees were out when first visited as arranged. They were rearranged by phone, but one was still unavailable on the second visit, so the interview aborted. One day of Suffolk interviews had to be rescheduled due to computer failure on the researcher's part. These were rescheduled to the different days following week, and fortunately travel by train to these was feasible.

The degree of failure of interviews is on a par with the previous experience of this researcher. In a previous project¹, Housing Associations had been signed up to the project before funding was gained, and the main problems experienced then were that the length of time between signing up and the project going forward meant that other projects intervened and they were unable to devote the time to it they had originally envisaged, plus changes in personnel. Interviews had been arranged either by local contacts or by the project team; the number of people who were out when initially visited was, if anything, higher than in this project.

Questionnaire development and background research

While the interviews were being arranged, the researcher carried out a literature review on studies of energy use in the home particularly of fuel poor households, and post measures installation, and or carbon footprinting. No directly relevant studies of carbon footprinting were found, although some individual ecological footprint studies had been published², these did not focus on energy issues, and only one took any account of socio-economic data³. In order to develop the questionnaire for this project, the researcher relied heavily on the evaluation done for her previous project 'User Behaviour in Energy Efficient Homes', although during the report writing she recalled that she had intended to return to the questions asked in the Torbay report⁴ that she had read at this time. Although the questionnaire (Appendix 1) is satisfactory, it could be improved by further reference to the Torbay report.

During the development of the project proposal, the researcher had identified the Act On CO₂ carbon footprinting tool as the appropriate tool, because it had been developed by EST and was the Government's official tool, and also because the online arrangements appeared to offer both direct access and access to control data. In the event, whilst a large project with a web programmer or software developer would be able to utilise the system more effectively, the benefits were illusory. In order to use the system to record the interviewees' meter readings at the time and give them instant feedback on their carbon footprint (desired), it was necessary to build a copy of the Act On CO₂ tool using an Excel spreadsheet.

¹ Pett J & P Guertler (2004) User Behaviour in Energy Efficient Homes, ACE, London

² Caird, S & R Roy (2006) Household Ecological Footprints - Demographics And Sustainability *Journal of Environmental Assessment Policy and Management* Vol. 8, No. 4 (December 2006) pp. 407–429

³ Haq et al (2007) Greening the Greys – Climate Change and the over 50s. SEI, York

⁴ Basham M, S Shaw & A Barton (2004) Central Heating: Uncovering the impact on social relationships and household management. Torbay Healthy Housing Group, Devon

This is not to imply that the Act On CO₂ online tool is that simple, but by standardising the types of inputs through the interviews, the amount of functionality could also be reduced to a straightforward carbon calculator. However, in checking its validity using the input of the Steering Group, some doubts emerged over the way the Act On CO₂ calculator allocated seasonal meter readings. EST were very helpful in enabling the researcher to iron out these problems.

It should be noted that the Act On CO₂ tool is being enhanced and that the version online now is not necessarily the version used in the period March-June 2008 for this project.

One way of overcoming this issue would be to use a laptop with live internet capability to access Act On CO₂ in the home. Indeed, the number of households visited with internet access means that many could be done on line in the home, and the householder could continue using it in the future. However neither wi-fi access nor household internet access can be guaranteed, certainly not in rural areas where mobile phone signals may be problematic. Also the details of the house type, measures, readings and appliances were needed for the analysis, so do need to be recorded by the interviewer.

Interviews

Interviews took place in the participants' homes. After the introduction and gathering of household composition for classification purposes, the Act On CO₂ questions were asked and the carbon footprint produced using the spreadsheet version of the calculator. The carbon footprint was explained, and compared with the local and national footprints. Some high footprints were explored further and possible reasons explored, and the subject referred to the Energy Advice providers where appropriate.

Following the use of the calculator, the subjects were asked how their fuel bills compare now to before the measures were installed. This was complicated by recent fuel price rises and the use of direct debits which may or may not have been adjusted by the energy supplier⁵. A range of typical statements about comfort, easing of finances and health were asked, following which the subjects' income range and age range were established. Income ranges were divided into deciles based on ONS income data, and subjects were asked to make these inclusive of benefits.

At the conclusion of the interview, householders were asked whether they would be willing to take part in a more detailed study that includes a review of food buying habits, waste & recycling, and further discussion of the differences that the measures have made to their lifestyles.

The interview plan is included in Appendix 1.

No difficulties were encountered during the interviews either with the questions or with the calculator itself. Two houses in the first group where non-standard measures and additional fuels were used provided the opportunity to 'tweak' the system, and this worked well when other additional fuels were encountered in later interviews. One subject was happy to complete the carbon footprint part of the interview but declined to answer the questions on fuel costs or income.

⁵ In passing, it was noticed that the direct debits for E.On, EdF and Scottish & Southern were not raised unless the householder agreed to them, and they could pay off any debit balance on receipt of the quarterly statement. British Gas, on the other hand, raised direct debits as they saw fit and those households using this company were generally in credit, usually in excess of £100.

Data management and analysis

Data held comprises:

- Reference number of interview
- Household type; age and adult etc composition
- House type and construction type (cavity or solid wall)
- House details as required for Govt calculator
- Fuel/heating types and usage
- Appliance types and usage
- Transport types and usage
- Carbon Footprint
- Income bracket
- Willingness to take part in second interview for case study

And for case studies:

- Water usage for the period or actual meter readings
- Waste arisings for the period
- Food purchases by receipts plus specified packaging for analysis of provenance
- A public transport diary (private transport is included in Act On CO₂)

Carbon footprints were analysed by household type, by fuel type, income bracket and age bracket. The actual fuel costs provided are used to identify degree of fuel poverty (Affordable Warmth Index) before and after measures, and the house type and measures modelled using the ACE Fuel Prophet tool to estimate Affordable Warmth Indices for before measures at current prices, before at previous prices, and after and current prices (March-May 2008 prices). This allows the comparison of footprints of those who have moved in and out of fuel poverty.

Sources of error

Raw data:

- gas and electricity meter readings were taken one month apart, plus or minus 2 days, however they are not corrected for degree days nor for unusual events, like guests for the weekend, although one couple who took one week's holiday were interviewed with a five week gap between their two sets of readings
- the two interviews that were rescheduled due to the interviewers computer problems had their meter readings adjusted to an equivalent four week period
- Fuel bills paid by direct debit are usually unknown or estimates
- Fuel rates that have been 'fixed' i.e. guaranteed for a period by the energy supplier, are assumed to be the actual bills (as they are the money that is being paid) although they are not directly comparable with others in similar houses
- Income was self-reported in deciles and included benefits
- The self-reported behavioural questions in Act On CO₂ have no benchmark for the prompted answers e.g. sometimes, often

Case studies

Five case studies were carried out with people willing to discuss the changes in their lifestyle because of the energy efficiency measures and to monitor their use of other resources with a secondary carbon impact.

The objective was to discover what the energy efficiency measures have meant to them in terms of:

- Warmth
- Health
- Disposable income

- Changes in type of carbon emissions

The aim was to secure additional interviews representing the following groups:

- Family with young children
- Pensioner
- Long-term sick or disabled
- Rural
- Hard to Treat homes (probably an off-gas property rather than solid walled due to the type of schemes under consideration).

Because of the delay in carrying out the second batch of interviews, the majority of the case studies came from the first round, i.e. from Norwich City and Suffolk Coastal. The LAs involved in the project were invited to comment on this list and the main request was to include a single young mum in rented accommodation if possible. This wasn't possible in the profile of the original interviewees, but six candidates were invited to take part who represented this group, one of whom experienced a health problem during the monitoring period and withdrew.

The six were sent a letter with instructions on data and items to save during the period, with an example (see appendix 2), and an appointment was made for a date close to the end of the monitoring period. Four of the interviews took place in the first week of June, and the other 2 weeks later (a 25-35 year old single mother who was the last to be interviewed in the original round). The interview looked at the information they had collected, noting any difficulties experienced; reviewed information they gave in their first interview about the changes that the measures installed made to their lifestyle, this time collecting narrative detail, and checking where any information subsequently realised to be important (e.g. energy supplier) had not been collected initially. They were also asked about their understanding of the term 'carbon footprint', and due to recent publicity about personal carbon allowances and acceptability, a question about how they would feel about these.

The results of the case study monitoring were used to estimate secondary carbon footprints for food, waste, water and public transport, to add to the Act On CO₂ breakdowns and create a footprint more closely aligned to the average figures quoted for comparison by Act On CO₂. The case studies were written up and a draft sent to the individuals for approval and amendment, together with a permission form. Stamped addressed envelopes were included for their use to reply.

The case study methodology was based on the approach used by the Open University in the Environmental Change and Public Health course, the data accrued from which is the basis of the further analysis by Caird & Roy (op.cit). The main difficulties were developing a questionnaire that could be used across a number of different waste regimes (bins sizes, recycling facilities offered) and water usage options (metered versus unmetered). The travel diary was straightforward and based on one used by Transport for London in the 2001-6 period.

Sources of error:

- waste was recorded as amount in bin when put out for collection, ranging through quarter full, half full, three quarters full, full, and overflowing. This is a rough estimate by eye and does not reflect the weight of rubbish disposed of, nor the compressibility of the contents. Carbon emissions from waste are estimated for general municipal waste by weight, and do not reflect the amount recycled. One month's diary may not reflect the pattern for the year.
- water diaries are notoriously unreliable, and in this case an estimate of the amount of water used in each action was based on the OU average, which

is far more than the researcher's personal experience, and may bear no relation to any of the case study usages. All the case studies recorded water usage well below average and these results are displayed with caution

- travel distances are estimated; public transport carbon emissions are variable although standardised factors are being developed
- food purchases were recorded for use on a food carbon calculator but others exist that simply work on the amount spent. The food bills saved may not have been inclusive and the footprint does not take account of meals out.

Comparison with a control group

The aim was to compare this survey sample with the general population to assess whether people who receive measures under an affordable warmth programme have lower carbon footprints than the general public.

Early in the project the support of d-gen, the people behind the Act On CO₂ engine, was sought to provide a control group; they recommended Herefordshire Unitary Authority as the furthest advanced. Comparison of the carbon footprints of this group with a control group was intended to determine whether the sample group was significantly different from a group drawn from a wider cross-section of society but in a similarly mixed rural/market town/ small city region. It took some time to secure this data, and other alternatives were explored, but eventually Herefordshire agreed. Although their site was explored early in the project, and both surveys use the same engine, the Hereford footprint was finally produced as a personal one, excluded air travel and included a food footprint. This meant that the footprints were not directly comparable. Attempting to gain the underlying data from d-gen, which Herefordshire suggested, drew a blank. As the average food footprint cited in their online report was 2.0 tCO₂, a 'fudge' was made by subtracting this from the control average, and recalculating the household footprint of the survey to personal ones excluding air transport, thus enabling a comparison to be made, although it is not robust. The calculation of t-test comparing the two groups indicated that the survey sample was not significantly different from the Herefordshire control group.

Clearly this is not ideal. Had the final form of the control group been recognised at an earlier stage, the typical week's food shopping bill could have been asked as a standard question and a proper comparison with the control group would have resulted. The learning point is to ask the question anyway in future, even if the control group has been secured.

Results of the interviews

The survey group characteristics

There were thirty-one subjects from five local authorities. The majority (22) were retired, and those with families were spread across age groups. Table 2 shows the base characteristics of the survey group.

Table 2: Characteristics of households interviewed

Age group	25-34	35-44	45-54	55- p.a	p.a – 74	75+
Number	1	4	2	2	12	10
Income decile	A	B	C	D	E	Prefer not say
Number	11	7	3	6	3	1
Number in Household	1	2	3	4	5	
Number	10	14	5	1	1	
Occupation (head)	Retired	Full-time employed	Part-time employed	Long-term sick/disabled	Self-employed	
Number	21	2	5	2	1	
Children	H'holds with children	Child age	3 -	4 -11	12-18	
Number	8		1	4	8	
Priority group	PG (Bens)	PG (age)	nonPG			
(estimated)	18	7	6			(n=31)

The sample may be overweight in pensioner households but that is not surprising given the type of areas involved.

The house types are shown in the matrix below. All but five homes were on the gas network when interviewed; of the oil-fired homes, 2 were 2 bedroom bungalows, 1 a 3-bedroom bungalow, and the other 2 were three bedroom semi-detached. Four dwellings were solid wall, 9 inch brick, and one was traditional timber frame with weatherboard. One of the solid walls dwellings was also off the gas network. Given the nature of programmes for energy efficiency being highly biased against measures for hard to treat homes, and East Anglia having a relatively higher proportion of these, this is a reasonable reflection of the area.

Table 3: House types of interview group

(n=31)	2 bedroom	3 bedroom	4 bedroom
Maisonette	1		
Mid-terrace House		4	1
End-terrace House	2		
Semi-detached house		7	1
Semi-detached bungalow	2		
Detached house		2	1
Detached bungalow	6	4	

The carbon footprinting questionnaire required the classification of urban or rural. Many of the households were in small market towns or large villages, and the decision to classify them as rural depended on whether there was farmland or similar within 200 yards and whether there was good local public transport. So a

house in the centre of a small town might be 400 yds away from farmland; if no bus service was available, it was classed as rural, but with good transport links, as urban. On this basis, 19 were classed as urban and 12 as rural. This is somewhat arbitrary and no guidance is given on the Act On CO₂ website.

Whether the occupants had experienced reduction in fuel bills was masked to a great extent by the fuel price rises over the previous twelve months, some suppliers having increased prices twice in that period. Nevertheless, reductions in prices had been noticed by 14 in response to the question "Have you noticed any change in your fuel bills since the work was done" with a further 3 saying down then up after recent price rises. One person preferred not to give answers on these ancillary questions. It was decided to explore this question further when analysing the data when the effects of price rises could be applied to the data obtained in the interviews.

This question was followed by a list of possible changes to their lifestyle since the work was done. The list was drawn up from typical statements made in previous surveys and suggestions from the Steering Group. Although some people made comments about some of the statements because to them they seemed absurd, particularly 'I've been feeling better in myself', other subjects agreed with the expression whole-heartedly (11 agreed). And the range of issues seemed well covered. This survey did not intend to enquire specifically about health benefits, especially as the time elapsed between the measures installation and the survey was unknown at the outset and could vary from LA to LA. Also the previously cited 'User Behaviour' study found limited use in the health questions, especially among an ageing population. However the health questions used by the Torbay study would be usefully revisited in a wider survey.

One issue raised by one of the Steering Group when reviewing the report is the extent to which the selection of the survey sample put a bias in favour of 'Middle England'. It is true that ethnic minorities and urban households are under-represented in this survey, as a result of the focus on the east of England, and in particular on Huntingdonshire, Norfolk & Suffolk. The survey appears to represent these areas reasonably well; it may not be directly transferable across all regions, especially not to highly urbanised areas. Many of the pensioners visited could be described as 'genteel'. There is a range of those managing easily on their pensions and those experiencing hardship and even privation. It could be suggested that some of these are the 'hard to reach' but the fact that they responded (twice) to a local authority letter about energy efficiency contradicts that idea.

One question that could usefully be added is "What made you decide to take part in the survey?" Some volunteered the information that they were interested in the subject, some were clearly keen on using resources 'well' or frugally, and at least two expressed motivations reflecting thanks to the council for having helped with the measures and a duty to help in return. Expressly asking the question would have provided information on motivations and helped eliminate or confirm bias.

Carbon Footprints of the survey group

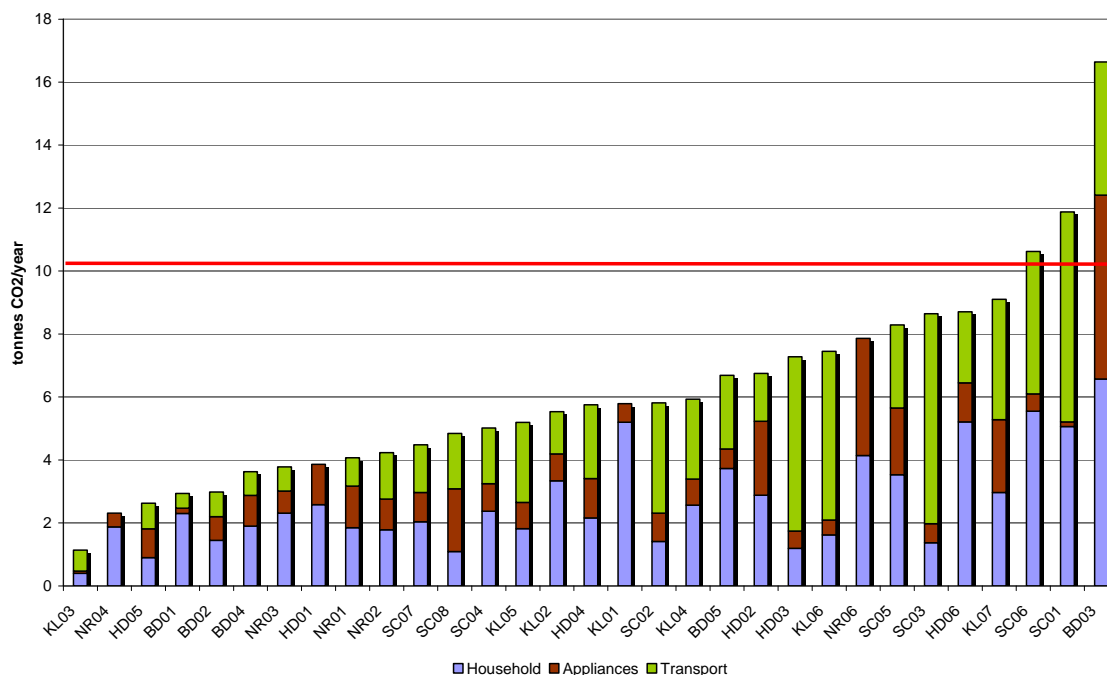


Figure 1: Carbon footprints, low to high

The carbon footprints were prepared using the Act On CO₂ calculator, and are shown in Figure 1 above. Although most of these are below the UK average of 10.2 tonnes CO₂ per year, shown in red, this figure does not reflect the same sources of emissions as those measured in Act On CO₂, even though it is used in the on-line report. This is an issue that the Act On CO₂ team are addressing, and new data released since the publication of the report evaluates carbon emissions more appropriately for the comparisons. There were some slight differences between the constructed version used in the interviews, and the online (official) version, but these were narrowed down to issues of definition of season (for seasonal bills), use of additional heating fuels (not modelled in the official version) and to appliance usage (not included in the constructed version). When given the feedback in the interviews, the footprint had been described as an estimate, and the final figure would be shown in the report they would be sent. None of the variations were more than 1 tCO₂ per year.

Where comparisons were meaningful, e.g. for rural versus urban dwellers, differences between the carbon footprints (in their component parts) were tested for significance and reported on.

The footprints were compared against a number of variables, but it was not possible to draw conclusions, largely because of the size of the sample, and largely because relationships were weak. A full multivariate analysis was inappropriate with this sample size, however a large sample could usefully look further at the relationships between early and late pension age and footprints, and between house size, income and footprints. The number of people in the household and the age of the head of household has been looked at in other studies with some trends being hypothesised, so further data would be useful, although the work on energy use by ECI, Oxford (the DECADE studies) makes the same points without the carbon footprint element.

Affordable Warmth and carbon emissions reduction

Analysis of fuel bills recorded by the subjects, to give actual before and after heating fuel and electricity expenditure, and a second approach using modelled data, was used to look at an Affordable Warmth Index (AWI) – roughly the extent to which the subjects were or could be in fuel poverty, and the amount by which their carbon footprint might be reduced through the measures.

The analysis covers:

- percentage of income spent on fuels (actual costs), before and after measures (affordable warmth index)
- the same based on modelled costs
- carbon emissions reductions based on modelled changes
- a comparison of these figures for where actual costs are available

The fuel costs were adjusted to take account of price increases in 2007 and early 2008 as described in the main report, and an indication for the price increases for Summer 2008 were also provided.

The major weakness in this analysis is the income data. The subjects were invited to select their income decile rather than asking exact figures for income. Using the maximum of the decile range potentially gives a low AWI, but most of those in the lowest range were at the maximum of the range as they had claimed all the benefits to get them to that level. Using the mid-point of the range might be more appropriate for the rest of the subjects. One subject had a fluctuating income because of self-employment. So income was estimated at the maximum for the lowest decile (category A), the average of the minimum and maximum for the self-employed household and mid-point for the rest. The 'before' income was adjusted to 95.5% of the current income, based on the 4.7% cost-of living increase in January 2008. (£100 in 2007 is £104.70 in 2008).

However this includes all benefits but does not take out housing costs, so the scale used reflects neither definition of income used in the Fuel Poverty Strategy.

The amount of fuel used by the householder is also not an accurate amount required to maintain an appropriate level of warmth according to the definition of fuel poverty. The modelling does assume the appropriate level of warmth. One of the reasons for aiming to carry out the interviews in late winter was to find out the temperature that people kept their living rooms at. All bar one of those in Suffolk were below the standard temperature, the exception was in a south facing room with the heating off! The Norwich City householders were also interviewed in March, they were mostly at or only slightly below the standard living room temperature. However, the rest of the interviews were held after the heating season so no temperature records were taken. This is a valuable piece of this work that was intended but not followed through, and it is strongly recommended that calibrated heating records are made in the winter season if the survey was to be done again.

However, the details of the fuel expenditure as percentage of income (affordable warmth index) based on reported fuel expenditure, included supplementary fuels such as coal and wood. This allowed calculation of what would have been spent on all fuels if no measures had been carried out, and elderly housebound people would have been in extreme difficulty, along with those in solid wall homes.

Modelled expenditure and affordable warmth

These figures were modelled using the ACE Fuel Prophet (AFP), in order to get an indication of the situation for those who did not have or were not able to provide

information on the previous year's fuel expenditure. The output is interesting and potentially useful, but suffers from considerable error as it stands:

- income data as previously discussed
- house type and size are fixed in AFP and a 'best fit' approach is used, scaled in a similar way to how Defra scaled the CERT Illustrative Mix data
- measures approximation in some cases
- actual fuel price is approximated, the best fit in AFP is used

Clearly the best method is to carry out this calculation using a proper energy rating for the house involved. This might be possible in a larger survey if a hand held tool such as NHER Builder is used, but needs a qualified person to carry out the survey. Note that a DEA survey would not be appropriate due to the limitations of the RDSAP software, unless the problems in the 2008 version have been solved and it can manage the variation in dwelling type, construction and measures encountered in this survey.

The comparison between the actual and modelled data was included in the project report. The correlation between the actual and modelled figures is 0.68 which is fair, given the unavoidable difference between actual and modelled heating regime, but it is not good enough to recommend this method again.

Carbon emissions and their reduction

The degree to which carbon emissions (and thus carbon footprint due to household use) had been reduced was deduced from the modelled data where the 'before' data were not available. Although the methodology behind this was sound, the figures are still based on the AFP methodology above, so the caution that applies to the fuel saving data applies to the carbon saved data also.

According to that calculation, the average household footprint after measures was 2.68 tCO₂ per year, and that before was 4.39, giving an average reduction of 1.71 tCO₂ per year, or 39% (of household only). Taking account of the overall carbon footprint, the reduction is 22% (1.71 on an average 7.83 before measures). Given the responses on what people had done with money saved (mostly found they were able to afford other necessities, or just afford the fuel bills now), and the ambient temperatures recorded in the first set of interviews, the concept of comfort taking in this context is found to be illogical. Whether the result would be different in a different economic climate is for a researcher in the future to find out.

Value of the investment to LAs

The final piece of analysis based on this same data was a value to local authorities of their programmes. This was felt to be important to consider how fuel poverty programmes sat alongside carbon reduction programmes. Given the reduction in carbon footprint found above, it follows that carbon savings from the programme are likely to be reasonable. This suggests that the investment of the five local authorities in these 31 households has given a carbon emissions reduction of 47.9 tCO₂/year. Since the researcher was also doing some analysis of CERT at the time of this project, it seemed interesting to compare the costs and savings from the measures installed if they had been installed under a CERT regime. On reflection, it is questionable whether this is a useful piece of work in real terms, although it does demonstrate rather clearly the differences that can be drawn from different models looking at the same measures in 'typical' houses.

The assumed CO₂ savings found in this analysis were similar to or greater than the calculated savings under CERT for the same set of measures and cost, which suggested that, provided the costs to the LA are not significantly more than under CERT, the value of delivering these types of measures to households at risk of

fuel poverty is the same or better than delivering them to supposedly 'fuel-rich' households.

This was a key finding for the project, as it was precisely the tension between programmes for the fuel poor and carbon-reduction programmes for the 'fuel rich' that led to the project being undertaken in the first place. However it is of concern to the author that it may just be a combination of assumptions, simplifications and differences in modelled data that cause the differences, rather than any real benefit.

Case studies

The object of selecting five case studies from the survey group was to explore further their changes in lifestyle and their carbon footprints in more detail. This aimed to add more understanding of the implications of affordable warmth programmes in the context of local authority carbon reduction targets, and to understand the impacts on different types of households, especially those who are classed as vulnerable.

The case studies were:

A – Mrs F, an 80-year old widow living in a rented three bedroom mid-terrace house in Norwich City

B – Ms C, a lady in the 35-44 age group with three children the eldest of whom has Down's syndrome and the youngest is under 3 years old. They live in a traditional wooden (weatherboard) house in a seaside village in Suffolk, and her partner is self-employed mainly working away from home and has a fluctuating income.

C – Mrs W and her son who is her full time carer. Mrs W is in her eighties and had a stroke which left her with impaired mobility. She also has memory loss. They live in a 3 bedroom semi-detached house in a large Suffolk market town.

D – Mr & Mrs M who are recently retired, living in a 1960s three bedroom house in a small market town in Suffolk

E – Miss Y, aged 25-34, who lives with her daughter aged 4 in a semi-detached house in a rural village in Norfolk, off the gas network.

Table 4: Summary of case study footprints

<i>Case study</i>	A	B	C	D	E
<i>Urban/rural</i>	urban	rural	urban	rural	Rural
<i>Income decile</i>	a	c-e	a	e	e
<i>Age</i>	75+	35-44	75+	65-74	25-34
<i>No in Household</i>	1	5	2	2	2
<i>House</i>	3 m-th, <1930, gas	3 s-dh. <1930, gas	3 s-dh. <1930, gas	3 s-dh, 1960s, gas	3 s-dh, 1950s, oil
<i>Household</i>	2.37	5.06	5.55	3.53	3.73
<i>Appliances</i>	0.77	0.15	0.55	2.12	0.62
<i>Transport</i>	3.78	6.67	4.52	2.64	2.34
<i>Total Act On CO₂</i>	6.92	11.88	10.62	8.29	6.69
<i>Food</i>	1.66	2.28	1.44	1.60	0.86
<i>Waste</i>	0.013	0.027	0.020	0.013	0.006
<i>Water</i>	0.053	0.042	0.047	0.054	0.041
<i>Public transport</i>	0.025	0.08	0	0.036	0
<i>Total</i>	8.67	14.31	12.13	9.99	7.60
<i>Less Air travel</i>	0	0	0	0	0
<i>Total</i>	8.67	14.31	12.13	9.99	7.60

The range of carbon footprints split into their various components are shown side by side in Table 4. As might be expected, the household with the most occupants (B) has the highest overall footprint, which also has the highest food footprint, although according to the food footprinting calculator, this is only average for the population as a whole. All five case studies appeared to have low water consumption compared with the industry averages if 160 litres per household per day in unmetered properties, or in case studies C & D, which are metered, 150 litres per household per day. Indeed if the water diaries and measurements are correct, all of these case studies have a water consumption that is below the target for water consumption conservation. It is most likely that the diaries and average measurements are flawed, but this does not explain the meter readings.

Case studies B & C have high transport and fuel footprints which can be clearly explained by their lifestyle factors. These dominate the overall footprints, and they are both above the average UK household footprint of 10.2 tCO₂/year. This is probably the most accurate assessment against the UK average, as the Act On CO₂ ignores the secondary effects covered by food, waste and water, and includes air transport, whereas the UK average is based on the total emissions for all ground based emissions and ignores air transport, divided by the number of households. For both B & C, both of whom have vulnerable occupants, the additional emissions from heating their homes can be explained from the need for additional warmth and for specialist transport requirements.

The Methodology section covered the issues in designing the diaries and the calculations arising, and the errors in the data. Nevertheless, the main point of these case studies is to add information on lifestyles, particularly whether saving money on fuel bills would lead to a more carbon intensive lifestyle using other products. In fact it gave valuable insight into the strategies adopted by people on limited incomes under conditions of rising fuel prices.

The principal value for the researcher was to raise policy issues arising from these qualitative interviews and additional measures:

- catering for the needs of vulnerable members of society; ensuring that those with special needs, the sick and elderly can be assured of appropriate heat (and water) for their physical and psychological needs
- catering for the different perspectives of different age groups – those who remember rationing may have a different set of skills and attitudes to resources (and possibly to the community) than those brought up in the consumer era. Role of peer group/role models on individual approaches to resources may affect this also.

If this approach was to be used again the main improvements would be:

- sample the case studies selected rather than choose from among a willing few
- use best practice in respect of reward for participation
- seek to match the diary measurements more closely with robust data emerging from other research e.g. consumer behaviour and water usage in preparation at Waterwise

Testing the implications of the research

In this section the individual findings from the research report are tested.

<i>Finding cited in the Project Report</i>	<i>Assessment</i>
<p>Although this survey was only a small study, it does provide some pointers to a number of issues that have so far been researched mainly through modelling.</p>	<p>How to assess significance of this survey group?</p> <p>31 interviews from 156 letters sent out yields a 15.8% confidence interval at the 95% confidence level.</p> <p>If the letters were sent out again 100 times and 31 interviews took place, you would expect that the average carbon footprint, which was for this sample 6.12 (total), would be between 5.15 and 7.09.</p> <p>Taking as a proxy the number of vulnerable households improved under EEC2 as the population (approx 4 million in the Priority Group), the confidence interval only changes to 17.6% at the 95% confidence level. The average carbon footprint might be expected to lie within 5.04 and 7.20.</p>
<p>The carbon emissions saved through addressing this group have been estimated slightly higher than the average that would have been credited for the same measures under CERT. This means that carbon savings have been realised at least as well as expected through energy and climate change programmes.</p>	<p>Both measures rely on modelling and neither are good matches for the houses and measures installed. Unreliable calculation but given the changes in actual fuel bills, the carbon savings from those are no worse than policy expectations, save where elderly housebound required a point source in addition to central heating</p>
<p>There is no evidence that the money saved has been spent on anything other than general day-to-day expenses, under the conditions of rising food, tax, water and petrol prices, and the price of fuel itself. During the concluding stages of this report a further increase in costs averaging 20% was announced by a number of energy companies, with a Centrica forecast of increases possibly as much as 70% reported in the press. Consequently the householders can at best stand still with their fuel costs, whilst the carbon emissions savings persist.</p>	<p>True statements with a logical conclusion</p>
<p>It appeared that the average cost of measures was substantial, even drawing in funds from a number of sources. It also appears that those homes classified as hard to treat i.e. off gas or non-cavity wall or both, where they were treated under one of these programmes, contributed substantially</p>	<p>True based on average costs of measures but actual costs of measures in these programmes unknown</p>

<p>to the warmth experienced by their occupiers, who were often elderly or with special needs and therefore among the most vulnerable in society.</p>	
<p>Many people were also very concerned to save resources, and use their income wisely, so it is of some concern that despite the new measures, many of the first homes visited had daytime temperatures below the recommended level, and that those in the case studies were prepared to reduce their heating if there was a limit imposed on the amount of carbon emissions they were allowed under some future policy approach. There was a sense of playing their role in society through reducing their emissions (and water and through recycling from the case studies) and wanting a sense of fair-play between different sections of the community. ...many interviewees commented on their reason for participation, and gratefulness to the council was an oft-cited reason; the council had helped them so they were happy to give something back in return.</p>	<p>Observations from interviews reinforced with case studies</p>
<p>There was also a sense that the increasing number of policies in play were directed towards a section of society to change their behaviour, but just made it impossible for others to manage, especially for the elderly and less well-off. Changes in waste collections was an on-going issue in a number of the authorities at the time of the interviews, and a one-size-fits-all policy (quite literally) was hardly appropriate for an elderly lady with a small back yard who nevertheless produced a small amount of garden or food waste, and now was faced with another charge for its disposal, from a fixed income. Three of the case studies also had a chance to air their feelings on this subject.</p>	<p>Observations limited to those in the case studies</p>
<p>It was clear that people were interested in the outcome of the interview but the standard report from the Act On CO₂ calculator effectively meant that this was a populist outcome [such as a quiz in a newspaper]. The version sent to the participants was heavily edited to reflect their individual situations, but the current vogue of promoting under-floor insulation was noticeable in all the initial reports despite the expense and</p>	<p>Feedback that can be provided to EST. The Act On CO₂ calculator is being upgraded and improved.</p>

<p>great disruption that appears to make the measure applicable in only a very small number of cases. However comments that elicited more interest were information on energy use of different types of televisions, or A rated appliances, and tips on eco-driving.</p>	
<p>The difficulty experienced in matching the Act On CO₂ calculator to average emissions figures, plus the variation of footprints obtained when using a variety of calculators even those ostensibly using the same engine (AMEE/dgen) suggests that we have a long way to go to get a standard, valid and reliable measure. It may not be advisable to press on regardless unless this can be sorted out. If we do, we risk losing public confidence in Carbon Footprints as a benchmark</p>	<p>Conclusion based on experience of the carbon footprinting tool and research on other similar tools.</p>

This suggests that while the conclusions made by the researcher are open to discussion, the footprint figures are more reliable than first thought, and therefore create more confidence in the conclusions, and the recommendation that a wider sample might be worthwhile. The methodology for assessing the actual carbon saved needs to be improved along the lines of that stated earlier.

Recommendations for further research

The recommendations made in the project report stand as:

- carry out a larger study with reduced bias due to self-selection, to assess carbon footprints and attitudes to reducing them. Explore in more detail the types of lifestyles that can show a reduced carbon footprint whilst still enabling families to live modern lifestyles and elderly people to live in warmth and comfort. Include in the study groups of urban and inner-city residents.
- research the actual rebound effect of installing measures in households in fuel poverty. Take a robust approach to calculating 'comfort taking', especially with regard to actual ambient temperatures.
- further work is needed to identify interactions between different types of household carbon emissions and what is reasonable for different societal groups in the ongoing research to determine how to reduce individual carbon footprints. Develop aspirations to a different lifestyle that people find easier to adopt.

Carbon Footprint of the project

The carbon footprint of the project can be assessed in three main impact areas:

- energy use in the office, for heating, lighting, electrical equipment, communications, refreshments
- Travel to interviews
- Secondary energy costs related to printed matter i.e. reports and letters sent to candidates

The office energy use is extrapolated from the energy used for this research organisation, and based on non-interview hours spent on the project. The daily office carbon emissions unit is derived from the organisation's environmental review. A consideration for the time of the steering group is made on the basis of a similar energy use in their offices, although it could be argued that all the office energy use would have existed even if this project had not been carried out. Mileage was recorded throughout the project for budgetary purposes.

Letters and reports were sent as follows. One envelope is treated as one sheet of paper for simplicity:

Item	No of people	No of pages	No of envelopes	Total
Letters of invitation from LAs	156	2	2	624
Invitation/ Confirmation letters for interviews	38	1	1	76
Interview sheets	36	1		36
Footprint reports (double sided, average)+ letter	31	1+3	1	155
Case study instructions	6	5	1	36
Case study agreement & thank you	5	4	2	30
Total sheets				957

Sundry paper was also used for e.g. printing maps, lists of addresses, a few research papers.

Within this carbon footprint there also needs to be an allowance for dissemination. This is included on the basis of the original budget, with a meeting in London, Cambridge and another major city, Newcastle is taken as a possibility. Travel to these would be by train, so an estimated mileage is sufficient given the low carbon footprint of train travel. On this basis the carbon footprint is made up as follows:

Item	Unit	No of units	kgCO ₂ per unit	Total kgCO ₂ emitted
Office energy use	days	52.5 + 6 = 58.5	2.82 (2)	164.97
Car travel	Miles	1500	0.1772 (1)	265.76
Rail travel	Miles	320	0.096	30.72
Dissemination	miles	940	0.096	90.24
Dissemination	days	5	2.82	14.10
Paper	sheets	1100	0.0168 (3)	18.48
Total				584.27

(1) hybrid vehicle at 58.7 mpg (2) based on heating oil plus electricity use (3) derived from www.greenpdf.com

This gives an estimated carbon footprint for the project of **0.58 tCO₂**.

Summary

This project carried out a survey of 31 households in the East of England, all of who had received measures under a fuel poverty programme, although there was no assessment of whether they were in fuel poverty or not before the measures were installed. The majority of the people involved were retired, but some families were involved and many households included vulnerable people.

The objective was to collect data to establish the carbon footprint using the Government's Act On CO₂ calculator, and to compare these with national and local averages, in order to determine whether their footprints were any different from the average. The purpose was to add information to the debate on whether fuel poverty programmes run by local authorities conflicted with climate change reduction programmes. At issue was the use of any cost savings from measures, and whether they were used in a way that increased the carbon footprint rather than decreasing it.

The main conclusion from this study is that there is as yet no evidence that people who receive measures under a fuel poverty programme are likely to use any money saved to spend on high-carbon emissions products and services. So the rebound effect, if any, does not seem likely to lead to an increase in carbon footprint. Whether this is the case for all types of households requires further study.

The evaluation of this project suggests that these are reasonable conclusions and the project achieved its objectives.

This evaluation report identifies areas that could be improved in the methodology of the study:

- larger sample including a wider range of demographic characteristics
- robust assessment of fuel poverty including an energy survey
- minor improvements to the interview questionnaire
- better use of real data in order to calculate carbon savings before and after measures, rather than relying on modelled data.

Appendix 1: Interview plan and questionnaire

Introduction

Purpose of the research

I'd like to note the room temperature while we talk is that ok?

What energy efficiency measures did you have done

When

I'm going to go through the carbon footprint calculator now, then come back to a few more questions at the end

(After calculator)

Have you noticed any difference in your fuel bills since the work was done

(Yes, up, down, down then up after price rises recently, no, no change to direct debits)

How much were your bills before the work was done (estimate is fine)

gas
electricity

I'm going to show you a list of possible things that may have changed since the work was done

Please tell me every one that you think applies

It's been easier to keep warm

The temperature indoors has been quite variable

It's been difficult to keep a comfortable temperature

I've been able to afford things like food and clothing more easily

I've bought some thing(s) I've been saving up for

I've been feeling better in myself

I've treated myself/my family to some thing(s)

I've not been so worried about bills

I've been more worried about bills

There are some problems relating to the work which havent been fixed

I've been getting out and about more

I'm planning to do something I wouldnt have done before

(probe answers)

Finally, I need to ask about your age and income groups

Please would you point out your age range on this sheet (table A1)

and your income range on this sheet, its group in weekly, or monthly, or yearly, whichever you find easiest to think in. (table A2)

How many adults in household

How many infants under 3

How many children under 12

How many children 12-18

employed f/t

employed p/t

retired

student

long term illness or disability

u/e

self-employed

That's it. The temperature while we've been talking has been

Thank you very much for talking to me. One thing before we finish is that I need to find five people who are willing to do a more detailed study. This would involve you keeping a diary of what you do for two weeks (I will supply that diary). Would you be willing to be considered for that?

I'll send you a report on your carbon footprint (and the information about what the detailed study would involve for you to think about).

Any questions you have before I go?

Thank you once again.

Table A1: Age range

Please would you point out your age range on this sheet

16-24
25-34
35-44
45-54
55 - pensionable age
Pensionable age – 74
75 +

Table A2 Income (weekly, monthly, yearly)

Income range – weekly

A	Up to	180
B	181	245
C	246	290
D	291	330
E	331	385
F	386	450
G	451	525
H	525	640
J	641	more

Income range – monthly

A	Up to	780
B	781	1060
C	1060	1245
D	1246	1435
E	1436	1670
F	1671	1940
G	1941	2275
H	2276	2760
J	2761	more

Income range – yearly

A	Up to	9390
B	9391	12720
C	12721	14950
D	14951	17230
E	17231	20000
F	20001	23280
G	23281	27290
H	27291	33120
J	33121	more

Appendix 2: Case study Diaries

Dear

East Anglia Carbon Footprint project - Case Study follow-up

You mentioned in the interview earlier in the year that you might be willing to take part in the case study phase.

The case study section of the project aims to discuss how the lifestyles of five subjects affect their carbon footprints, and how their lives have been affected by improving the energy efficiency of their homes. All those participating in this part of the project have already been interviewed and their initial footprint for household, appliances and private transport established using the Government's Act On CO₂ calculator. The case study section will also look at carbon footprint due to public transport, waste, water usage and make an estimate of that due to food purchase choices.

In order to do this, participants are asked to keep a diary using the attached sheets. These are, in the main, tick boxes and simple estimates. There is no complicated measurement to do, and it doesn't have to be neat and tidy. For food purchases, participants are asked to keep till receipts and plastic bag/film packaging so that the researcher can analyse them in terms of distance travelled in the supply chain.

The study will take place over four weeks at the end of which there will be another interview, some of which will explore some of the comments made in the first interview. This second interview will take no longer than an hour.

If you are still willing to take part, please look at the attached documents and make sure you feel able to complete them. I will be calling you at the end of April to check that you want to go ahead and to agree dates. If you are going to be away for a week or two during May or early June this can be fitted into the study.

Thank you once again for your help with this project, and call me at any (reasonable) time if there is anything that you are unsure of regarding the study.

Yours sincerely

Jacky Pett

Attached:

1. Travel record
2. Waste record
3. Water and food shopping instruction
4. Example from my typical week

Travel Record

In order to make an estimate of carbon emissions due to your use of public transport, please keep a note of your travel for a typical week during the study period. Only one week is necessary, unless you are happy to do more.

Include taxis, buses, school buses, park & ride, trains. Do not include your own cars or lifts in private cars (these were covered earlier). The first line is an example for you to follow.

Day	Type	From	To	Single/return
Monday	Bus	Home	Woodbridge	return

Note: if one member of the family does one trip, write that in. If a number of members of the family make the same trip together, only count it once.

Waste Record

The waste record asks you to tick **how full** your wheelie bin or recycling box was **when it was emptied**, and to estimate any other waste recycled or taken to the dump. As in many areas collections are fortnightly, please start by circling how full each bin is on the day you start the study, and leave weeks blank when they were not emptied.

Bin/box/sack	Start	Wk 1	Wk 2	Wk 3	Wk 4
Household waste	empty				
	¼				
	½				
	¾				
	Full				
	overflowing				
Recycling – paper, cans etc	empty				
	¼				
	½				
	¾				
	Full				
	overflowing				
Garden waste	empty				
	¼				
	½				
	¾				
	Full				
	overflowing				
Trips to other recycling bank	write in number of bottles etc				
	write in items of clothing or shoes				
Trips to the dump	Tick box				
Compost heap (if you have one)	How many buckets or bags do you put on your compost heap in each week				

If you don't end up putting a bin or box out for collection during the study, please tick how full it is on the last day of the study.

Water Record

Is your water metered?

Yes: what were the last two meter readings you had with dates:

Date:	reading
Date:	reading

No: please complete the following table for one week (7 days). Use a gateleg **HH** to mark off things that happen often e.g. toilet flushing.

Item of water use	Number in a week	Value
Baths		Number of baths
Showers		5 minute showers
Toilet flush (approximate is fine)		flushes
Washing under running tap e.g. hands, teeth		Number of times
Washing up and clothes washing in the sink		Number of times
Watering the garden by bucket or can		Number of cans
Watering the garden by hose or sprinkler		Hours
Washing the car using hose		Times
Pans and kettles of water (for tea or cooking)		Number of pans or kettle fills
Glasses of water from the tap (if more than a couple a day)		
Anything else?		

Note: dishwashers and washing machine use were noted on the earlier survey.

Food purchase choices

For this section please put aside a shopping bag (e.g. free plastic bag) for the duration of the study.

Put into it your

- food shopping **till receipts**,
- film covering and **plastic bags from vegetables** (not meat).

Do not include plastic trays, tubs, bottles or pots.

The aim is to identify the proportion of your food shopping that is meat, fish, dairy, fruit & veg and other, for which there are standard assumptions on how much energy they use in order to get to the shelf. Keep plastic wrappings from fruit and veg for me to estimate air miles. If you buy local produce e.g. from a market or farm store, we will talk about it in the interview, and you don't need to keep bags that you use for that.

Example from my typical week

Travel:

Day	Type	From	To	Single/return
Monday	Bus	Home	Woodbridge	return
Wednesday	Train	Norwich	London	return
Wednesday	Tube	London	Westminster	return
Thursday	Train	Norwich	Cambridge	Return
Friday	Bus	Home	Asda	Return

Waste

Bin/box/sack	Start	Wk 1	Wk 2	Wk 3	Wk 4
Household waste	empty				
	¼				
	½			✓	
	¾				
	Full				
	overflowing				

Water

Item of water use	Number in a week	Value
Baths	-	Number of baths
Showers	5	5 minute showers
Toilet flush (approximate is fine)	HHH HHH HHH HHH HHH II	flushes
Washing under running tap e.g. hands, teeth	10	Number of times
Washing up and clothes washing in the sink	2	Number of times
Watering the garden by bucket or can	2	Number of cans
Watering the garden by hose or sprinkler	-	Hours
Washing the car using hose	-	Times
Pans and kettles of water (for tea or cooking)	HHH HHH HHH	Number of pans or kettle fills
Glasses of water from the tap (if more than a couple a day)	2 a day so no need to put this in	
Anything else?	-	