

**The impact of national policy
measures on local carbon
emissions: methodology
paper**

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Contract Document 253
Version 6

August 2010

Work supported by:



**SOUTH WEST IMPROVEMENT
& EFFICIENCY PARTNERSHIP**



Version History

1. First draft
2. Second draft – initial TAM comments
3. Third draft DCC comments added
4. Methodology updated for use with June 2010 updated LCTP projections. Section 3 data and comments updated, but Section 5 data and comments not updated yet. Wait until model run on all LAs.
5. Section 5 updated for revised methodology (June 2010 data)
6. Updated for new GVA data (from South West Regional Accounts: has figures for all tier 1 authorities in South West).

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Executive Summary

This REIP project has set out to review all the recent national policy developments, particularly the Government's Low Carbon Transition Plan (LCTP), and assess their impacts on local emissions across all authorities in the South West. It also explores the level to which authorities can influence the effectiveness of these policies and hence where they might best focus their efforts. Authorities can then use this as a basis to review their targets and delivery plans for NI186, so that they are consistent with the national agenda. This analysis will also support RIEP project 028 on carbon reduction planning using the Vantage Point tool, with both projects working together to support authorities in developing carbon reduction plans.

This paper sets out the methodology developed and piloted with Devon County Council to establish a local emissions baseline and assess how national policies measures impact upon this. The project is based on three main analysis activities covering:

1. Establishing a baseline set of greenhouse gas emissions for each authority over a more comprehensive set of sectors than the current NI186 CO₂ data set, and including a wider range of greenhouse gases (GHGs);
2. Reviewing current government policy initiatives, targets and delivery agencies that are expected to contribute to local emissions reduction;
3. Assessing the impact of these national policy initiatives on emissions from each authority in the South West and exploring the level of influence that authorities have over these initiatives.

The analysis draws on three main data sources: regional CO₂ data from DEFRA/DECC, national emissions and predictions from the Low Carbon Transition Plan (LCTP) and local proxy data that represents local activity in each sector. The analysis provides detail for the 3 main GHGs: CO₂, CH₄ and N₂O, and 8 sectors covering:

- Business
- Industrial Processes
- Transport
- Residential
- Public
- Agriculture
- Land Use, Land Use Change and Forestry (LULUCF)
- Waste Management

Applying the methodology to Devon gave the following key results:

- A 2007 baseline data set covering the main GHGs (CO₂, CH₄, N₂O) for 8 sectors (business, industrial processes, public, residential, transport, agriculture, LULUCF and waste management).
- Within the 2007 baseline agriculture, a sector not fully reported as a separate entity in NI186, accounted for some 16% of Devon's emissions.
- The business as usual (BAU) scenario comprising central growth and existing policy measures indicated emissions in Devon would reduce by 6.5% from 2008 to 2022 compared to a 7.5% reduction nationally (ignoring emissions from land use, land use change and forestry).
- The introduction of the LCTP policies would see this reduction increase locally to a 21.6% compared to 24.1% nationally.

- Overall Devon would have moderate to considerable influence over some 51% of the savings from these national measures.
- The key areas where Devon would have influence are increased renewable energy in the electricity generation mix (owing to planning powers) and the Home Energy Management Strategy (through partnership working with suppliers and other organisations). Other areas include the renewable heat incentive (which could be applied to public sector buildings), waste management, agriculture (through the Rural Development Programme (RDPE) and planning and waste management influences on energy from waste and combined heat and power initiatives), zero carbon homes (through planning influences), and low carbon emission buses. Wider transport initiatives fall outside of the measures introduced in the LCTP (which are technology focussed), but still have an important rôle to play in reducing carbon emissions.

This methodology can be applied to all authorities in the South West providing a consistent data set on current emissions, the expected change in these emissions due to Government policy and the level of local influence authorities will have over these policies. This data can then be used to support authorities in setting realistic local carbon reduction targets in line with Government policy, and identifying where they should potentially be focusing their effort to ensure maximising impact of national policy locally.

1. Introduction

In the Local Area Agreement (LAA) period 2008 to 2011 many authorities in the South West have set climate change as a priority with National Indicator 186 (NI186) as the indicator against which progress is measured. In defining NI186 as a priority measure the authorities have to set an improvement target. Setting a realistic target, associated proxy indicators and delivery programmes has been problematic for many authorities. One reason for this has been because significant policy activity takes place at the national level and the interaction of this with local activity is not always clear.

Through the South West Energy and Environment Group (SWEEG), the Centre for Energy and Environment (CEE) at the University of Exeter has worked with a number of authorities to help set improvement targets and delivery programmes. A key to this process is an understanding of current baseline emissions, the potential impact of national policy measures on these emissions, and the likely level of influence of authorities on these national policy measures.

This REIP project has set out to review all the recent national policy developments, particularly the Government's Low Carbon Transition Plan (LCTP), and assess its impacts on local emissions across all authorities in the South West. It also explores the level to which authorities can influence the effectiveness of these policies and hence where they might best focus their efforts. Authorities can then use this as a basis to review their targets and delivery plans for NI186, so that they are consistent with the national agenda. This analysis will also support RIEP project 028 on carbon reduction planning using the Vantage Point tool, with both projects working together to support authorities in developing carbon reduction plans.

This paper sets out the methodology developed and piloted with Devon County Council to establish a local emissions baseline and assess how national policies measures impact upon this. The project is based on three main analysis activities covering:

1. Establishing a baseline set of greenhouse gas emissions for each authority cover a wider set of sectors and greenhouse gas (GHG) emissions than the current NI186 CO₂ data set;
2. Reviewing current government policy initiatives, targets and delivery agencies that are expected to contribute to local emissions reduction;
3. Assessing the impact of these national policy initiatives on emissions from each authority in the South West and explore the level of influence that authorities have over these initiatives.

Section 2 provides a review of the key data sources used to carry this analysis. Sections 3 to 5 describe the methodology for each these analysis activities and the results of the pilot analysis carried out for Devon County Council.

2. Overview of datasets used for the analysis

The two main data sources used to establish the baseline emissions and future predictions of policy impacts are:

1. Regional CO₂ emissions data produced annually by DEFRA/ DECC^{[1],[2]} which include the NI186 indicator reporting data set.
2. National level emissions data (used in national policy analysis), in particular the 5th National Communication under the United Nation Framework Convention on Climate Change (5NC), 2009^[3],

the UK Low Carbon Transition Plan (LCTP), 2009 ^[4] and updated energy and emission projections, 2010 ^[15].

Both of the national reports provide historic data and forward projections. They are therefore the main source of information on the impact of national measures on carbon emissions.

Local and national data on GVA, population, land area and household numbers have been used to disaggregate national data to the local level where necessary, as well as CH₄ emissions from the waste management sector mapped on a 1 km-resolution grid.

2.1. NI 186 and regional CO₂ emissions data

Regional CO₂ data has been compiled by DEFRA (now DECC) since 2005, covering the period up to 2007. These data were developed to support action at a local level to reduce carbon emissions. A subset of this data was defined for reporting under NI 186. The NI 186 subset is intended to cover the emissions that local authorities may have some influence over. The coverage of both data sets and comments on how they are developed are shown in Table 1 below.

Regional CO ₂ Sector	NI186 subset	Description of data
Commercial and industrial	Sites not covered by the EUETS	Covers industrial, commercial and agricultural emissions. It is based on metered fuel consumption data for gas and electricity, and estimated data for oil and solid fuels. Also included is an estimate of energy use from off-road machinery. Large power generation is not included.
Domestic	Covers all	Covers metered fuel consumption for households as collected by BERR, including electricity and gas. Oil and solid fuel usage is also estimated.
Transport	Excludes motorway and diesel rail	Based on DfT vehicle traffic data and fleet data. The traffic data are based on local traffic count information, the vehicle fleet data reflects the national stock of vehicles rather than the specific local fleet.
LULUCF	Not included	Estimated from data on land use change, farming and forestry.

Table 1. Definition of the regional and NI186 data sets

The regional data only report CO₂ emissions and not those of other greenhouse gases and there is no disaggregation of non-domestic electricity and gas consumption (it is all reported as industrial and commercial). In order to estimate emissions in more detail the other principal greenhouse gases (CH₄ and N₂O) need to be taken into account and the industrial and commercial sector disaggregated to show emissions due to business, industrial processes, public, agriculture and waste management. Whilst the NI186 data contain detailed data for oil, solid fuel and non-fuel use in the agriculture sector, these are of limited use given the lack of sectoral data for electricity and gas.

2.2. 5th National Communication (5NC)

The 5NC provides emissions data on the principal greenhouse gases (CO₂, CH₄, N₂O, HFC, PFC and SF₆) and with results allocated both by source and end user for most sectors. As well as greater sectoral detail, 5NC provides projections of emissions to 2020, including the impact of national policy measures set out prior to the UK Low Carbon Transition plan. Emissions projections, by end user, through to 2020 are shown in Appendix I. A summary of data for 2006 (the last full inventory year) can be seen in Table 2 and Table 3.

These tables show that CO₂ is the dominant greenhouse gas overall in all sectors, except for waste management where methane emissions dominate, and agriculture where nitrous oxide dominates (and

methane is also significant). This reveals why reporting has focused on CO₂ emissions, especially in the business, residential and transport sectors which are the main energy consumers.

These data provide a good basis for sectoral disaggregation and also the estimation of non-CO₂ emissions.

Sector	CO ₂		CH ₄		N ₂ O		Total CO ₂ eq	
	Mt CO ₂ eq	%	Mt CO ₂ eq	%	Mt CO ₂ eq	%	Mt CO ₂ eq	%
Business	197.4	36.6%	4.2	8.5%	2.0	5.2%	203.6	32.5%
Industrial processes	14.4	2.7%	0.4	0.8%	2.4	6.3%	17.2	2.7%
Transport	151.5	28.1%	0.8	1.6%	5.8	15.2%	158.1	25.2%
Residential	149.0	27.6%	3.6	7.3%	0.6	1.6%	153.2	24.4%
Public	21.5	4.0%	0.5	1.0%	0.1	0.3%	22.1	3.5%
Agriculture	7.1	1.3%	18.7	38.0%	25.9	67.9%	51.7	8.2%
LULUCF (net)	-1.9	-0.3%	0.0	0.0%	0.0	0.0%	-1.9	-0.3%
Waste management	0.4	0.1%	21.1	42.8%	1.3	3.5%	22.8	3.6%
Total	539.5	100.0%	49.3	100.0%	38.1	100.0%	626.9	100.0%

Table 2. 5NC emissions data for 2006 by sector and greenhouse gas.

Sector	Total CO ₂ eq	CO ₂	CH ₄	N ₂ O
	Mt CO ₂ eq	%	%	%
Business	203.6	97.0%	2.1%	1.0%
Industrial processes	17.2	83.7%	2.3%	14.0%
Transport	158.1	95.8%	0.5%	3.7%
Residential	153.2	97.3%	2.3%	0.4%
Public	22.1	97.3%	2.3%	0.5%
Agriculture	51.7	13.7%	36.2%	50.1%
LULUCF (net)	-1.9	100.0%	0.0%	0.0%
Waste management	22.8	1.8%	92.4%	5.8%
Total	626.9	86.1%	7.9%	6.1%

Table 3. Proportion of total greenhouse gas emissions by gas for each sector for 2006.

2.3. UK Low Carbon Transition Plan (LCTP)

The LCTP is a slightly more recent document and analysis than 5NC, and provides further analysis of the impact of the additional measures set out in the LCTP. In the LCTP data emissions are primarily allocated by source, i.e. power stations and refineries are listed as additional sectors. Supplementary tables giving the energy consumption of end users^{[6], [16]} can be used to apportion power station and refinery emissions to the end-user sectors. The original LCTP data focussed mainly on CO₂ emissions; the non-CO₂ greenhouse gas emissions being aggregated without details of emissions by sector although a number of trajectories are presented, based on different price, policy and growth scenarios.

Updated projections, released in June 2010^[15], provided further detail of non-CO₂ greenhouse gas emissions, including gas-by-gas emission projections for one scenario (presumably the central scenario), and indication that all emission reductions were in CO₂ except for agricultural and waste management emissions. Given the continued lack of non-CO₂ emissions data for the baseline scenario, and inconsistencies in the new sectoral CO₂-equivalent data (individual sectors show variations in emissions between the baseline and LCTP scenario prior to 2008, when they should be the same, but the CO₂-equivalent totals match), our established methodology for determining baseline emissions at local

authority level has not been changed to use the new data, non-CO₂ emissions being estimated on the basis on 5NC. The baseline emissions and energy consumption data has, however, been updated. In the analysis of individual measures at local authority level the new data has been used for the effect of each measure (including the addition of new measures and removal of some measures) under the baseline and LCTP (central) scenarios^{[17], [18], [19]}, as well as the sectoral energy consumption projections^[15].

The LCTP CO₂ emissions data used to determine baseline local authority emissions, including those estimated on an end user basis, are tabulated in Appendix I. The energy consumption data by which end user emissions were allocated are presented in Appendix II.

A summary of the LCTP CO₂ results for 2006 are shown in Table 4, with the equivalent data from 5NC presented alongside for comparison. The following points should be noted. Firstly waste management is not reported as a separate sector in the LCTP data, but according to 5NC gives rise to very low CO₂ emissions. Secondly there is a very big difference between the two data sources regarding emissions in the business and industrial sectors. This appears to be a result of the accounting process, and suggests that 5NC has only included process emissions in the industrial sector while emissions from other energy use in the sector has been allocated to business/commercial. The LCTP approach by contrast has included all CO₂ emissions associated with industry, not just the process emissions. The LCTP seems the more intuitive and informative as an end user sector. Lastly there is a small difference in total emissions and the reasons for this are not clear from the data.

Sector	Mt CO ₂	
	LCTP	5NC
Business (Commercial)	51	197
Industrial (Process, combustion, energy use)	179	14
Transport	150	152
Residential	144	149
Public	22	22
Agriculture	7	7
LULUCF	-2	-2
Waste Management		0
Total	551	539

Table 4. Summary of LCTP and 5NC CO₂ emissions for 2006.

3. Developing a detailed GHG baseline data set

The National Indicator 186 is used as the Government’s regional indicator against which to measure progress against reducing local carbon emissions. These data are based upon centrally produced statistics from which Local Authority (LA) CO₂ levels are estimated as described above. This work is carried out by AEA Technology on behalf of Defra/DECC. NI 186 however only covers CO₂ emissions and not the wider set of greenhouse gases. Another limitation is the number of economic sectors covered as only domestic (residential), non-domestic and road transport is included. As such NI 186 alone is unlikely to give a full picture of local carbon emissions or indicate where best to make reductions.

Developing a more detailed data set allows for the assessment of a wider range of policy interventions. The scope of emissions best matched to assessing local and national policy interventions is that used by national Government in its assessment work and covers:

1. The three main greenhouse gases
 - Carbon dioxide (CO₂)
 - Methane (CH₄)
 - Nitrous oxide (N₂O)
2. A more comprehensive breakdown by sector as used by the LCTP
 - Business
 - Industrial Processes
 - Transport
 - Residential
 - Public
 - Agriculture
 - Land Use, Land Use Change and Forestry (LULUCF)
 - Waste Management

In the sector analysis emissions can be allocated by source or by end user and it is important to be consistent as the approach adopted can vary. The importance of the difference between the two can be seen in the treatment of electricity. When emissions are allocated by source, electricity generation is shown as a separate sector. When allocated by end user, these emissions are allocated to the household or business which consumes the electricity. In this baseline analysis the focus is on end users, as it is they that will primarily be influenced by local action.

This disaggregation is used for the establishment of a baseline set of GHGs for each authority and the subsequent assessment of national policy measures. All of the emissions are reported in CO₂ equivalent terms (CO_{2eq}).

3.1. Data hierarchy used for developing the baseline

In developing a local baseline covering the 8 sectors and 3 GHGs set out above both regional and national data sources needed to be used. The overall aim was first to estimate CO₂ at the more detailed sector level and then estimate the additional GHGs for each sector. This was done using a hierarchy of data sources as shown in Table 5 below. The rationale adopted was to use published regional statistics directly wherever possible and also use them as an overall consistency check. Where this was insufficient estimated results were used firstly based on LCTP data and where this was unavailable at the time of the analysis were based on figures from 5NC.

Priority	Data Source	Data Available	Use of Data
1	Regional data from DEFRA/ DECC	CO ₂ emissions on an end user basis in four sectors: <ul style="list-style-type: none"> • Industrial/ Commercial, • Residential, • Transport and • LULUCF (Data is further disaggregated by fuel type, road type etc.)	<ul style="list-style-type: none"> • Direct use of CO₂ data for Transport, Residential, LULUCF. • Use of total CO₂ Industrial/ Commercial emissions to normalise detailed emissions for the Business, Industrial, Public, Agriculture and Waste Management sectors estimated from LCTP and 5NC.
2	LCTP	National CO ₂ emissions by source and energy consumption on an end user basis for all sectors except Waste Management.	<ul style="list-style-type: none"> • CO₂ emissions data, adjusted to an end user basis in the business, industrial processes, public and agriculture sectors (emissions from power stations and refineries apportioned by electricity and oil consumption in each sector)
3	5NC	National CO ₂ , CH ₄ , N ₂ O, HFC, PFC and SF ₆ emissions on a source or end user basis for all sectors, except LULUCF and Waste Management where end user figures are given as an overall total for all gases	<ul style="list-style-type: none"> • Use of emission figures from waste management sector (estimated from the end user emissions for all gases and the source emissions breakdown by gas). • Use of the ratio of CH₄ and N₂O emissions to CO₂ emissions in each sector to estimate emissions of these gases from the CO₂ estimates derived from regional and LCTP data.

Table 5. Prioritisation of data sources for estimating greenhouse gas emissions at local authority level.

3.2. Allocations of national data to the local level

To allocate national data to the regional level proxy indicators for local activity were used. These are indicators which include data at national and local levels and indicate the level of local activity in the sector. Emissions estimates can then be made by apportioning on the basis of these indicators. The indicators adopted as being representative of emissions in each sector are given in Table 6.

Sector	Proxy Indicator
Agriculture, Industry Business, Public	Gross Value Added (GVA) ^{[7], [8]}
Waste Management	CH ₄ emissions from waste treatment and disposal. (These are reported on a 1 km resolution grid in the National Atmospheric Emissions Inventory, NAEI ^[9])

Table 6. Proxy indicators of emissions for each sector

Where emissions were given by source for the power and refinery sectors in the LCTP this had to be allocated to each end-user sector on the basis of electricity or petroleum consumed, prior to allocation to the local level. The calculated proportions of electricity and petroleum consumption by sector are presented in Appendix II.

Finally having developed a sector-based CO₂ emission data set the CH₄ and N₂O ratios from the 5NC data, as shown in table 3, were used to estimate the other GHGs for each sector. This overall methodology used to estimate the Local Authority emission baseline data by sector and GHG is illustrated in a flow chart in Appendix III.

3.3. Selecting the base year

The selection of the baseline year gives a point of reference for comparing future emissions and illustrating trends. The decision is governed by the availability of data in each year as can be seen in Table 7. From this table it is clear that 2007 is the appropriate choice for the baseline year as it is the most recent for which data is available for (almost) all sources.

Data Source	Availability	Notes
Regional CO ₂ data	2005 - 2007	
LCTP	1990 – 2022 (2025 for updated dataset)	Energy consumption data available for 2000 – 2022 (now to 2025) (used to estimate emissions on an end user basis)
5NC	See Notes	<ul style="list-style-type: none"> • Sectoral emissions by end user available for: 1990, 1995, 2000, 2005, 2006, 2010, 2015 and 2020 • Total emissions by end user available for: 1990, 1995, 2000, 2005 and 2007 • Sectoral and total emissions by source available for: 1990, 1995, 2000, 2005, 2006, 2007, 2010, 2015, 2020 (no N₂O in 2006; no CO₂ or CH₄ in 2007)
GVA	1995 – 2007	
NAEI CH ₄ emissions	2007	
Population	2005 - 2007	
Land Area	2007	

3.4. Baseline results for Devon

The following tables contain the estimates of baseline greenhouse gas emissions for DCC for 2007 disaggregated by greenhouse gas and sector. Table 8 gives figures in kilotonnes of CO₂ equivalent (kt CO_{2eq}) while the following tables give the same data in percentage terms, firstly by sector (Table 9) and then by greenhouse gas (Table 10). Percentages may not sum to 100 due to rounding.

Sector	kt CO _{2eq}			Total
	CO ₂	CH ₄	N ₂ O	
Business	334	7	4	344
Industry	1182	36	198	1416
Transport	1980	10	79	2069
Residential	1779	43	7	1828
Public	182	4	1	187
Agriculture	163	431	603	1197
LULUCF	297	0	0	297
Waste Management	6	310	20	336
Total	5921	842	911	7674

Table 8. Baseline emission estimates for DCC for 2007

Table 9 shows the percentage of total emissions of each gas attributable to each sector, and Table 10 shows the percentage of total emissions from each sector arising from each gas (on a CO₂ equivalent basis).

Sector	CO ₂	CH ₄	N ₂ O	All Gases
Business	5.6	0.9	0.4	4.5
Industry	20.0	4.3	21.7	18.4
Transport	33.4	1.2	8.6	27.0
Residential	30.0	5.1	0.7	23.8
Public	3.1	0.5	0.1	2.4
Agriculture	2.7	51.2	66.2	15.6
LULUCF	5.0	0.0	0.0	3.9
Waste Management	0.1	36.8	2.2	4.4

Table 9. Percentage of baseline emission estimates for DCC for 2007 by sector.

Sector	CO ₂	CH ₄	N ₂ O
Business	96.9	2.1	1.0
Industry	83.5	2.5	14.0
Transport	95.7	0.5	3.8
Residential	97.3	2.4	0.4
Public	97.3	2.3	0.5
Agriculture	13.6	36.0	50.4
LULUCF	100.0	0.0	0.0
Waste Management	1.8	92.3	5.9
All Sectors	77.2	11.0	11.9

Table 10. Percentage of baseline emission estimates for DCC for 2007 by greenhouse gas.

4. Review of Government policies impacting on local emissions

The Low Carbon Transition Plan (LCTP) is the latest document setting out the full range of measures that will be implemented nationally to reduce greenhouse gas emissions. This document and supporting analysis builds on the work of the Committee for Climate Change and the analysis of the 5NC. It is helpful for local authorities to understand the effect of these measures on emissions within their area, to ascertain what additional local measures may be necessary to meet targets and influence the emissions reportable under NI186. It is also important for local authorities to appreciate their rôle in supporting and implementing the national measures.

This section considers the measures outlined in the LCTP by sector, describing the delivery agency and the perceived degree of influence that the local authority has over the implementation of each measure. As noted in Section 2.3, the analysis at individual measures level is based on the revised dataset issued in June 2010^[17]

4.1. Commercial Sector

In the commercial sector (industry and business), the key initiatives aim to reduce emissions by:-

- offering incentives for the installation of lower carbon technologies (renewable heat incentive, interest free loans, carbon reduction commitment);
- raising awareness of energy consumption (product labelling, smart metering, energy certification of buildings), and
- offering advice on improvements to buildings, heating and air conditioning plant.

The measures are summarised in Table 11. The primary rôle of local authorities in this sector appears to be raising awareness of the centrally administered schemes. They could also encourage the voluntary reporting of business emissions to DECC.

Table 11. List of LCTP measures, the delivery agency for each, and the level of local authority influence on their implementation for the commercial sector.

Measure	Description	Delivery Agency	Local Authority Influence		Description
			Score ¹	Tier ²	
Product policy	European legislation to ecolabel products and set minimum standards for the energy efficiency of products. UK government is supporting the development of these schemes, and in some cases pre-empting them (e.g. early phasing out of incandescent light bulbs).	Minimum standards and labelling protocols set by EU & Central government. Implemented by manufacturers and retailers.	1	1 2	Awareness campaigns encouraging procurement of the most energy efficient products.

¹ 0 = none; 1 = little; 2 = moderate; 3 = considerable.

² 1 = County Council; 2 = District Council (applies only to two-tier authorities)

Measure	Description	Delivery Agency	Local Authority Influence		
			Score ¹	Tier ²	Description
Energy Performance of Buildings Directive	European legislation on Energy performance certificates (EPC), display energy certificates (DEC), inspections of air conditioning systems, boiler advice	<p>EU legislation implemented by Central government.</p> <p>Trading standards are responsible for ensuring compliance with the EPC, DEC and air conditioning inspections.</p> <p>Accredited assessors are responsible for producing DECs, EPCs and conducting the air conditioning system inspections.</p> <p>Government has elected to provide energy efficient advice on boilers rather than enforce periodic inspection. The equivalence of this approach on carbon reduction has to be reported periodically. Advice is delivered by the Carbon Trust, Energy Saving Trust and oil and gas appliance trade organisations.</p>	1	1 2 2	<p>Awareness campaigns to encourage tenants to select energy efficient premises and owners to improve the energy efficiency of their buildings.</p> <p>Potential planning conditions linked to energy performance of existing buildings on a site.</p>
Smart metering (small and medium business)	Provision of smart meters by utility suppliers. Funding of research into technology to create a "smart grid"	Government has placed an obligation on utility suppliers to provide smart metering to certain customers. Project will be overseen by Ofgem.	0		None, although the added information available may be of use in energy efficiency awareness campaigns
Carbon Reduction Commitment	Mandatory scheme for half-hour metered organisations to report electricity or CO ₂ emissions, larger consumers must purchase carbon allowances.	Administered by the Environment Agency on behalf of Central government	0		None
Renewable Heat Incentive	Financial support for lower carbon heating installations installed by certified installers	Central government scheme, administered by Ofgem. Installers must be MCS accredited.	1	1 2	Promotion of scheme
One-off interest free loans to SMEs	Interest free loans for carbon-saving technologies	Carbon Trust	1	1 2	Raising awareness of scheme
Energy intensive industries	Climate change agreements between government and industry. Discounts of up to 80% on the Climate Change Levy for meeting energy or carbon saving targets	Central government	0		None

4.2. Transport Sector

In the transport sector, the key initiatives aim to reduce emissions by:-

- technological improvements to road vehicles;
- use of biofuels in road and rail vehicles, and
- promoting more fuel-efficient driving techniques.

These measures are technology-focussed, and therefore local authorities have little influence over them. Local authorities have considerable influence, as transport authorities, over encouraging modal shift and sustainable development. Such measures are captured within the baseline analysis of the LCTP.

The LCTP measures are summarised in Table 12. The primary rôle of local authorities in this sector appears to be procurement of the local authority's vehicle fleet, and placing requirements on public transport operators on local authority-supported routes.

Table 12. List of LCTP measures, the delivery agency for each, and the level of local authority influence on their implementation for the transport sector.

Measure	Description	Delivery Agency	Local Authority Influence		Description
			Score ¹	Tier ²	
EU new car average fuel efficiency standards of 130g CO ₂ /km by 2015	EU regulation on average new car CO ₂ emissions. Penalties for manufacturers who miss the targets over their manufactured output	Presumably national government would be responsible for data collation and administering penalties to manufacturers	1	1	Promotion
				2	Fleet procurement. Government aim to meet targets early in government-procured fleets
Extension of biofuels to 10% (by energy)	EU Renewable Energy and Fuel Quality Directives	Central government, probably the Renewable Fuels Agency	1	1	Promotion, support for local biofuel initiatives
Low carbon emission buses	£30m funding and support for several hundred buses with at least 30% lower carbon emissions	Central government funding	2	1	Supporting operators in applying for funding within the LA area. Setting contractual requirements for lower carbon buses on LA-supported routes
SAFED training for bus drivers	DfT funded scheme for driver training	Authorised training providers deliver training for the DfT	1	1	Promotion of scheme to local operators, contractual requirements for LA-supported public transport routes

Measure	Description	Delivery Agency	Local Authority Influence		
			Score ¹	Tier ²	Description
Complementary measures in cars	EU regulations are under development promoting various technological advances (gear shift indicators; tyre pressure monitoring systems; low viscosity lubricants; low rolling resistance tyres; and more efficient air conditioning)	Central government?	1	1	Promotion
				1 2	Fleet procurement
Low rolling resistance tyres for HGVs	EU regulations are proposed for low rolling resistance tyres for HGVs	Central government?	1	1	Promotion
Additional impact of new car average fuel efficiency standards of 95g CO ₂ /km by 2020	EU regulation on average new car CO ₂ emissions.	Presumably national government would be responsible for data collation and administering penalties to manufacturers	1	1	Promotion
				1 2	Fleet procurement
Potential EU new van CO ₂ regulation	EU Regulation on new van CO ₂ emissions	Presumably national government would be responsible for data collation and administering penalties to manufacturers	1	1	Promotion
				1 2	Fleet procurement
Rail electrification (illustrative savings)	Illustrative savings from the electrification of 750 km of track are included in the scheme. Central government to develop a strategy for electrification in due course	Central government, DfT, Network Rail	0		Electrification unlikely west of Bristol.

4.3. Residential Sector

In the residential sector, the key initiatives aim to reduce emissions by:-

- promoting energy efficiency and low carbon technology in existing homes;
- raising awareness of energy consumption through smart metering and product labelling, and
- increasing standards for new buildings, with aspirations for zero carbon new homes.

The measures are summarised in Table 13. The primary rôle of local authorities in this sector appears to be working in partnership with initiatives such as Home Energy Management Strategy, raising awareness of energy and carbon issues, promoting uptake of the schemes, and encouraging low carbon developments through the planning process. Note that many of the policies listed separately in the original LCTP (e.g. smart meters, obligations on energy suppliers, CERT and CESP) are now subsumed under the Home Energy Management Strategy initiative, which has the following aims ^[20]:-

- every home where it is practical will have loft and cavity wall insulation –by 2015 as an ambition;
- every home in Britain will have a smart meter and display to help them better manage their use of energy;

- up to 7 million households will have had an eco-upgrade which would include advanced measures such as solid wall insulation or heat pumps alongside smart meters and more basic measures;
- people living in rented accommodation will enjoy higher levels of energy efficiency as landlords – private and social – take action to improve the fabric of properties;
- there will be wider take up of district heating in urban areas, such as in blocks of flats, in new build and social housing, and in commercial and public sector buildings; and
- there will be a core of up to 65,000 people employed in the new industry of energy efficiency, and potentially several times more down supply chains. Jobs will include installing and manufacturing energy saving measures or providing home energy advice.

Whilst the boiler scrappage scheme and additional effort in Warm Front have been added in the revised list of measures^[17], their effect has not yet been quantified.

Table 13. List of LCTP measures, the delivery agency for each, and the level of local authority influence on their implementation for the residential sector.

Measure	Description	Delivery Agency	Local Authority Influence		
			Score ¹	Tier ²	Description
Product policy	European legislation to ecolabel products and set minimum standards for the energy efficiency of products. UK government is supporting the development of these schemes, and in some cases pre-empting them (e.g. early phasing out of incandescent light bulbs).	Minimum standards and labelling protocols set by EU & Central government. Implemented by manufacturers and retailers.	1	2	Awareness campaigns encouraging procurement of the most energy efficient products.
Home Energy Management Strategy	Package of measures as described in body of report.	Domestic energy suppliers, progress is reported by Ofgem. Schemes are often delivered through a partnership approach between suppliers, local authorities and community groups	2	2	Awareness, partnership working between energy suppliers and local authority initiatives
Boiler Scrappage Scheme	Incentives to fit energy efficient condensing boilers	Central government funding scheme	1	2	Promotion of scheme
Additional Effort in Warm Front	Insulation and heating improvements scheme managed by Eaga	EAGA	1	2	Promotion of scheme
Zero carbon homes	Increasing standards for domestic developments through tightening of building regulations (zero carbon by 2016 for new homes)	Local authority building control, and private sector approved inspectors	2	1 2	Planning policy, Section 106 agreements. Local authority building control officers will need training to interpret and assess compliance with the new requirements
Renewable Heat Incentive (residential sector)	Financial support for lower carbon heating installations installed by certified installers	Central government scheme, administered by Ofgem. Installers must be MCS accredited.	1	2	Promotion of scheme

4.4. Public Sector

In the public sector, the key initiatives aim to reduce emissions by:-

- encouraging greater energy efficiency and reduced emissions through participation in the Carbon Reduction Commitment (CRC) and schemes offering financial support for the upgrading of buildings, and
- informing product procurement through ecolabelling.

The measures are summarised in Table 14. The primary rôle of local authorities in this sector is to participate in the schemes and have environmental policies for product procurement and carbon reduction.

It must be remembered that the public sector is relatively small so although the local authority influence is strong in this sector the overall effect will be small.

Table 14. List of LCTP measures, the delivery agency for each, and the level of local authority influence on their implementation for the public sector.

Measure	Description	Delivery Agency	Local Authority Influence		Description
			Score ¹	Tier ²	
Carbon Reduction Commitment (public sector)	Mandatory scheme for half-hour metered organisations to report electricity or CO ₂ emissions, larger consumers must purchase carbon allowances.	Administered by the Environment Agency on behalf of Central government	3	1 2	Participation in scheme
Renewable Heat Incentive (public sector)	Financial support for lower carbon heating installations installed by certified installers	Central government scheme, administered by Ofgem. Installers must be MCS accredited.	3	1 2	Participation in scheme
One-off interest free public sector loans	Interest free loans of £5000 plus available for building insulation boiler and lighting upgrades, IT efficient improvements etc. £51.5m loans available in addition to existing Salix fund	Scheme administered by Salix, an independent, not-for-profit company	3	1 2	Scheme specifically aimed at financing improvements to public sector buildings
Product policy (public sector)	European legislation to ecolabel products and set minimum standards for the energy efficiency of products. UK government is supporting the development of these schemes, and in some cases pre-empting them (e.g. early phasing out of incandescent light bulbs).	Minimum standards and labelling protocols set by EU & Central government. Implemented by manufacturers and retailers.	2	1 2	Set procurement policies based on the environmental credentials of products as reported by ecolabelling schemes

4.5. Agriculture and Waste Sectors

In the agricultural sector, the key initiatives aim to reduce emissions by:-

- action taken by farmers to reduce their emissions;
- possible future legislation if the voluntary approach is not effective;
- Financial support for energy efficiency measures, bioenergy and anaerobic digestion, and
- encouraging afforestation and reducing the landfilling of waste.

The measures are summarised in Table 15. Local authorities have considerable influence in the waste sector, through their management or procurement of domestic refuse collection and recycling schemes. The county farm estate may also provide the opportunity to demonstrate best practice in the agricultural sector for the larger rural counties, although county farms form only small proportion of the agricultural land area so the overall effect on the sector would be small. Wider influence in the agricultural sector comes from the local authority's role in administering rural development programme grants and planning and waste management influences over combined heat and power and waste disposal initiatives.

Table 15. List of LCTP measures, the delivery agency for each, and the level of local authority influence on their implementation for the agriculture and waste sectors.

Measure	Description	Delivery Agency	Local Authority Influence		
			Score ¹	Tier ²	Description
Further emission savings: Agriculture	<ul style="list-style-type: none"> Encourage farmers to reduce emissions by 6% by more efficient use of fertiliser, and better management of livestock and manure. 	Farmers Central Government Devolved Administrations Climate Change Task Force (including National Farmers Union, Country Land and Business Association and the Agricultural Industries Confederation) Rural Climate Change Forum England Catchment Sensitive Farming Delivery Initiative Environmental Stewardship scheme Act on CO ₂ campaign Natural England Environment Agency Regional Development Agencies	2	1	Implementation on the County Farm Estate. Support and promotion of initiatives. Administration of Rural Development Programme (RDPE) Waste strategy (CHP, Energy from Waste schemes)
	<ul style="list-style-type: none"> Review voluntary progress in 2012 and if necessary introduce additional measures Provide energy efficiency advice and financial support 	DEFRA to consider new policies Carbon Trust Bioenergy Capital Grants funded by the Department of Energy and Climate Change			

Measure	Description	Delivery Agency	Local Authority Influence		
			Score ¹	Tier ²	Description
Further emission savings: Agriculture (continued)	<ul style="list-style-type: none"> • Research measurement and reporting of agricultural emissions • Encourage woodland creation • Financial support for anaerobic digestion • Reduce landfilling 	Forestry Commission Anaerobic Digestion Task Group			(score, tier and description as above)
Continuation of the landfill tax escalator	Increasing charges for landfilling waste	HM Revenue and Customs	2	1	Local authority waste strategy
Further emission savings: Waste	Restrictions on landfilling certain materials Improved methane capture	Environment Agency	2	1	Local authority waste strategy

4.6. Power and Heavy Industry Sector

In this sector, the key initiatives aim to reduce emissions by:-

- Shifting electricity generation to renewable energy sources (which are potentially more decentralised), and
- Reducing emissions from power stations and heavy industry through the Industrial Emissions Directive, and by piloting carbon capture and storage on coal-fired power stations.

The measures are summarised in Table 16. The primary rôle of local authorities in this sector is to support the push towards renewable electricity generation through their rôle in the planning process. The local authority perhaps has a greater rôle to play in small renewable schemes than large projects.

The analysis in this report has been conducted on an end-user basis, and the effect of measures affecting energy supply have been apportioned to end users on the basis of their electricity and petroleum consumption. The effect of the Industrial Emissions Directive has been apportioned between industrial emissions and emissions from electricity generation and refineries (apportioned to end users of the electricity and petroleum) on the basis of CO₂ emissions from industry and power generation under the central scenario for the LCTP measure, the Industrial Emissions Directive (the central scenario emissions being used since most of the reductions in the industry and energy supply sectors are from other LCTP measures), and under the baseline scenario for the baseline measure, the Large Combustion Plants Directive.

Table 16. List of LCTP measures, the delivery agency for each, and the level of local authority influence on their implementation for the energy supply sector.

Measure	Description	Delivery Agency	Local Authority Influence		
			Score ¹	Tier ²	Description
Additional renewables in electricity generation from UK Renewable Energy Strategy	Five-fold increase in renewable electricity generation to 30% by 2020	Office for Renewable Energy Deployment	2	2	Planning influence
Carbon Capture and Storage Demonstration	Four demonstration projects	Office of Carbon Capture and Storage (part of the Department of Energy and Climate Change)	0		None
Industrial Emissions Directive	Consolidation and tightening of controls on emissions from large combustion plant and other industrial sources.	Central government, Environment Agency	0		None, unlikely to fall under EHO remit?
Feed-In Tariff	Payments incentivising the installation of renewable electricity generation technologies	Energy suppliers, regulated by Ofgem. Microgeneration Certification Scheme – accredited installers	2	2	Planning influence

4.7. Summary of Measures

The measures can be summarised as follows:-

- financial incentives and penalties aimed at reducing CO₂ emissions through housekeeping measures and the provision of new technology;
- legislation raising standards of energy efficiency and reducing carbon emissions from new buildings, building services, road vehicles and waste management;
- policies to increase the provision of renewable energy supply and electrified rail services, and to pilot carbon capture and storage, and
- providing information to assist energy management and the selection of new products, and energy-efficient driving techniques.

Local authorities clearly have the greatest influence over emissions from their own activities, including public buildings, their own transport activities, waste management and recycling, the county farm estate and public sector housing. In terms of wider emissions, the local authority also has influence through the planning system, which could enable them to encourage the exploitation of renewable energy sources and low carbon developments in their area. The local transport plan provides the key mechanism in affecting transport emissions through behavioural change, transport infrastructure and supporting the uptake of new technologies.

They also have the opportunity to promote many of the other initiatives aimed at reducing CO₂ emissions through energy management and the uptake of new technologies. Within the LCTP, the Home Energy Management Strategy is projected to bring substantial reductions in carbon emissions.

5. Estimating the impact of future policy measures

The key Government policy measures on reducing carbon emissions are set out in the LTCP and are reviewed in the section above. This section sets out how the impact of these measures can be estimated at the local level and where local authorities have most influence over these impacts. The analysis is carried out in three steps:

1. Estimating a business as usual (BAU) scenario projecting emissions forward from 2008 to 2022, including expected growth, fuel prices and existing policy measures;
2. Estimating the savings resulting from the LCTP and allocating these to the local level;
3. Based on the likely influence of an authority over each measure, assess the proportion of savings attributable to the LCTP that it can directly influence.

5.1. Establishing the business as usual (BAU) scenario

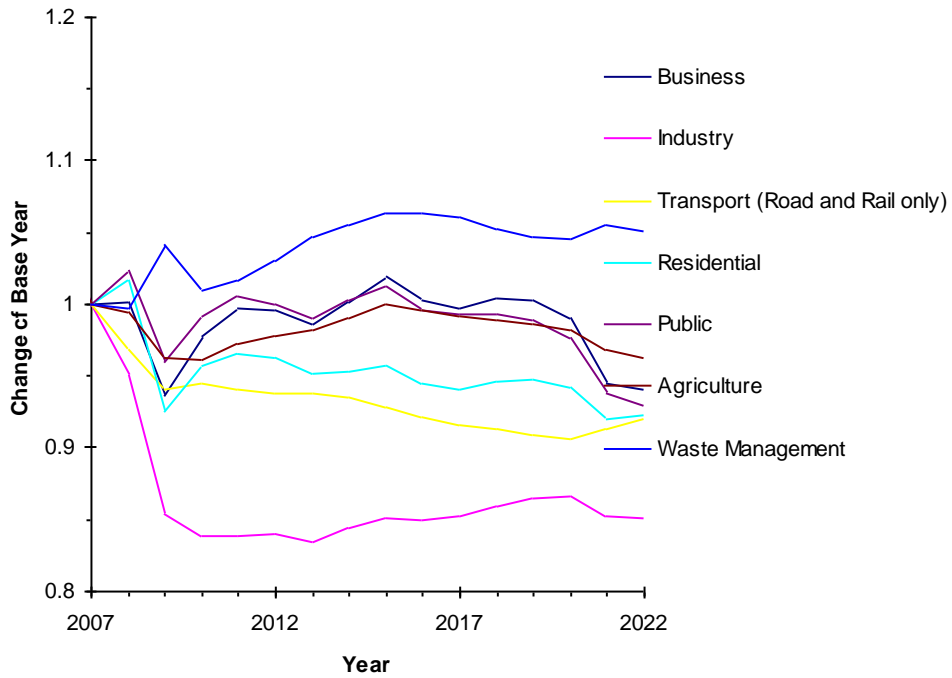
The Low Carbon Transition Plan (LCTP) outlines initiatives and their projected effect on CO₂ (and CO₂ equivalent) emissions. It also sets out a baseline scenario, accounting for economic growth and future fuel prices, which includes the effect of existing policies that pre-date the LCTP. The policy initiatives included in the baseline are listed in Appendix V. The scenario used in this analysis uses central growth and central oil price predictions as shown in table 14 below.

Table 17. Central growth and oil price forecasts in the BAU scenario

	2010	2015	2020	2025
GDP increase per annum (%)	1.25	2.4	2.3	2.4
Central oil price scenarios (\$/barrel)	70	75	80	85

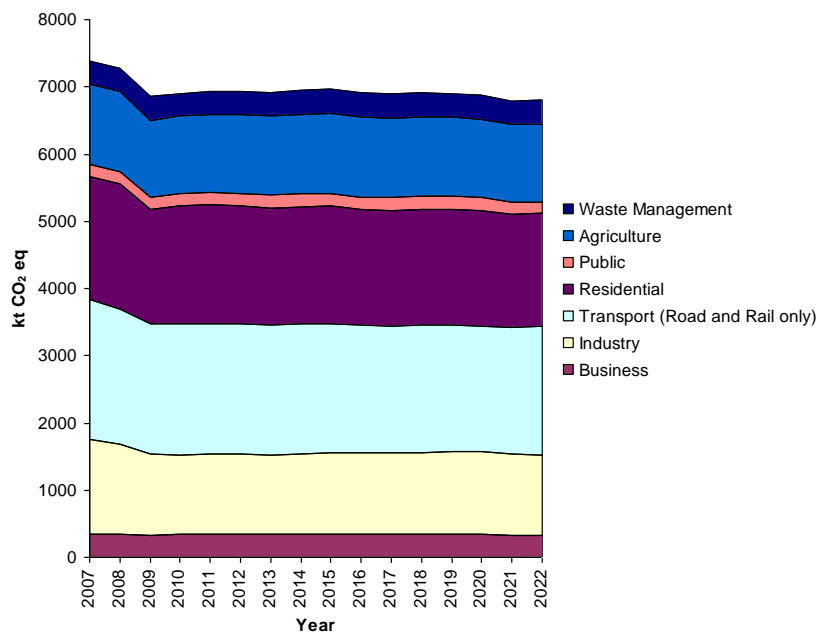
The BAU scenario from the LCTP analysis is shown in Appendix I Table A1.3 and gives the predicted national CO₂ emissions by sector through the 2022. This is provided on a source basis, which has been converted to an end-user basis using predicted end-user electricity and petroleum consumption data. Using this data a sector carbon growth factor is defined relative to 2007 the baseline year. These growth factors are shown in Figure 1 below.

Figure 1. National sector carbon growth factors for the BAU scenario



To obtain a local BAU prediction these growth factors are simply applied to the 2007 baseline data for each sector as developed in section 3. This then provides a BAU scenario against which the LCTP savings can be estimated. The resulting forecast for Devon is shown in figure 2 below and shows a 6.5% reduction from 2008 to 2022. Nationally, a 7.5% reduction is predicted (for consistency, again excluding LULUCF, aviation and shipping). The difference between Devon and the UK is attributable to the regional variation in the magnitude of the different sectors. Agriculture, in particular, has a greater dominance in Devon than is the case nationally. The net reductions attributable to baseline policies have more than doubled in the new dataset released in June 2010, on which the above figures are based ^{[15], [16], [17], [18], [19]}.

Figure 2. BAU scenario results for Devon



5.2. Estimating the impact of the LCTP measures

Using the analysis data from the LCTP the effect of each measure, on each sector, for each year from 2008 to 2022 can be estimated and allocated to the local level. The data in the LCTP is presented as the change in CO_{2,eq} emissions on a source basis. Additionally, it is stated that due to policy interaction the sum of the effect of all policies differs slightly from the total projected emissions saving. Therefore to estimate the effect at a local level for these measures the following analysis steps are carried out:

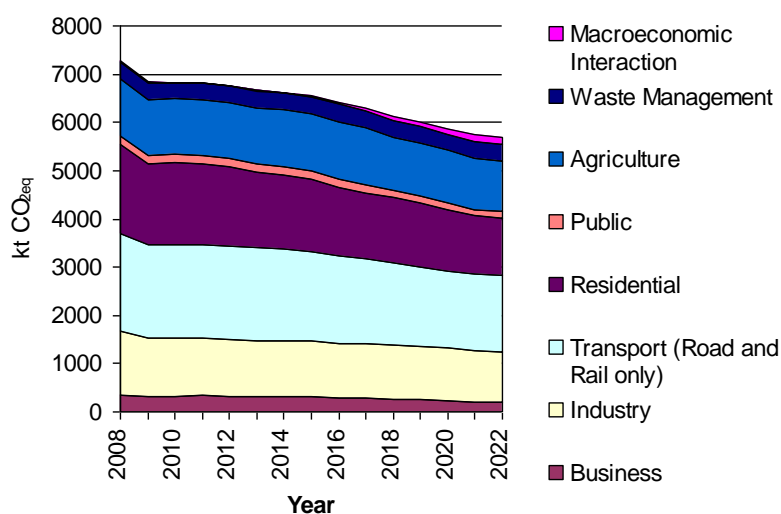
1. The saving from measures affecting the energy supply industries has been re-allocated to end-users on the basis of relative sectoral energy consumption (as reported for the central LCTP scenario for LCTP measures and for the baseline scenario for baseline measures). In the absence of end-user energy consumption data for the waste management sector, re-allocation to this sector has not been attempted. Savings from measures affecting heavy industry and energy supply have been apportioned on the basis of sectoral electricity and petroleum consumption, and CO₂ emissions from power stations, refineries, industrial combustion and industrial processes, under the central or baseline scenario for LCTP and baseline measures respectively.
2. These national measure savings of CO_{2,eq} emissions have been allocated to the local level using the ratio of local to national baseline emissions in 2007 for each sector:

$$Local M_{CO_{2,eqAdj}} = National M_{CO_{2,eq}} \times \frac{Local\ 2007\ sector\ baseline}{National\ 2007\ sector\ baseline}$$

3. The LCTP measure savings are then subtracted from the BAU results for each year to get a future prediction of local emissions for each sector including the impact of national policy measures.
4. The difference between the sum of measures and the reported difference in the total emissions between the LCTP central and baseline scenario has been shown as macroeconomic interaction.

Applying this analysis to Devon gives the predicted future emissions as shown in Figure 3. Overall, a reduction in emissions of 21.6% is projected for Devon by 2022 compared to 2008. This is close to the 24.1% predicted nationally. Compared to the BAU scenario, a reduction of 16.1% is predicted for Devon in 2022, and an 18.0% reduction is predicted nationally (all of these figures exclude emissions from LULUCF, aviation and shipping). Hence if measures are implemented equally effectively at local level as is the case nationally, a similar percentage reduction in overall emissions is expected to result.

Figure 3. LCTP impact scenario results for Devon



The savings attributable to each measure for Devon, by LCTP budget period, are shown in Table 18 below. The measures are ranked by level of impact, with more measures having an effect in the later periods.

Table 18. Ranked list of LCTP measures across all sectors, for the three budget periods, with percentage of total reduction within each budget period

Rank	Budget 1 (2008 to 2012)	Budget 2 (2013 to 2017)	Budget 3 (2018 to 2022)
1	Home Energy Management Strategy (64.3%)	Home Energy Management Strategy (35.0%)	Additional Renewables in Electricity Generation (21.1%)
2	Product Policy (20.2%)	Additional Renewables in Electricity Generation (16.3%)	Home Energy Management Strategy (20.1%)
3	Public sector loans (8.6%)	Product Policy (15.1%)	Product Policy (12.3%)
4	Possible EU new van regulation (3.5%)	Renewable Heat Incentive (7.3%)	Renewable Heat Incentive (11.0%)
5	Renewable Heat Incentive (2.6%)	RES Transport bio-fuel (from 5% volume to 10% by energy) (6.1%)	RES Transport bio-fuel (from 5% volume to 10% by energy) (8.9%)
6	SAFED bus driver training (1.6%)	Carbon Capture and Storage Demonstration (4.3%)	Agriculture (7.9%)
7	Carbon Reduction Commitment (1.5%)	Possible EU new van regulation (3.5%)	Interim VA target to 130g/CO2 (5.9%)
8	Complementary measures for cars (1.2%)	Interim VA target to 130g/CO2 (3.4%)	Carbon Capture and Storage Demonstration (5.8%)
9	Loans to SMEs (1.0%)	Energy Intensive Industry (2.5%)	EU new car CO2 regulation: 95gCO2/km target for 2020 (5.5%)
10	DCLG- Zero carbon homes (0.7%)	Carbon Reduction Commitment (2.2%)	Possible EU new van regulation (2.7%)
11	Feed-In Tariff (0.7%)	Complementary measures for cars (1.7%)	Carbon Reduction Commitment (2.3%)
12	Energy Performance of Buildings Directive (0.2%)	Public sector loans (1.6%)	Energy Intensive Industry (1.1%)
13	Additional Renewables in Electricity Generation (0.2%)	Feed-In Tariff (1.3%)	Industrial Emissions Directive (1.1%)
14	Smart Metering (0.1%)	Smart Metering (0.8%)	Complementary measures for cars (1.1%)
15	Low carbon buses (0.1%)	DCLG- Zero carbon homes (0.8%)	Feed-In Tariff (1.0%)
16		EU new car CO2 regulation: 95gCO2/km target for 2020 (0.7%)	Waste (1.0%)
17		SAFED bus driver training (0.7%)	DCLG- Zero carbon homes (0.9%)
18		Landfill tax (0.6%)	Smart Metering (0.7%)
19		Energy Performance of Buildings Directive (0.3%)	Landfill tax (0.5%)
20		Low carbon buses (0.1%)	Low rolling resistance tyres for HGVs (0.3%)
21		Low rolling resistance tyres for HGVs (0.1%)	Energy Performance of Buildings Directive (0.3%)
22		Loans to SMEs (0.1%)	SAFED bus driver training (0.3%)
23			Low carbon buses (0.3%)
24			Illustrative electrification of 750km of single track rail line (0.2%)

5.3. Assessing the level of LCTP savings influenced by LA activity

The degree of influence that local authorities potentially have over each LCTP measure was discussed in Section 4. If this is combined with the estimated local savings from each LCTP measure we get an estimate of what proportion of savings, and from which measures, an authority has influence over. Using the data for Devon, Figure 4 shows the percentage of CO₂-equivalent savings from the LCTP by level of local authority influence, over all sectors, for each budget period. It can be seen that the overall scale of the measures over which Devon may have considerable influence is relatively small (2 to 3%, except in the first

budget period, where 8.6% of total LCTP savings are from interest-free public sector loans). Measures with a high level of local authority influence are all directly targeted at the public sector (Carbon Reduction Commitment for public sector, Renewable Heat Incentive for the public sector and interest free public sector loans).

Measures where the local authority has little or no influence account for between 32% and 47% of the total effect. The influence of measures over which the local authority has moderate influence accounts for between 51% and 60% of total savings from LCTP measures. In the third budget period, 21% of the savings from measures with moderate local authority influence are from additional renewables in the electricity generation mix (where local authorities may have some influence through planning decisions), 20% are from the Home Energy Management Strategy, and 8% are from the agriculture sector.

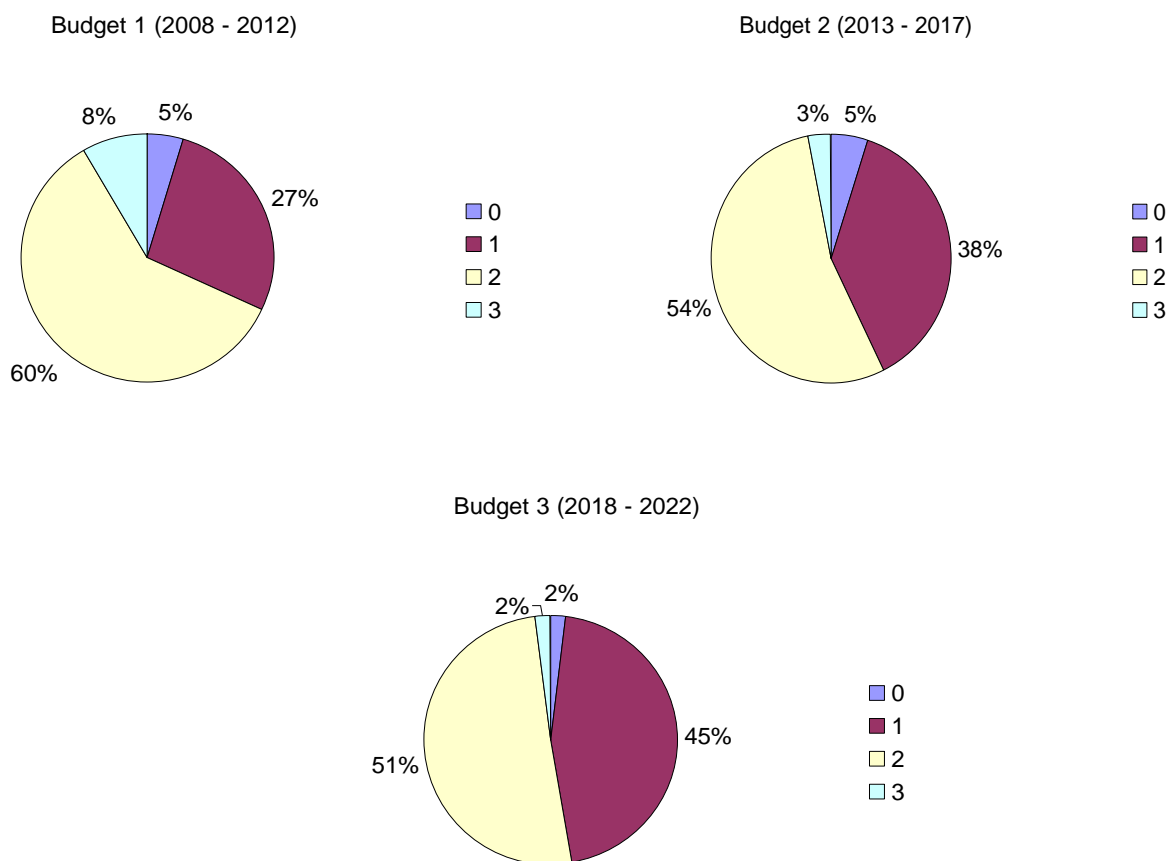
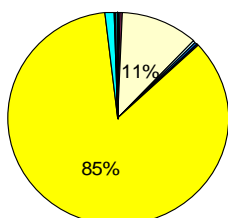


Figure 4. Emission reductions estimated for DCC for each budget period attributable to LCTP measures with different rankings for local authority influence (0 = none, 1 = little, 2 = moderate, 3 = considerable).

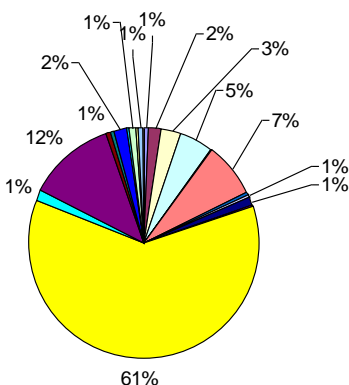
Figure 5 shows the percentage of emission savings attributable to measures that the local authority is deemed to have moderate or considerable influence over, for each budget period. The dominance of the Home Energy Management Strategy (where local authorities have influence through partnership working) is clear, although its dominance reduces in the later budget periods as additional renewables for electricity generation becomes more dominant.

Budget 1 (2008 to 2012)



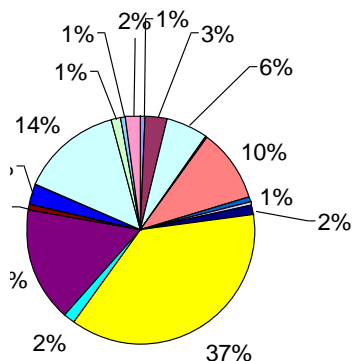
- Carbon Reduction Commitment (Public)
- Public RHI
- Public sector loans
- Additional renewables in generation (RES) (Business sector)
- Feed-in Tariff (Business sector)
- Additional renewables in generation (RES) (Industrial processes sector)
- Feed-in Tariff (Industrial processes sector)
- Low carbon buses
- Additional renewables in generation (RES) (Transport sector)
- Feed-in Tariff (Transport sector)
- Home Energy Management Strategy
- DCLG- Zero carbon homes
- Additional renewables in generation (RES) (Residential sector)
- Feed-in Tariff (Residential sector)
- Product policy (public)
- Additional renewables in generation (RES) (Public sector)
- Feed-in Tariff (Public sector)
- Agriculture
- Additional renewables in generation (RES) (Agriculture sector)
- Feed-in Tariff (Agriculture sector)
- Landfill tax
- Waste

Budget 2 (2013 to 2017)



- Carbon Reduction Commitment (Public)
- Public RHI
- Public sector loans
- Additional renewables in generation (RES) (Business sector)
- Feed-in Tariff (Business sector)
- Additional renewables in generation (RES) (Industrial processes sector)
- Feed-in Tariff (Industrial processes sector)
- Low carbon buses
- Additional renewables in generation (RES) (Transport sector)
- Feed-in Tariff (Transport sector)
- Home Energy Management Strategy
- DCLG- Zero carbon homes
- Additional renewables in generation (RES) (Residential sector)
- Feed-in Tariff (Residential sector)
- Product policy (public)
- Additional renewables in generation (RES) (Public sector)
- Feed-in Tariff (Public sector)
- Agriculture
- Additional renewables in generation (RES) (Agriculture sector)
- Feed-in Tariff (Agriculture sector)
- Landfill tax
- Waste

Budget 3 (2018 to 2022)



- Carbon Reduction Commitment (Public)
- Public RHI
- Public sector loans
- Additional renewables in generation (RES) (Business sector)
- Feed-in Tariff (Business sector)
- Additional renewables in generation (RES) (Industrial processes sector)
- Feed-in Tariff (Industrial processes sector)
- Low carbon buses
- Additional renewables in generation (RES) (Transport sector)
- Feed-in Tariff (Transport sector)
- Home Energy Management Strategy
- DCLG- Zero carbon homes
- Additional renewables in generation (RES) (Residential sector)
- Feed-in Tariff (Residential sector)
- Product policy (public)
- Additional renewables in generation (RES) (Public sector)
- Feed-in Tariff (Public sector)
- Agriculture
- Additional renewables in generation (RES) (Agriculture sector)
- Feed-in Tariff (Agriculture sector)
- Landfill tax
- Waste

Figure 5. Percentage split of emission savings between LCTP measures with moderate or considerable local authority influence.

In Figure 6, each sector is considered in turn, and for the third budget period the proportion of emission savings attributable to measures with different rankings for local authority influence is shown. Except in the public sector, there are no measures where local authorities have considerable influence. The significant areas of local authority influence outside the public sector are the impact of additional renewables on emissions from electricity consumption in the commercial sector, and the Home Energy Management Strategy in the residential sector.

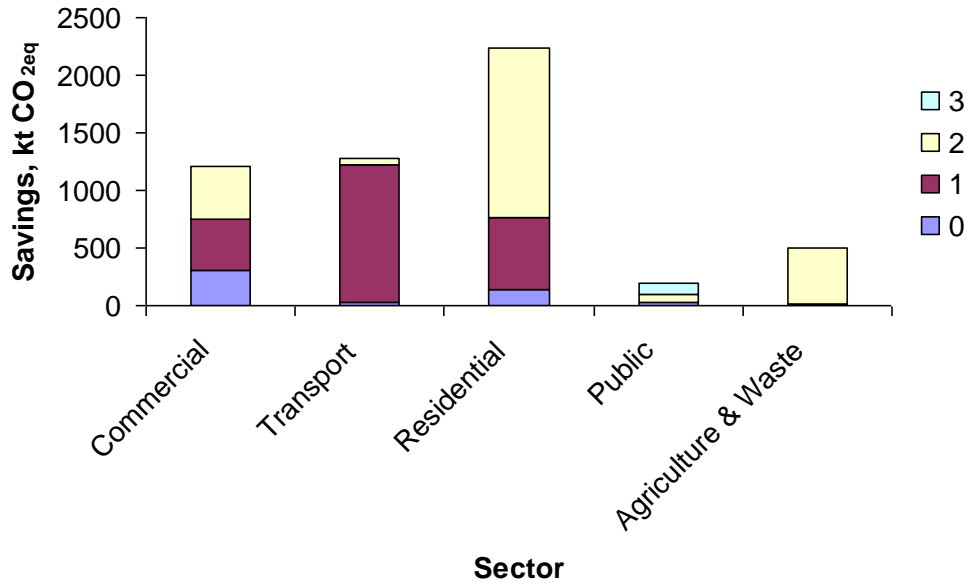


Figure 6. Percentage of total emission reductions estimated for DCC for the third budget period (2018 to 2022) attributable to LCTP measures with different rankings for local authority influence (0 = none, 1 = little, 2 = moderate, 3 = considerable).

The lack of influence in the transport sector is because the LCTP measures focus mainly on nationally implemented technology policy. Measures such as behavioural change where authorities would have more influence are included in the baseline predictions.

6. Conclusions

This paper has set out the methodology that has been used to:

- Establish a baseline of local GHG emissions covering more comprehensive set of sectors and a wider range of greenhouse gases than is present in NI186;
- Review national policy measures, identify the relevant delivery agencies and the potential for authorities to influence delivery at the local level;
- Estimate the impact of national policy measures at the local level, and the proportion of the savings over which an authority has some influence.

To carry out this analysis the methodology uses 3 main data sets:

1. Regional CO₂ data from DEFRA/DECC;
2. National emissions data and predictions from the LCTP and the 5NC;
3. Local proxy data to represent levels of activity in each of the sectors.

The method was piloted with Devon County Council giving the following key results:

- A 2007 baseline data set covering the main GHGs (CO₂, CH₄, N₂O) for 8 sectors (business, industrial processes, public, residential, transport, agriculture, LULUCF and waste management).
- Within the 2007 baseline agriculture, a sector not fully reported as a separate entity in NI186, accounted for some 16% of Devon's emissions.
- The business as usual (BAU) scenario comprising central growth and existing policy measures indicated emissions in Devon would reduce by 6.5% from 2008 to 2022 compared to a 7.5% reduction nationally.
- The introduction of the LCTP policies would see this reduction increase locally to a 21.6% compared to 24.1% nationally.
- Overall Devon would have moderate to considerable influence over some 51% of the savings from these national measures.
- The key areas where Devon would have influence are increased renewable energy in the electricity generation mix (owing to planning powers) and the Home Energy Management Strategy (through partnership working with suppliers and other organisations). Other areas include the renewable heat incentive (which could be applied to public sector buildings), waste management, agriculture (through the Rural Development Programme (RDPE) and planning and waste management influences on energy from waste and combined heat and power initiatives), zero carbon homes (through planning influences), and low carbon emission buses. Wider transport initiatives fall outside of the measures introduced in the LCTP (which are technology focussed), but still have an important rôle to play in reducing carbon emissions.

This methodology can be applied to all authorities in the South West providing a consistent data set on current emissions, the expected change in these emissions due to Government policy and the level of local influence authorities will have over these policies. This data can then be used to support authorities in setting realistic local carbon reduction targets in line with Government policy, and where they should potentially be focusing their effort to ensure maximising impact of national policy locally.

References

- 1 **Detailed data supporting the indicator (Indicator 186: Per capita CO₂ emissions in the LA area), sector and fuel details.** Department of Energy and Climate Change.
http://www.decc.gov.uk/Media/viewfile.ashx?FilePath=Statistics\climate_change\1_20090921094641_e_@@_localco2ni186indicators.xls&filetype=4
- 2 **Full Local CO₂ emission estimates, sector and fuel details.** Department of Energy and Climate Change.
http://www.decc.gov.uk/media/viewfile.ashx?filepath=statistics/climate_change/1_20090917090939_e_@@_localco2dataset.xls&filetype=4.
- 3 **The UK's Fifth National Communication under the United Nations Framework Convention On Climate Change.** 2009, Department of Energy and Climate Change.
http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/gbr_nc5.pdf
- 4 **The UK Low Carbon Transition Plan.** 2009, The Stationery Office.
http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx
- 5 **UK Low Carbon Transition Plan Emissions Projections. Table A: Carbon Dioxide Emissions by Source and Other Greenhouse Gases.** 2009.
http://www.decc.gov.uk/media/viewfile.ashx?filepath=statistics/projections/1_20090812111722_e_@@_tablea.xls&filetype=4
- 6 **UK Low Carbon Transition Plan Emissions Projections. Table C: Final Energy Demand.** 2009.
http://www.decc.gov.uk/media/viewfile.ashx?filepath=statistics/projections/1_20090715101416_e_@@_tablec.xls&filetype=4
- 7 **NUTS2:11 Gross Value Added (GVA) by NUTS2 area and 15 industries at current basic prices by region.** Office of National Statistics.
http://www.statistics.gov.uk/downloads/theme_economy/PROGRESS_NUTS2.xls
- 8 **GVA data for South West England and Great Britain.** ECON|i Software tool version 2.12.
- 9 **NAEI CH₄ emissions by 1x1km.** http://www.naei.org.uk/data_warehouse.php
- 10 **Devon Facts and Figures Land Areas.** Devon County Council.
http://www.devon.gov.uk/index/councildemocracy/improving_our_services/facts_figures_and_statistics/factsandfigures/thecounty/geographicareas/geogareasdevondis.htm
- 11 **Land Cover 2007 Statistics.** 2007, Office for National Statistics.
<http://www.statistics.gov.uk/cci/nugget.asp?id=150>
- 12 **Quantification of the Potential Contribution of Government Initiatives to Carbon Emission Reductions in Devon: Sectoral Baseline Emissions.** G. Hitchcock and T.A. Mitchell. SWEEG Internal Document 712. 2010.
- 13 **Quantification of the Potential Contribution of Government Initiatives to Carbon Emission Reductions in Devon: Analysis of LCTP Measures.** G. Hitchcock and T.A. Mitchell. SWEEG Internal Document 738. 2010.
- 14 **Assessment of the 2008-9 Proxy Indicator Data for Devon's LAA5.** G. Hitchcock. SWEEG Internal Document 652. 2009.

- 15 **Updated Energy and Emissions Projections: June 2010 URN 10D/510.** 2010, Department of Energy and Climate Change.
<http://www.decc.gov.uk/en/content/cms/statistics/projections/projections.aspx>
<http://www.decc.gov.uk/assets/decc/Statistics/Projections/67-updated-emissions-projections-june-2010.pdf>
- 16 **Updated Energy and Emissions Projections: June 2010. Annex C: Final Energy Demand.** 2010, Department of Energy and Climate Change.
<http://www.decc.gov.uk/assets/decc/Statistics/Projections/50-annex-c-final-energy-demand-.xlsx>
- 17 **Updated Energy and Emissions Projections: June 2010. Annex G: Policy Savings Included in the Projections.** 2010, Department of Energy and Climate Change.
<http://www.decc.gov.uk/assets/decc/Statistics/Projections/70-annex-g--policy-savings-included-in-the-projectio.xlsx>
- 18 **Updated Energy and Emissions Projections: June 2010. Annex A: Greenhouse Gas Emissions by Source.** 2010, Department of Energy and Climate Change.
<http://www.decc.gov.uk/assets/decc/Statistics/Projections/51-annex-a-greenhouse-gas-emissions-by-source-.xlsx>
- 19 **Updated Energy and Emissions Projections: June 2010. Annex B: Carbon Dioxide Emissions by Source.** 2010, Department of Energy and Climate Change.
<http://www.decc.gov.uk/assets/decc/Statistics/Projections/52-annex-b-carbon-dioxide-emissions-by-source-.xlsx>
- 20 **The Government launch Home Energy Management Strategy (HEMS) at Ecobuild 2010.**
<http://www.syntegra-epc.co.uk/2010/03/the-government-launch-home-energy-management-strategy-hems-at-ecobuild-2010/>

Appendix I. National CO₂ and CO_{2eq} Data

For the LCTP, figures are based on the central price, baseline policy and central growth scenarios.

Table A1.1. 5NC national CO₂ emissions by end user. N/A denotes insufficient data available to calculate value.

Sector	CO ₂ Emissions (Mt / annum)								
	1990	1995	2000	2005	2006	2007	2010	2015	2020
Business	227.5	197.6	196.4	194.6	197.4	N/A	169.9	173.4	166.0
Industrial processes	17.3	15.8	15.6	14.2	14.4	N/A	12.9	13.5	13.8
Transport	140.6	142.7	146.7	152.2	151.5	N/A	144.8	147.6	146.2
Residential	155.7	143.5	146.8	149.5	149	N/A	135.7	126.7	113.2
Public	29.2	26.6	22.3	21.6	21.5	N/A	20.4	20.0	18.4
Agriculture	8.8	8.2	7.3	7.2	7.1	N/A	6.7	6.8	6.6
LULUCF ³	3.0	1.3	-0.3	-1.9	-1.9 ⁴	N/A	N/A	N/A	N/A
Waste management ³	1.2	0.9	0.5	0.4	0.4 ⁵	N/A	N/A	N/A	N/A

Table A1.2. 5NC national CO_{2eq} emissions by end user.

Sector	CO _{2eq} Emissions (Mt / annum)					
	1990	1995	2000	2005	2006 ⁶	2007
Business	243.8	211.8	211.1	206.5	204.9	203.2
Industrial processes	56.8	47.0	26.2	18.4	18.5	18.6
Transport	144.8	149.3	151.7	155.6	155.8	156.0
Residential	168.4	153.5	155.7	156.2	152.6	149.1
Public	31.2	28.2	23.3	22.1	21.5	20.9
Agriculture	64.5	61.7	58.0	53.6	52.1	50.6
LULUCF ⁷	3.0	1.3	-0.3	-1.9	-1.9	-1.8
Waste management ³	52.9	46.9	34.1	22.8	22.8	22.8

³ Estimated from total end user CO_{2eq} emissions on the basis of CO₂ cf. CO_{2eq} source emissions for the sector.

⁴ 2006 data interpolated between 2005 and 2007 for LULUCF CO_{2eq} and N₂O emissions.

⁵ 2006 data interpolated between 2005 and 2007 for waste management CO_{2eq} and N₂O emissions.

⁶ 2006 data interpolated between 2005 and 2007.

⁷ Estimated from total end user CO_{2eq} emissions on the basis of CO₂ cf. CO_{2eq} source emissions for the sector.

Table A1.3. LCTP national CO₂ source emissions (UEP basis) (central price, central growth, base case policy scenario).
Raw data are available for all years 1990 to 2022. June 2010 updated dataset.

Source Sector	CO ₂ Emissions (Mt / annum)												
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
Power Stations	205	164	159	173	182	178	173	149	154	158	158	156	160
Refineries	18	21	17	19	16	16	15	16	16	16	16	16	16
Residential	80	81	87	85	82	78	81	75	78	78	78	77	76
Services	30	32	30	27	26	25	26	26	27	27	27	27	28
public	13	13	12	11	10	10	10	10	10	10	10	10	10
commercial	12	13	14	12	11	11	12	13	13	13	13	14	14
agriculture	5	5	5	5	4	4	4	4	4	4	4	4	4
Industry	135	132	132	120	115	115	109	102	98	98	99	99	100
industrial combustion	91	83	83	73	71	69	67	63	60	60	61	61	63
industrial processes	16	15	15	14	13	15	14	14	14	14	15	15	15
other energy supply	20	26	27	25	22	23	21	19	19	19	18	18	18
off road construction	7	7	7	8	8	8	7	6	5	5	5	4	4
Road Transport	109	111	116	120	120	121	117	113	113	112	112	112	111
Other Transport	13	11	11	12	13	13	13	14	14	14	14	14	14
civil aviation (domestic landing and take off)	0	0	1	1	1	1	1	1	1	1	1	1	1
civil aviation (domestic cruise)	1	1	1	2	2	2	2	2	2	2	2	2	2
railways	2	2	2	2	2	2	2	2	2	2	2	2	2
national navigation	4	4	3	4	6	5	5	6	6	6	6	6	6
military aviation & shipping	5	4	3	3	3	3	3	3	3	3	3	3	3
aircraft support	0	0	0	0	0	0	0	0	1	1	1	1	1
LULUCF	3	1	0	-2	-2	-2	-2	-2	-1	-1	0	0	0
Total	593	553	551	554	551	544	533	493	499	502	503	501	505

Table A1.4. Estimates of national CO₂ emissions, based on LCTP source emissions in Table A2.3 and energy consumption data presented in Appendix II (central price, central growth, base case policy scenario).

N/A denotes insufficient data available to calculate value. Based on June 2010 updated dataset.

End User Sector	CO ₂ Emissions (Mt / annum)												
	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
Residential ⁸	N/A	N/A	142	144	144	139	141	129	133	134	134	132	133
Services ⁸	N/A	N/A	77	78	80	78	78	73	76	77	77	76	77
public ⁸	N/A	N/A	22	22	22	21	22	20	21	21	21	21	21
commercial ⁸	N/A	N/A	48	49	51	50	50	47	49	50	50	50	50
agriculture ⁸	N/A	N/A	7	7	7	6	6	6	6	6	6	6	6
Industry ⁸	N/A	N/A	189	183	179	178	169	150	148	149	150	150	153
industrial combustion	N/A	N/A	83	73	71	69	67	63	60	60	61	61	63
industrial processes	N/A	N/A	15	14	13	15	14	14	14	14	15	15	15
other energy supply	N/A	N/A	27	25	22	23	21	19	19	19	18	18	18
off road construction	N/A	N/A	7	8	8	8	7	6	5	5	5	4	4
Transport ⁸	N/A	N/A	144	151	150	151	147	143	143	143	143	143	142
Road Transport	N/A	N/A	116	120	120	121	117	113	113	112	112	112	111
Other Transport	N/A	N/A	11	12	13	13	13	14	14	14	14	14	14
civil aviation (domestic landing and take off)	N/A	N/A	1	1	1	1	1	1	1	1	1	1	1
civil aviation (domestic cruise)	N/A	N/A	1	2	2	2	2	2	2	2	2	2	2
railways	N/A	N/A	2	2	2	2	2	2	2	2	2	2	2
national navigation	N/A	N/A	3	4	6	5	5	6	6	6	6	6	6
military aviation & shipping	N/A	N/A	3	3	3	3	3	3	3	3	3	3	3
aircraft support	N/A	N/A	0	0	0	0	0	0	1	1	1	1	1
LULUCF	N/A	N/A	0	-2	-2	-2	-2	-2	-1	-1	0	0	0
Total	N/A	N/A	551	554	551	544	533	493	499	502	503	501	505

⁸ Including apportioned emissions from power stations and refineries.

Appendix II. Final Energy Consumption as Reported in the LCTP

Figures based on the central price, baseline policy and central growth scenarios.

Table A2.1. Proportion of electricity consumption by sector (excluding international aviation), and total consumption.
June 2010 updated dataset.

Proportion of Electricity consumption by sector (exc. International Aviation)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
Iron & Steel	0.019	0.014	0.017	0.014	0.014	0.011	0.013	0.013	0.013	0.013	0.013
Other Industry sectors Error! Bookmark not defined.	0.327	0.333	0.326	0.329	0.318	0.301	0.295	0.296	0.300	0.304	0.307
Transport (exc. international aviation)	0.026	0.025	0.024	0.024	0.025	0.025	0.025	0.025	0.025	0.024	0.024
Domestic	0.340	0.337	0.338	0.337	0.344	0.352	0.351	0.350	0.349	0.349	0.349
Public Administration	0.063	0.060	0.064	0.064	0.065	0.069	0.071	0.071	0.071	0.070	0.069
Commercial Error! Bookmark not defined.	0.211	0.217	0.219	0.220	0.223	0.230	0.232	0.232	0.231	0.229	0.227
Agriculture	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.011
Total Consumption (ktoe / Annum)	28325	29791	29640	29360	29441	28892	28828	29131	29670	30254	30804

Table A2.2. Proportion of petroleum consumption by sector (excluding international aviation), and total consumption.
Based on June 2010 updated dataset.

Proportion of Petroleum consumption by sector (exc. International Aviation)	2000	2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
Iron & Steel	0.002	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other Industry sectors Error! Bookmark not defined.	0.118	0.127	0.126	0.121	0.120	0.113	0.109	0.107	0.107	0.108	0.108
Transport (exc. international aviation)	0.779	0.788	0.791	0.802	0.800	0.800	0.807	0.808	0.809	0.810	0.810
Domestic	0.060	0.054	0.056	0.050	0.054	0.057	0.054	0.054	0.053	0.052	0.051
Public Administration	0.019	0.009	0.008	0.009	0.008	0.012	0.012	0.012	0.012	0.012	0.012
Commercial Error! Bookmark not defined.	0.011	0.015	0.013	0.013	0.011	0.012	0.012	0.012	0.012	0.012	0.012
Agriculture	0.012	0.006	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006
Total Consumption (ktoe / Annum)	54261	57407	57990	57346	55836	53656	53287	52865	52661	52612	52400

Appendix III. Indicators of Local Authority versus National Sectoral Activity

As discussed in Section 4.1, GVA, gridded CH₄ emissions, population and land area have been used as proxy indicators of regional activity. The values used are contained in Tables A4.1 to A4.3.

National GVA statistics are reported in either NUTS 2 areas (e.g. the County of Devon) in 15 sectors, or in NUTS 3 areas (district and unitary authorities) in 6 sectors. However, these are not available for all tier 1 authorities. GVAs were obtained from the South West Regional Accounts software tool, Econ-i. This, however, does not contain the UK GVA required for the disaggregation. Therefore the GB GVA has been used, and scaled according to the ratio between the NUTS 2 GB and UK GVAs.

The following GVA sectors have been used to represent the emission sectors:

- For agricultural emissions, the Agriculture, Forestry and Fishing GVAs have been used.
- For public sector emissions, the Public administration, education and health GVAs have been used.
- For industrial emissions, secondary industry, manufacturing, energy and water (excluding electricity generation) and construction GVAs have been used.
- For business emissions, hotels and catering, postal and telecommunications, finance and business services GVAs have been used.

Table A4.1. GVA, CH₄ emissions from waste treatment and disposal, population and land area in DCC area as a proportion of the UK total. N/A denotes not available.

Indicator	2007
GVA: Agriculture, forestry and fishing	0.030382
GVA: Public	0.010311
GVA: Industry	0.007995
GVA: Business	0.007975
CH ₄ emissions from waste treatment and disposal	0.01472
Population (mid-year estimate from NI186)	0.01178
Land Area	0.02905

Table A4.2. GVA, CH₄ emissions from waste treatment and disposal, population and land area in DCC area.

Indicator	2007
GVA: Agriculture, forestry and fishing	283
GVA: Public	2300
GVA: Industry	2269
GVA: Business	4054
CH ₄ emissions from waste treatment and disposal (tonnes)	14519.7
Population (mid-year estimate from NI186) (thousands)	750
Land Area (ha)	656407

Table A4.3. GVA, CH₄ emissions from waste treatment and disposal, population and land area for the UK.

Indicator	2007
GVA: Agriculture, forestry and fishing	9314.61
GVA: Public	223066.00
GVA: Industry	283818.48
GVA: Business	508316.75
CH ₄ emissions from waste treatment and disposal (tonnes)	986362.8
Population (mid-year estimate from NI186) (thousands)	60975.4
Land Area (ha)	22600000

Appendix IV. Methodology for the Disaggregation of National Emissions to Local Authority Level

This gives a detailed description of the methodology used to estimate local authority greenhouse gas emissions from the available regional and national data sources. The rationale behind the approach is described in Section 4.

Figure A5.1 describes how the best available data source was determined for each sector.

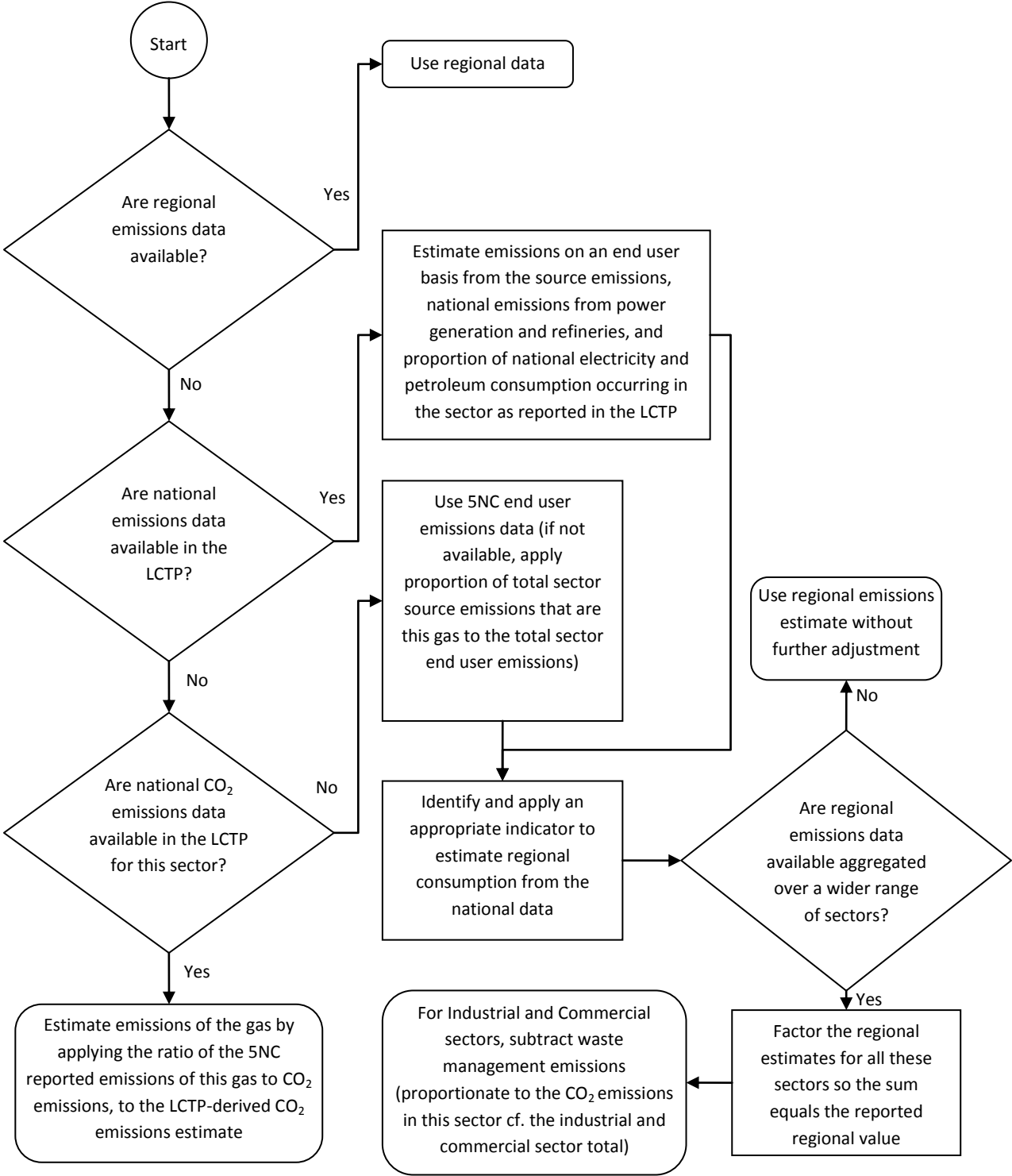


Figure A5.1. General methodology for the estimation of regional greenhouse gas emissions.

A detailed description of the process required for each sector is provided below. Further details of the GVA sub-sectors used in the analysis are given in Appendix III. The LCTP data used are those on a UEP basis, for the central price, baseline policy, central growth scenario.

Business Sector

- CO₂ emissions from refineries and power generation attributable to the commercial sector are determined from LCTP sectoral electricity and petroleum use. These emissions are added to the LCTP source CO₂ emission figure to estimate business sector CO₂ emissions on an end user basis.
- Regional CO₂ emissions from the business sector are estimated by multiplying the national estimate by the proportion of GVA in the business sector arising in the region cf. nationally.
- An adjustment factor is applied such that the sum of regional CO₂ estimates from industry, business, public, agriculture and waste equals DECC regional reported CO₂ emissions for industry, commercial and agriculture⁹. This adjustment factor was 0.728 for the analysis of DCC for 2007, indicating that the emissions intensity is lower than the national average for these sectors in the DCC area.
- Emissions attributable to waste management (which are not reported separately in the LCTP) are subtracted from the regional CO₂ estimate to avoid double-counting. The fraction of estimated regional waste management CO₂ emissions subtracted is in proportion to business CO₂ emissions cf. industrial and business CO₂ emissions.
- CH₄ and N₂O emissions are estimated by factoring the CO₂ estimate by the proportion of business sector end user greenhouse gas emissions arising as CH₄ or N₂O as against CO₂, as reported by 5NC.

Industry Sector

- CO₂ emissions from refineries and power generation attributable to the industrial sector (including iron and steel) are determined from LCTP sectoral electricity and petroleum use. These emissions are added to the LCTP source CO₂ emission figure to estimate industry sector CO₂ emissions on an end user basis.
- Regional CO₂ emissions from industry are estimated by multiplying the national estimate by the proportion of GVA in the industrial sector arising in the region cf. nationally.
- An adjustment factor is applied such that the sum of regional CO₂ estimates from industry, business, public, agriculture and waste equals DECC regional reported CO₂ emissions for industry, commercial and agriculture¹⁰. This adjustment factor was 0.728 for the analysis of DCC for 2007, indicating that the emissions intensity is lower than the national average for these sectors in the DCC area.
- Emissions attributable to waste management (which are not reported separately in the LCTP) are subtracted from the regional CO₂ estimate to avoid double-counting. The fraction of estimated regional waste management CO₂ emissions subtracted is in proportion to industrial CO₂ emissions cf. industrial and business CO₂ emissions.
- CH₄ and N₂O emissions are estimated by factoring the CO₂ estimate by the proportion of industry sector end user greenhouse gas emissions arising as CH₄ or N₂O as against CO₂, as reported by 5NC.

⁹ The DECC figure also includes waste and public sectors, but these are not reported separately from industry and commercial.

¹⁰ The DECC figure also includes waste and public sectors, but these are not reported separately from industry and commercial.

Transport Sector

- The CO₂ emission figure reported by DECC is used directly. The full dataset figure is used which includes long distance road transport and diesel rail but excludes electric rail¹¹ (insignificant in the South-West), shipping and aviation.
- CH₄ and N₂O emissions are estimated by factoring the CO₂ estimate by the proportion of transport end user greenhouse gas emissions arising as CH₄ or N₂O as against CO₂, as reported by 5NC.

Residential Sector

- The CO₂ emission figure reported by DECC is used directly.
- CH₄ and N₂O emissions are estimated by factoring the CO₂ estimate by the proportion of residential end user greenhouse gas emissions arising as CH₄ or N₂O as against CO₂, as reported by 5NC.

Public Sector

- CO₂ emissions from refineries and power generation attributable to the public sector are determined from LCTP sectoral electricity and petroleum use. These emissions are added to the LCTP source CO₂ emission figure to estimate public sector CO₂ emissions on an end user basis.
- Regional CO₂ emissions from the public sector are estimated by multiplying the national estimate by the proportion of GVA in the public sector arising in the region cf. nationally.
- An adjustment factor is applied such that the sum of regional CO₂ estimates from industry, business, public, agriculture and waste equals DECC regional reported CO₂ emissions for industry, commercial and agriculture¹². This adjustment factor was 0.728 for the analysis of DCC for 2007, indicating that the emissions intensity is lower than the national average for these sectors in the DCC area.
- CH₄ and N₂O emissions are estimated by factoring the CO₂ estimate by the proportion of public sector end user greenhouse gas emissions arising as CH₄ or N₂O as against CO₂, as reported by 5NC.

Agriculture Sector

- CO₂ emissions from refineries and power generation attributable to the agriculture sector are determined from LCTP sectoral electricity and petroleum use. These emissions are added to the LCTP source CO₂ emission figure to estimate agricultural CO₂ emissions on an end user basis.
- Regional CO₂ emissions from agriculture are estimated by multiplying the national estimate by the proportion of GVA in the agriculture sector arising in the region cf. nationally.
- An adjustment factor is applied such that the sum of regional CO₂ estimates from industry, business, public, agriculture and waste equals DECC regional reported CO₂ emissions for industry, commercial and agriculture¹³. This adjustment factor was 0.728 for the analysis of DCC for 2007, indicating that the emissions intensity is lower than the national average for these sectors in the DCC area.
- CH₄ and N₂O emissions are estimated by factoring the CO₂ estimate by the proportion of agricultural end user greenhouse gas emissions arising as CH₄ or N₂O as against CO₂, as reported by 5NC.

¹¹ Electric rail is reported under the business and industry sector.

¹² The DECC figure also includes waste and public sectors, but these are not reported separately from industry and commercial.

¹³ The DECC figure also includes waste and public sectors, but these are not reported separately from industry and commercial.

LULUCF Sector

- The CO₂ emission figure reported by DECC is used directly.
- CH₄ and N₂O emissions are estimated by factoring the CO₂ estimate by the proportion of LULUCF source greenhouse gas emissions arising as CH₄ or N₂O as against CO₂, as reported by 5NC (end user emissions by gas are not available in 5NC for LULUCF).

Waste Management Sector

CH₄ end user emissions are estimated from 5NC data:

- The proportion of source emissions arising as CH₄ in the waste management, wastewater treatment and waste disposal on land sectors is applied to the total end user greenhouse gas emissions to estimate end user CH₄ emissions (end user CH₄ emissions for the waste sector are not reported in 5NC).
- Regional emissions are estimated as the proportion of NAEI 1km gridded CH₄ emissions from waste treatment and disposal arising in the region as against nationally.
- No adjustment factor is applied to match regional CO₂ estimates from industry, business, public, agriculture and waste and DECC regional reported CO₂ emissions for industry, commercial and agriculture, since the regional industry and business sector emission estimates are so adjusted before subtracting their shares of the waste management sector.

CO₂ and N₂O emissions are estimated by factoring the CH₄ estimate by the proportion of waste source greenhouse gas emissions arising as CO₂ or N₂O as against CH₄, as reported by 5NC.

Appendix V. Measures Included in the BAU scenario

Measures included in the LCTP baseline scenario are listed in Table 5.1.

Table 5.1. List of pre-LCTP measures, their delivery agency and expected LA influence.

Sector	Measure	Description	Delivery Agency	Local Authority Influence		
				Score ¹	Tier ²	Description
Business	Building Regulations (commercial)	Increasing standards for building works	Local authority building control, and private sector approved inspectors	1	2	Local authority building control officers will need training to interpret and assess compliance with the new requirements
	Carbon Trust measures (commercial)	Advice, finance and accreditation of carbon reduction measures	Carbon Trust	1	1 2	Raising awareness of scheme
Industry	Building Regulations (industry)	Increasing standards for building works	Local authority building control, and private sector approved inspectors	1	2	Local authority building control officers will need training to interpret and assess compliance with the new requirements
	Carbon Trust measures (industry)	Advice, finance and accreditation of carbon reduction measures	Carbon Trust	1	1 2	Raising awareness of scheme
	Climate change agreements	Climate change agreements between government and industry: 80% discount from Climate Change Levy in return for targets for energy efficiency or carbon reduction	Department of Energy and Climate Change and HM Revenue and Customs	0		None

Sector	Measure	Description	Delivery Agency	Local Authority Influence		
				Score ¹	Tier ²	Description
Transport	Renewable Transport Fuel Obligation (5% by volume)	Regulations on biofuels introduced in the Energy Act 2004	Renewable Fuels Agency	1	1	Promotion, support for local biofuel initiatives
	EU voluntary agreements on new car CO ₂ (to 2009), including supporting fiscal measures	Targets for new car CO ₂ emissions for European, Japanese and Korean cars	European Commission	1	1 1 2	Promotion Fleet procurement Government aim to meet targets early in government-procured fleets
Residential	Energy Efficiency Commitments (2002-5 and 2005-8)	Promotion of energy efficiency measures by electricity and gas suppliers	OFGEM, Energy Suppliers	1	2	Awareness
	Building Regulations	Increasing standards for building works	Local authority building control, and private sector approved inspectors	1	2	Local authority building control officers will need training to interpret and assess compliance with the new requirements
	Warm Front and fuel poverty	Insulation and heating improvements scheme managed by Eaga	EAGA	1	2	Promotion of scheme
Public	Revolving loan fund (Salix) (Public sector)	Loans for energy efficiency improvements	Salix (on behalf of Carbon Trust)	3	1 2	Scheme specifically aimed at financing improvements to public sector buildings

Sector	Measure	Description	Delivery Agency	Local Authority Influence		
				Score ¹	Tier ²	Description
Energy Supply (allocated to end user sectors in analysis)	Renewables Obligation	Government Renewables Obligation Certificates issued by OFGEM	OFGEM	0		(2 for public sector activity through provision of renewable energy schemes)
	Large Combustion Plants Directive	Consolidation and tightening of controls on emissions from large combustion plant	Central government, Environment Agency	0		None, unlikely to fall under EHO remit?
	Fuel Duty Escalator	Tax on non-domestic energy	Central government	0		(2 for public sector activity through energy efficiency measures)
	Climate Change Levy	Tax on non-domestic energy	Central government	0		(2 for public sector activity through energy efficiency measures)