



Sentinel Housing Association

Carbon Footprint Report

December 2009

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Sentinel Housing Association Carbon Footprint 2009

1.0 Executive Summary

This report contains results from the Sentinel Housing Association Greenhouse Gas Emissions Audit undertaken in **September 2009**, based on data for the 12 months September 2008 to August 2009, and snap shot data on housing stock from **December 2009**. This is Sentinel Housing Association base year. The audit was completed by Carolyn Whistlecraft, Climate Change Officer for Sentinel Housing, who holds a certificate in GHG Accounting from the GHG Institute dated July 2008.

The audit itself is based on the **WRI/WBCSD GHG Protocol Corporate and the ISO 14064 standard** and emissions factors from **2009 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting (published July 2009)**.

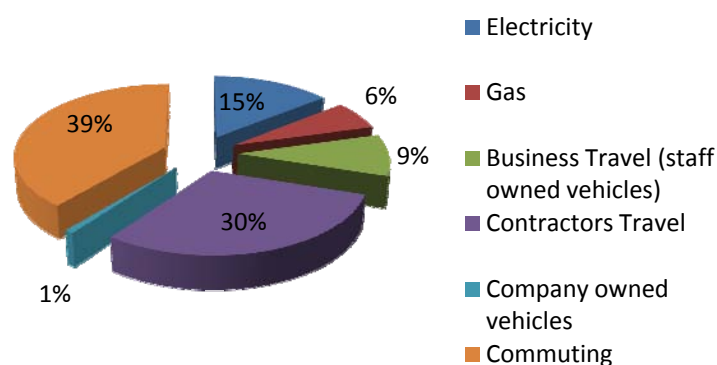
1.1 Carbon Assessment Results - Overall Footprint

Sentinel Housing Association's overall carbon footprint is **24,207.86 tCO₂**, for future comparison purposes this is **118.1 tCO₂** per full time employee (205 at time of audit). This is based on company operations (energy, business travel, contractor travel and commuting) and housing stock emissions.

1.2 Operations Carbon Footprint

- The total carbon footprint for Sentinel Housing Association operations is **1,058.42 tonnes of CO₂ equivalent**. On a per employee basis (205 FTE employees) this is **5.16 tCO₂e**.
- The total carbon footprint for Sentinel Housing Association operations *excluding* contractor travel, is **774.9 tCO₂**. On a per employee basis (205 FTE employees) this is **3.78 tCO₂e**.
- The total carbon footprint for Sentinel Housing Association contractor travel *only* is **283.46 tCO₂**. On a per employee basis (205 FTE employees) this is **1.38 tCO₂**

Breakdown of emissions by source



1.2.3 The total carbon footprint for water use **0.66 tCO₂e**

1.3 Housing Stock Carbon Footprint

Utilising Sentinel's property database, which stores the SAP rating of the properties. From the SAP rating the CO₂ emissions are determined. The average CO₂ emissions per Sentinel property is **3.3 tCO₂**. Based on the entire housing stock (7015 properties) the current carbon footprint is **23,149.5 tCO₂**

1.4 Reduction Targets

1.4.1 Government Targets

The UK Low Carbon Transition Plan whitepaper sets out plans for the government to deliver emission reductions of 18% by 2020 on 2008 levels.

Basingstoke and Deane have set a target of 20% by 2011 on a 2006/7 baseline with a further aspirational target of an additional 10% by 2013.

Test Valley have set a target of 10% by 2012 on 2007 levels.

Hart district council have set a reduction target of 5% for the calendar year 2010 based on 08/09 baseline, with a stretch target of 10%.

All three councils signed the Nottingham Declaration, which is a pledge to systematically address the causes of climate change within their districts in addition to preparing the communities for adaptation to the effects of climate change.

1.4.2 Sentinel Housing Association Targets

Val Bagnall, Executive Director, has overall responsibility for the achievement of these targets.

Operations

- Target of 10 % (0.38 tCO₂ per FTE) over three years on a baseline year 2009 at a cost of £12,000

Contractors

- Target of 3% (0.042 tCO₂ per FTE) over three years on a baseline year 2009

Housing Stock

- Targets:
 - average SAP to increase by 4.2 (up to 73.3) over three years on a baseline year 2009, aspirational target SAP to be raised 4.9 (up to 74)
 - average tCO₂ to decrease by 0.5 tCO₂ per property over three years on a baseline year 2009
 - average customer spend (existing stock) to decrease by £28.50 on a baseline year 2009

CURRENT POSITION		SAVINGS				INVESTMENT
Emission Source	2009/10 Actual	2010/11 Target	2011/12 Target	2012/13 Target	Total Target	Cost
Operations* (excl contractors)	774.9 tCO ₂ 3.78 tCO ₂ Per FTE	0.15 tCO ₂ 4%	0.115 tCO ₂ 3%	0.115 tCO ₂ 3%	0.38 tCO₂ 10%	Total £12,000 (4k has 3 year pay back, £8k has 4.5 year pay back)
Contractors Travel	283.46 tCO ₂ 1.38 tCO ₂ Per FTE	0.014 tCO ₂ 1%	0.014 tCO ₂ 1%	0.014 tCO ₂ 1%	0.042 tCO₂ 3%	n/a
Housing Stock SAP **	SAP 69.2	SAP 70.7	SAP 72.4	SAP 73.3	SAP 73.3	Yr 1 £1,035,000 Yr 2 £1,226,675 Yr 3 £1,091,675 Total £3,353,350 (excluding new build costs)
Housing Stock tCO ₂ per property	3.3 tCO ₂	6% 0.2 tCO ₂	6% 0.2 tCO ₂	3% 0.1 tCO ₂	15% 0.5 tCO₂	• See Appendix 14b to exclude new builds from these calculations • energy cost based ONLY on baseline existing stock
Energy savings per property***	£491.07	£7.50	£17	£4	£28.50	
Overall Footprint ****	24207.86 tCO ₂ 118.1 tCO ₂ Per FTE	117.1 tCO ₂	116.4 tCO ₂	118.5 tCO ₂	118.5 tCO₂ Per FTE	As above

* Sentinel's emissions reduction target is to reduce operational greenhouse gas emissions scope 1, 2 & 3 (for scope 3 only those which relate to energy use, business travel, and commuting), for the purposes of target setting, contractor travel data is separate.

**December 2009 SAP average and 3.3 tCO₂ sourced from Integrator database covering 6218 properties. Projected SAP figures based on pre-budget approved cyclical works programme. Reductions take into account increase in properties through business growth.

*** price of fuel 2008, information from Savills Stock Survey 2008 as average price per SAP of 69.2

**** Increase in housing stock and target tCO₂ reduction per employee accounted for within this. Calculations within Appendix 14b based on 205 FTE for guidance

Please see appendix 11 for more detail and appendix 14 for calculations and averages taken from Savills Stock Survey to determine the correlation between SAP, tCO₂ and energy spend.

Operations Reductions

These will be made up of:

- Boiler controls (cost approx £4k), conservative saving approximation 70 tCO₂
- Voltage Optimisation (cost approx £8k), conservative saving approximation 13 tCO₂
- Behaviour change in the work place

Contractor Travel

Sentinel will be working with our suppliers on driver education, to decrease fuel consumption. This reduction target will be part of the suppliers' contractual obligations in the future, however there is no investment from Sentinel for this reduction.

Housing Stock

The reductions will be made up of (based on pre-budget approved cyclical works programme):

- Year one 2010/11
 - Heating upgrades
 - Insulation (cavity and roof)
 - Door and window replacements
 - External cladding (solid wall insulation)
- Year two 2011/12
 - Heating upgrades
 - Insulation (cavity and roof)
 - Windows and doors
- Year three 2012/13
 - Heating upgrades
 - Insulation (cavity and wall)
 - Windows and doors

Please see Appendix 13 for further explanation of Housing Stock reduction figures

There are also behavioural changes that can be made within the home that can help reduce the residents yearly energy spend. Sentinel will continue to communicate these to residents through neighbourhood officers, website, residents' week and other events.

1.4 Recommendations for future measuring

Business Travel - including emissions on expenses forms. This has two benefits, it makes measuring emissions from business travel accurate and easy to measure, it also helps staff to understand the impact of their travel.

Waste – For this report, waste has not been measured due to lack of available data as the waste company does not weigh bins on collection. For future reports a method of understanding waste from each site would be recommended for accuracy and to measure success of reducing waste through sustainable procurement.

Smart metering – it is recommended that smart metering is out in place for up to date measurements and monitoring of energy use.

Working closely with contractors for ongoing data.

2.0 Introduction

Sentinel Housing Association

Sentinel Housing Association manages more than 7300 homes in North Hampshire. Originally formed through the transfer of council homes from Hart District Council and half of Basingstoke & Deane Borough Council, Sentinel has since emerged as a regional specialist in community regeneration, affordable housing developer, and provider of a range of services for older and vulnerable people.

To manage such a diverse portfolio, Sentinel has a multi-skilled Neighbourhood Team, providing advice and assistance on all housing issues from rent and anti-social behaviour to maintenance and environmental issues.

Sentinel is also the lead association of the Sapling Housing Partnership and has a multi-million pound and award winning development programme, building new homes and regenerating communities. Vestal Developments is a subsidiary of Sentinel Housing Association formed to carry out a range of market orientated developments.

Sentinel is not just about housing and offers care and support services both to tenants and to people living in private rented and owner-occupied accommodation such as Home Care, retirement accommodation and a 24-hour alarm service, CommuniCare.

Sentinel is governed by a Board of 13 members consisting of five tenants and eight independent Board members.

2.1 Why measure?

It is becoming invaluable for every organisation to have a clear picture of their impact on the environment, regardless of their industry. There are a number of reasons for this:

- climate change is presenting new challenges, understanding impact is a vital part of addressing these challenges
- To identify opportunities to reduce costs (e.g. energy use)
- To benchmark performance, identifying opportunities to improve competitiveness
- To demonstrate leadership and lead by example
- To provide information to stakeholders and clients
- To define and monitor corporate responsibility targets
- To assess risk for potential future legislation around Climate Change
- To engage in carbon offsetting or carbon trading
- To be part of larger scale Greenhouse Gas reporting initiative

Climate Change

'If the world continues emitting green house gases like carbon dioxide at today's levels then average global temperatures could rise up to 6° by the end of the century'

'The UK Low Carbon Transition Plan'

Climate Change presents a series of short and long term issues for Sentinel Housing Association and mitigation and adaptation strategies must be part of the broader strategy. Having a clear understanding of operational emissions is fundamental to measuring the success of these strategies.

Scientific consensus tells us that climate change will present as a series of events occurring as a result of increases in global temperatures that correlate directly with the concentration of CO₂ (and other greenhouse gases) in the atmosphere. These events include extreme weather and rising sea levels and could result in the spread of disease, extinction of animals, serious issues in food provision, and displacement of millions of people. Though exactly what we will experience in the UK is yet undefined, it is clear that our infrastructure cannot cope with extreme weather such as heavy rainfall, drought and hurricanes. Certainly as an island there are quite serious implications around rising sea levels and access to fuel and food.

There is a huge amount that we can do, but action must start now.



Photo acknowledgments to ManagEnergy and the Intelligent Energy - Europe Programme of the European Commission

3.0 The Greenhouse Gas Audit

There are a number of names for a Carbon Footprint report, such as 'Greenhouse Gas Audit', 'Emissions Assessment' or 'Climate Impact Assessment'. It is a measurement of greenhouse gasses being emitted into the atmosphere from defined activities, such as the running of a company or the running of a house.

Although the most well known and commonly referred to greenhouse gas is CO₂, there are others that are important to measure. This Carbon Footprint Report covers all the greenhouse gases and throughout emissions are measured in CO₂-equivalents (co₂e), where we are translating all the volumes into their global warming potential. This creates a realistic picture of volumes and their impact on the environment.

This chart illustrates the CO₂ equivalents:

Greenhouse gas	Global Warming Potential (GWP)
carbon dioxide (CO ₂)	1
methane (CH ₄)	21
nitrous oxide (N ₂ O)	310
hydrofluorocarbons (HCFCs)	140 – 11,700
Perfluorocarbons (PFCs)	6,500 – 9,200
Sulphur hexafluoride (SF ₆)	23,900

Source: Greenhouse Gas Institute

3.1 Scoping The Greenhouse Gas Audit

- Organisational Boundaries define what operations and percentage of these are included within a carbon footprint exercise. The options are 'equity share approach' and 'operational control'.

- Operational Boundaries determine what activities are going to be included within the carbon footprinting exercise.

3.1.1 Organisational Boundaries

The three areas of emissions for Sentinel can be split into three sections:

Operational Activities: emissions related to the day to day running of the organisation. Energy use and business travel (including contractors travel).

Housing Stock: The emissions related to the housing stock that Sentinel owns, including all houses, flats and shared housing.

Construction: The building of new properties. This includes those whereby Sentinel commissions the developer and those whereby Sentinel purchases them from the developer.

This report covers the operational activities of Sentinel and the housing stock.

3.1.2 Operational Boundaries

Scope 1, 2 and 3

Within the WRI/WBCSD GHG Protocol Corporate and the ISO 14064 standard, GHG gasses are split into three scopes.

Scope 1 – Direct Emissions (fuel combustion, company owned vehicles)

Scope 2 – Indirect Emissions (such as purchased electricity for own use)

Scope 3 - Indirect Emissions (outsourced operations, business travel, embodied energy in products purchased, waste disposal)

Whilst Scope 1 &2 are the minimum required within a greenhouse gas audit, Scope 3 inclusion is optional. It is generally accepted that organisations should include all activities that generate emissions in the day to day running of business. Whilst there could be an issue of double counting of emissions, for example - train journeys will be counted by the organisation and the rail company, it is accepted that the train journey is a controllable part of the business's activities and should therefore be measured.

Emissions covered within this audit:

Sentinel Operations

- Energy use at the two offices (electricity and gas)
 - Oakfern House, 56 Kingsclere Road, Basingstoke
 - 11 Church Road, Fleet.
- Travel
 - Business travel - Staff owned vehicles
 - Business travel – other vehicles including contractors
 - Business travel – company owned vehicles
 - Commuting
- Water

For water, it is a lifecycle analysis and therefore not comparable with the rest of the measured emissions, though their measurement and reduction is important.

Exclusions:

- Refrigerant losses (from air conditioning and refrigeration)*
- Site by site waste*

*Due to lack of available data.

Housing Stock

Sentinel Housing Association carry out an environmental audit on each property which results in an EPC (Environmental Performance Certificate). The EPC gives each property a SAP (standard assessment procedure) rating and CO₂ rating (on an index). Data within this document is based on these results. See appendix 10 for description of SAP and Appendix 11 for case study scenarios which was used to project potential savings of work to be done.

4.0 The Greenhouse Gas Audit Assumptions

The principle underlying the audit, is that all the data provided is accurate and correct.

Commuting – A questionnaire was sent out to all staff, there were 85 respondents. It is assumed that this is a fair representation of the rest of the staff.

Water – two differing measurement periods were provided, however it is assumed that the water consumption is a fair representation of the twelve month period that this report covers.

Supplier transport – this report assumes that suppliers have fairly separated the travel associated to Sentinel from that of their other customers.

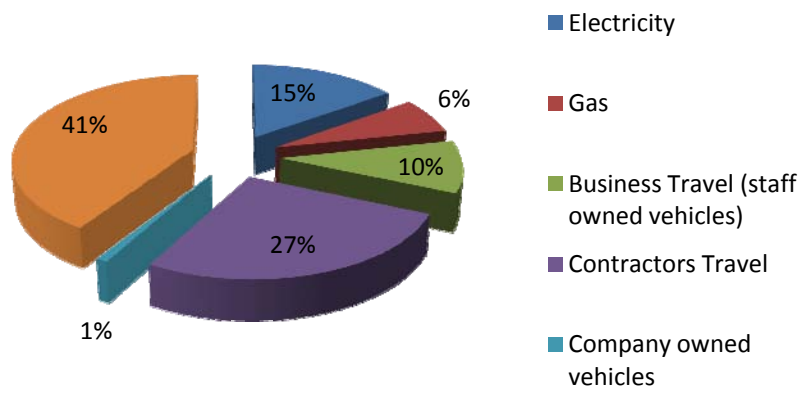
Housing Stock – Assuming the data within the Integrator data base is a fair representation of entire stock.

5.0 Carbon Footprint - Sentinel Housing Association Operations

Total Carbon Footprint

Source of emissions	tCO ₂ e
Electricity	159.6
Gas	70.21
Business Travel (staff owned vehicles)	103
Contractors Travel	283.46
Company owned vehicles	9.65
Commuting	432.5
Total	1058.42

Sources of Emissions

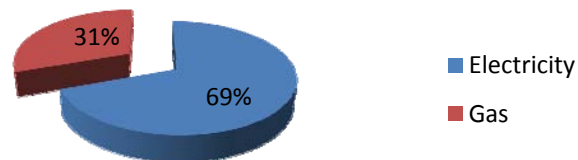


5.1 Energy Use only

See Appendix 1 for calculations

Source of emissions	tCO ₂ e
Electricity	159.6
Gas	70.21
Total	229.81

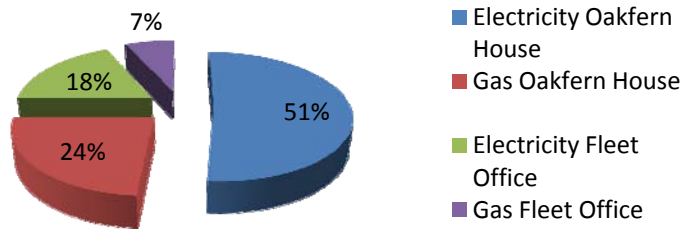
Energy Use breakdown



5.1.2 Energy use by type and office

Source of emissions	tCO ₂ e
Electricity Oakfern House	117.7
Gas Oakfern House	54.57
Electricity Fleet Office	41.9
Gas Fleet Office	15.64
Total	229.81

Energy Use at each office

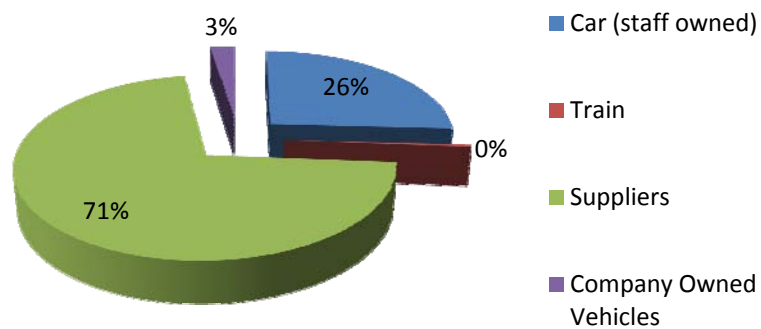


5.2 Business Travel

See Appendix 2 for calculations.

Vehicle Type	Total tCO ₂ e
Car (staff owned)	102.60
Train	1.59
Suppliers	283.46
Company Owned Vehicles	9.65
Total	

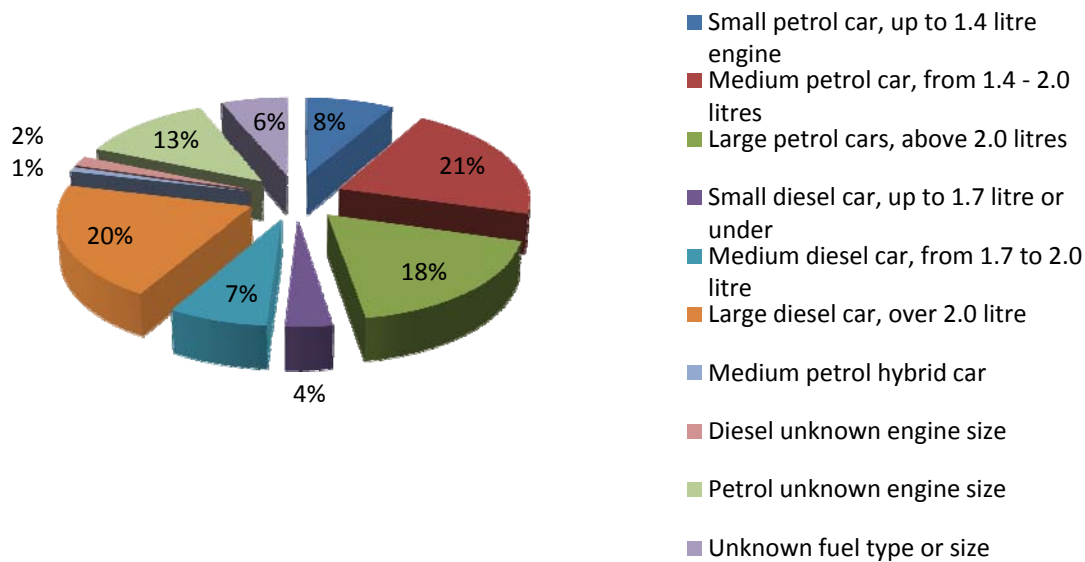
Business Travel Emissions



5.2.1 Business travel by car type – staff owned vehicles

Engine Size and Type	tCO ₂ e
Small petrol car, up to 1.4 litre engine	8.54
Medium petrol car, from 1.4 - 2.0 litres	21.66
Large petrol cars, above 2.0 litres	18.51
Small diesel car, up to 1.7 litre or under	3.57
Medium diesel car, from 1.7 to 2.0 litre	7.63
Large diesel car, over 2.0 litre	20.83
Medium petrol hybrid car	0.85
Diesel unknown engine size	1.80
Petrol unknown engine size	12.77
Unknown fuel type or size	6.45
Total	102.60

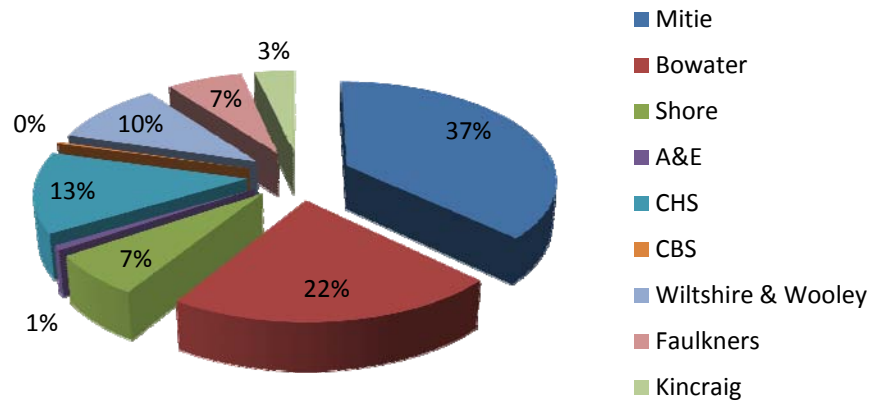
Business Travel - car breakdown



5.2.2 Business Travel Supplier Breakdown

Supplier	tCO ₂ e
Mitie	105.28
Bowater	61.65
Shore	18.82
A&E	2.18
CHS	36.98
CBS	0.81
Wiltshire & Wooley	28.78
Faulkners	18.96
Kincraig	10
Total	283.46

Emissions by Contractor

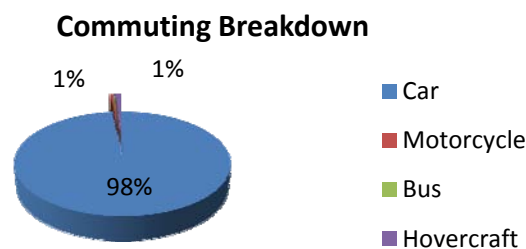


5.3 Commuting

See Appendix 3 for calculations.

Vehicle Type	Total tCO ₂ e
Car	176.39
Motorcycle	0.85
Bus	0.32
Hovercraft	1.88
Total	179.44 /85 respondents = 2.11 tCO₂e per employee X 205 FTE =432.5 tCO₂e

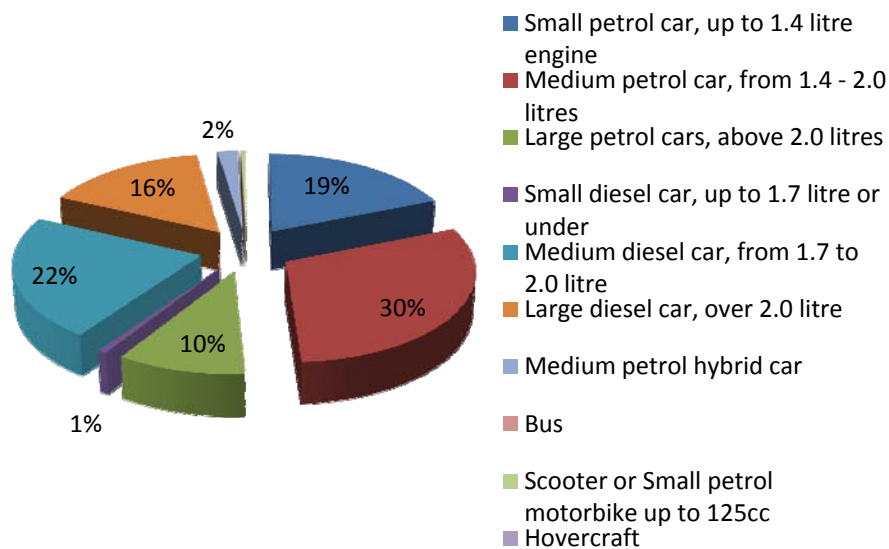
Commuting breakdown graph



5.3.1 A detailed breakdown of commuting emissions to include car types:

Emission Source	tCO ₂ e
Small petrol car, up to 1.4 litre engine	33.55
Medium petrol car, from 1.4 - 2.0 litres	53.49
Large petrol cars, above 2.0 litres	17.62
Small diesel car, up to 1.7 litre or under	1.27
Medium diesel car, from 1.7 to 2.0 litre	39.32
Large diesel car, over 2.0 litre	27.75
Medium petrol hybrid car	3.39
Bus	0.32
Scooter or Small petrol motorbike up to 125cc	0.85
Hovercraft	1.88
Total	179.44

Commuting Detailed Breakdown



5.4 Water

See Appendix 4 for calculations.

Site	Total tCO ₂ e
Oakfern House, 56 Kingsclere Road	0.26
Office , 11 Church Road	0.40
Total	0.66

Water Use by Office



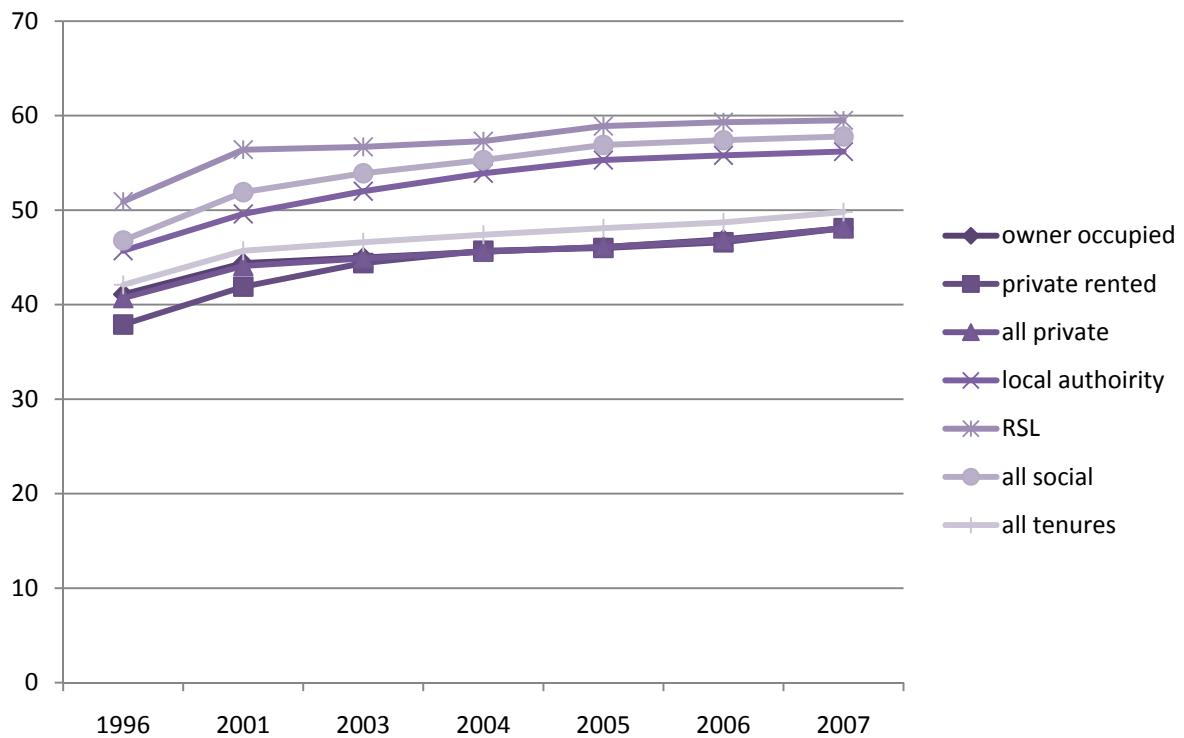
6.0 Carbon Footprint – Sentinel Housing Association Housing Stock

There is on going investment in Sentinel properties around energy efficiency. This is how the stock currently looks and compares.

6.1 Comparison Data

Average SAP Rating By Tenure 1996 – 2007

English House Condition Survey (2007 Annual Report published September 2009)



Sentinel's average SAP rating is 69.2 (see Appendix 10 for more information on SAP).

UK wide 'Carbon Dioxide Emissions by Tenure' - English House Condition Survey (2007 Annual Report published September 2009)

	Average (tonnes/year)	% less than 3 tonnes/year	%10 or more tonnes per year
Owner Occupied	7.3	3.8	15.1
Private Rented	6.1	14.6	10.1
Local Authority	4.4	20.2	1.9
RSL	4	32.8	1.7
all private	7.1	5.4	14.4
all social	4.2	26.4	1.8
all tenures	6.6	9.1	12.2

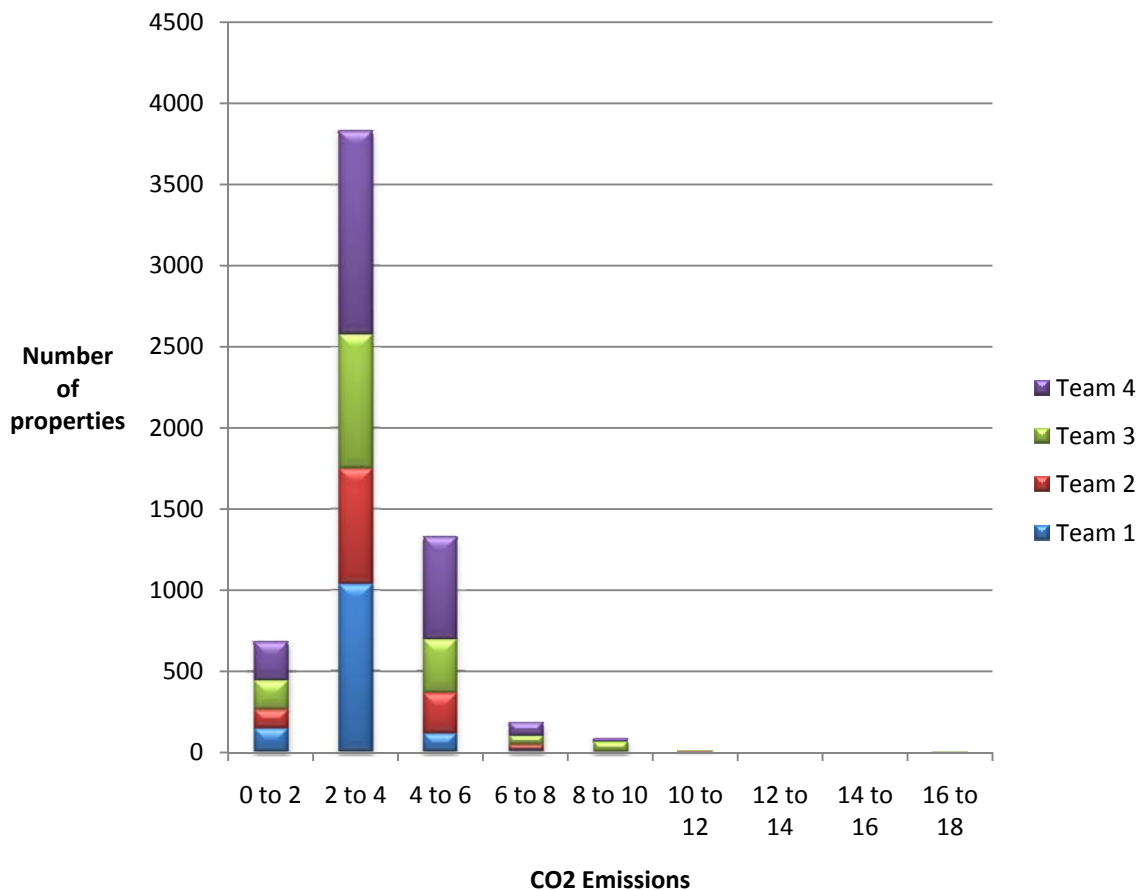
Sentinel properties are an average of 3.3 tonnes CO₂ per annum.

6.2 Totals across all Sentinel housing stock

The following data represents 6,129 properties of a total potential of 7,015 total rental properties based on data availability within our property data base Integrator as of November 2009. (This excludes shared ownership). (see Appendix 5 for housing stock breakdown).

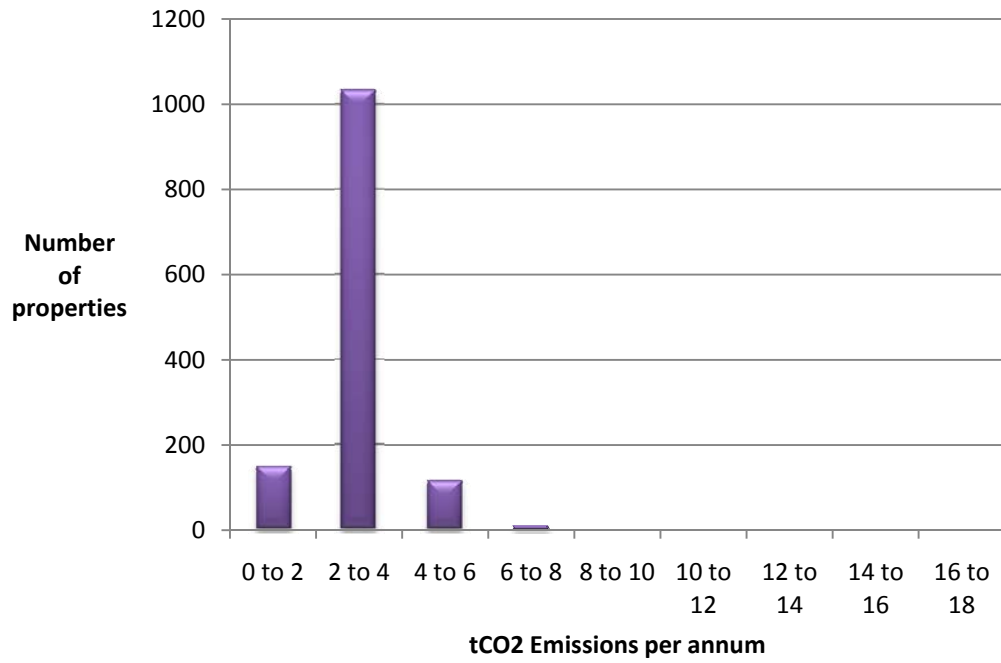
Tonnes CO ₂	Number of properties	%
0 to 2	684	11.16%
2 to 4	3831	62.51%
4 to 6	1332	21.73%
6 to 8	184	3%
8 to 10	85	1.39%
10 to 12	10	0.16%
12 to 14	1	0.02%
14 to 16	0	0%
16 to 18	2	0.03%

Totals across all Sentinel housing stock - Annual CO₂ Profile By Neighbourhood



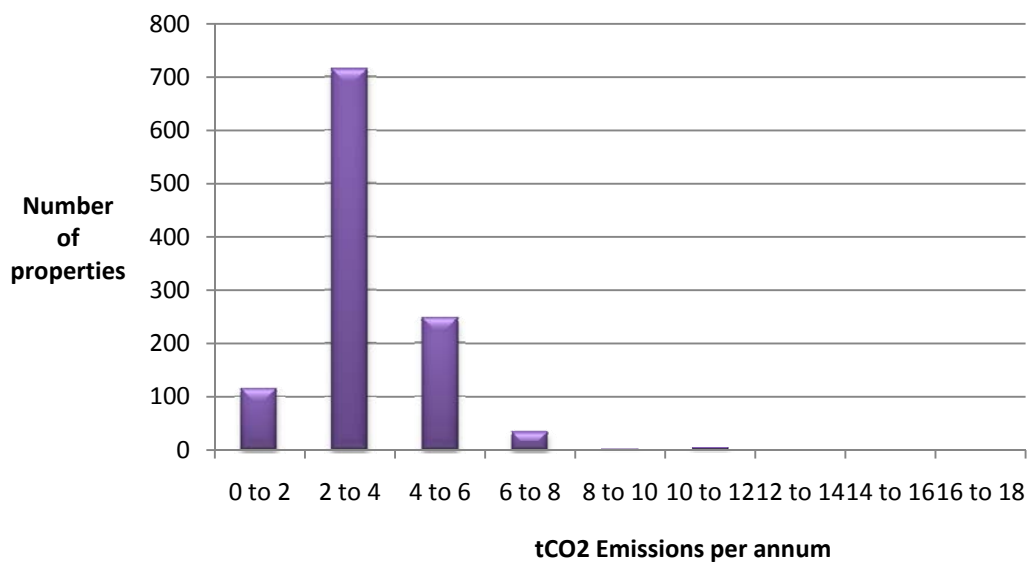
6.2.1 Team 1 Annual CO₂ Profile

See Appendix 6 for more detailed information.



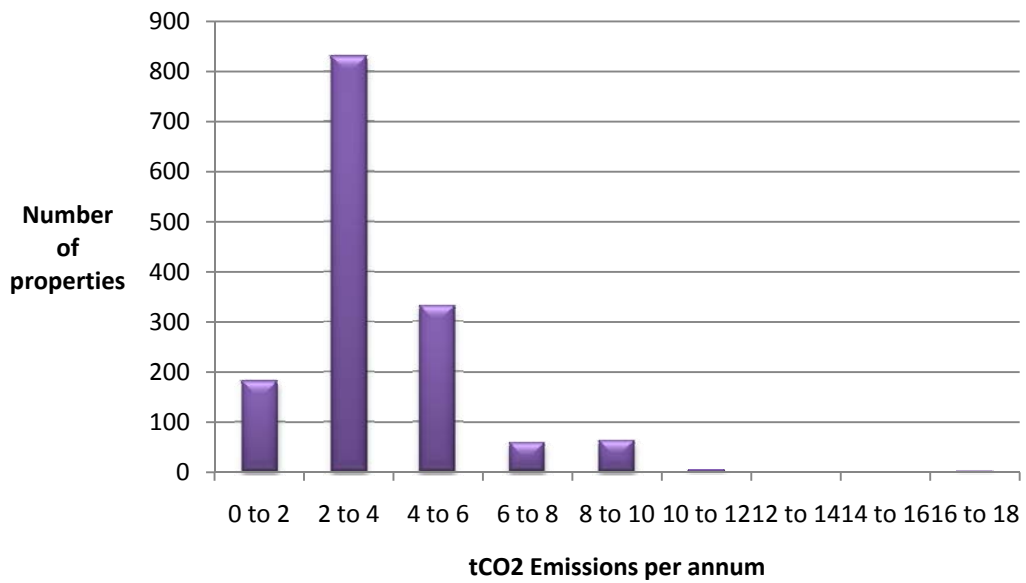
6.2.2 Team 2 Annual CO₂ Profile

See Appendix 7 for more detailed information.



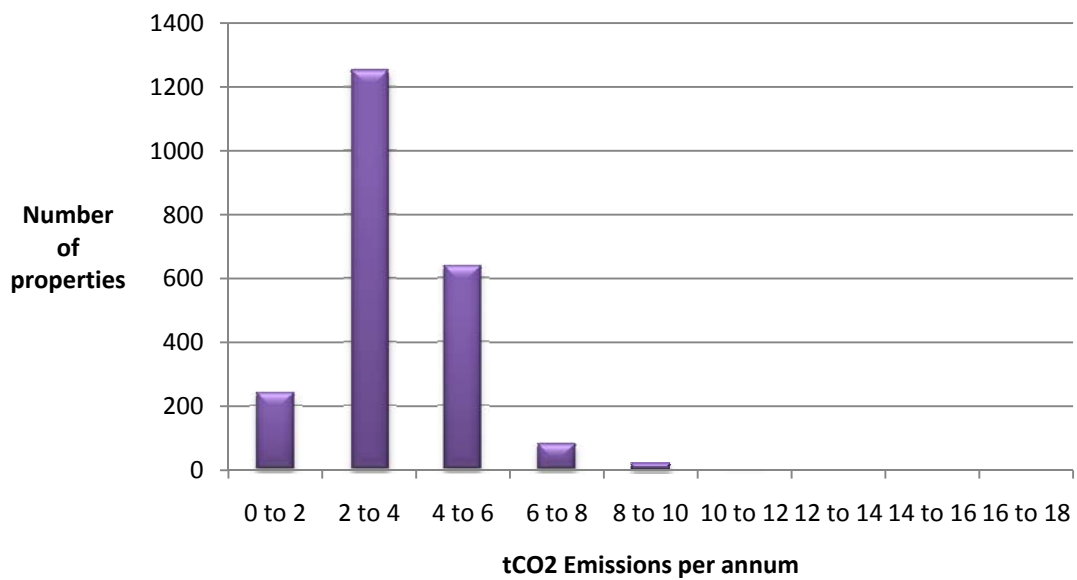
6.2.3 Team 3 Annual CO₂ Profile

See Appendix 8 for more detailed information.



6.2.4 Team 4 Annual CO₂ Profile

See Appendix 9 for more detailed information.

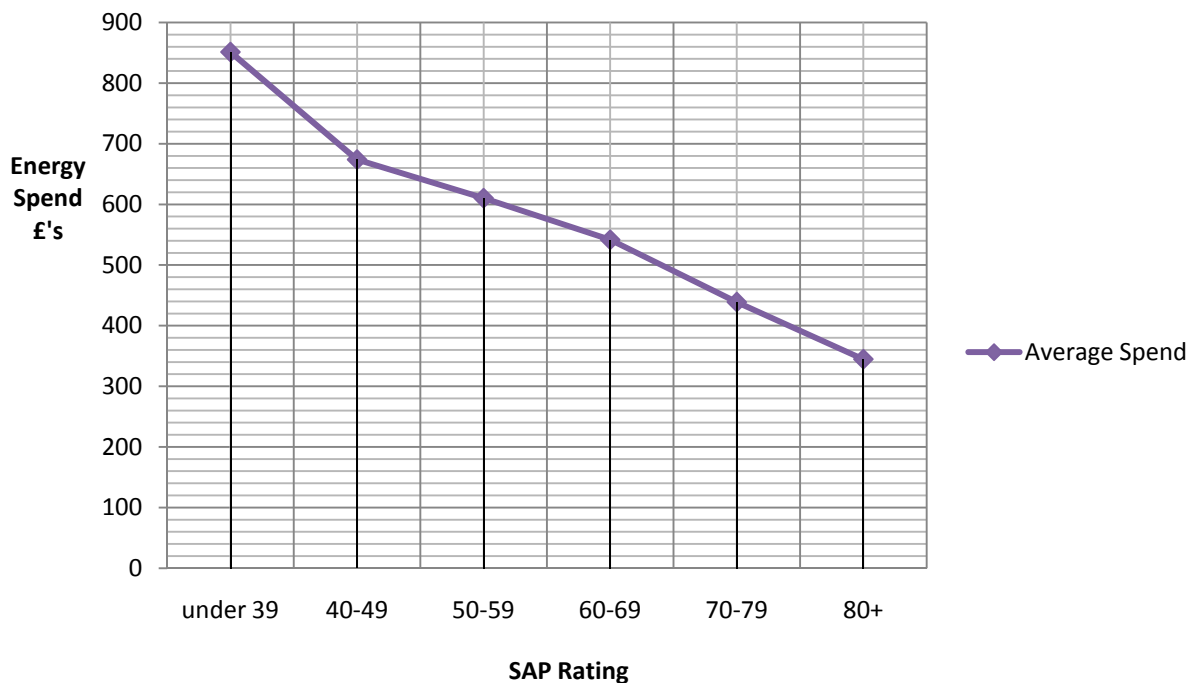


6.3 Energy Costs for residents

SAP	Average CO ₂	Average Spend
under 39	7.3	£851.40
40-49	5.5	£673.91
50-59	4.9	£610.40
60-69	3.7	£541.61
70-79	2.8	£438.84
80+	2	£344.63

As of December 2009, the average SAP rating of Sentinel's properties is 69.2, with a CO₂ footprint average of 3.3 tCO₂, with an average spend of £491.07.

Average household energy spend in £s by SAP Rating



7.0 Reductions

7.1 Operations

- Flush devices to be installed across sites where applicable
- Investigate higher water use at Fleet offices
- Place timers on hot and cold water dispensers to go off over weekends at night (24 hour call centre to be provided with a kettle)
- Staff travel reduction through driving education and working from home
- Install Smart meters at main offices
- Investigate voltage optimisation at two main offices (between 10 – 14 % saving on electricity)

- Investigate grey water recycling at sites
- Investigate lighting
- Driver training from the Energy Savings Trust
- Behaviour change to ensure electrical goods and lights are turned off when not in use (including unplugging phone chargers)
- Create a sustainable procurement strategy to:
 - Reduce waste associated to purchasing
 - Reduce travel/distribution associated to purchasing
 - Engage suppliers to reduce their carbon footprints

Operational savings	2010/11	2011/12	2012/13	Total	COST
Yearly Savings	£3,111	£3,111	£3,111	£9,333	based on £12k investment yr 2010/11
				83 tCO₂	
				£112 per tCO₂	
	tCO ₂ Saving*				

* This does not take into account unforeseen increases in energy costs or natural business growth resulting in higher energy use.

7.2 Housing Stock

Existing Stock – cyclical works

- Insulation programme
- Heating upgrade and replacement programme
- Windows and door replacement programme

Some examples of other savings that can be made by the resident to save energy:

The figures are based on CO₂ saving from the Energy Savings Trust (EST) figures as of 04/09/07 and assuming gas price of 3.407p/kWh.

Energy saving light bulbs

Savings are based on four hours use per day of a low energy equivalent to a 40W light bulb, and an electricity cost of 10.086p/kWh (including VAT).

Radiator reflectors

Energy saving figures are based on Ofgem CERT savings for approved silvered panels located on external solid wall (or uninsulated cavity) and assume 6m² of panel. Using a gas unit rate of 3.407p/kWh.

Shower

Energy saving is based on using a daily 5 minute shower using 35 litres of water, instead of a daily bath using 80 litres of water. This assumes a boiler operating at 90% efficiency and gas unit rate of 3.407p/kWh.

Bath

Energy saving is based on a 140 litre, foam insulated, electric immersion heater that is switched off when going on a 2 week holiday, and an electricity unit rate of 10.086 p/kWh.

Cat-flap/draft insulation

Energy saving is based on the Energy Saving Trust (EST) annual draught proofing CO₂ saving amount for a 3 bedroom semi-detached house, and a gas unit rate of 3.407p/kWh.

Appendix 1 - Energy Calculations

Electricity Calculations

Data provided by energy company, Monarch. Annex 3, table 3c, UK Grid 2007

Office	Days Billed	Total Usage (kwh)	Defra conversion factor	Full year use calculation *	total kg CO ₂ e **	total tCO ₂ e
Oakfern House, 56 Kingsclere Road	365	216282	0.54418	216282	117696.3	117.7
Office , 11 Church Road	334	70451	0.54418	76989.865	41896.34	41.9
Total						159.6

* kWh/billed days x 365 days = year calculation

This calculation allows the variation in data provided due to changes in suppliers

** Defra conversion factor x full year use calculation

Gas Calculations

Data provided by energy company, Monarch. Annex 1, table 1a Natural Gas Net CV Basis

Address	Days Billed	Total Usage (kwh)	Defra conversion factor *	Full year use calculation **	total kg CO ₂ e ***	tCO ₂ e
Oakfern House, 56 Kingsclere Road	366.00	268020.00	0.20417	267287.70	54572.13	54.57
Office , 11 Church Road	242.00	50789.00	0.20417	76603.24	15640.08	15.64
Total						70.21

*based on Net CV

** kWh/billed days x 365 days = year calculation

This calculation allows the variation in data provided due to changes in suppliers

*** Defra conversion factor x full year use calculation

Appendix 2 Business Travel Calculations

Data provided by finance based on expenses claims, Annex 6 tables 6b for petrol cars, 6c for diesel and 6d for hybrid.

Car Travel Calculations

Car Type	Defra conversion factor	mileage	Total kgCO ₂ e
Small petrol car, up to 1.4 litre engine	0.2929	29162	8541.55
Medium petrol car, from 1.4 - 2.0 litres	0.3459	62609	21656.45
Large petrol cars, above 2.0 litres	0.479	38637	18507.12
Small diesel car, up to 1.7 litre or under	0.2459	14523	3571.21
Medium diesel car, from 1.7 to 2.0 litre	0.3048	25034	7630.36
Large diesel car, over 2.0 litre	0.4146	50253	20834.89
Medium petrol hybrid car	0.2063	4104	846.66
Diesel unknown engine size	0.3192	5646	1802.20
Petrol unknown engine size	0.3344	38173	12765.05
Unknown fuel type or size	0.3297	19554	6446.95
		Total	102602.45

Train Travel Calculations

Data based on three months expenses claims from finance. Annex 6, table 6k national rail.

	Defra conversion factor	Passenger mile	Passenger km*	Total kgCO ₂ e 3 months	Total kgCO ₂ e for year
Train	0.0611	4032.2	6489.181	396.49	1585.96
				Total	1585.96

* miles converted into km, based on 1.60934 km per mile

Supplier Travel Calculations

Raw Data provided by suppliers

- **Mitie**
 - assuming CO₂e
 - assuming each month equals August emissions

	August 2009 kg CO ₂ e	Complete Year kCO ₂ e
MITIE	8773.5	105282
	Total	105282

- **Bowater**

- Assumes 25% of lorry travel is for Sentinel
- Lorry travel produces 16,200 kgCO₂e per month (16,200*12=194,400 total lorry emissions, 25% of 194,400 as 48,600kgCO₂e)

Vehicle Type	kgCO ₂ e
Car Travel	7,273
Fitters vans	5777.72
Lorries	48,600
Total	61,651

- **Shore**

- 7050 litres annual diesel use

Litres of diesel	Defra conversion factor	Total kg CO ₂ 2
7050	2.6694	18819.27
Total		18819.27

- **A&E**

- Assumes two contracts per year of 12 weeks (60 days) using three vans, each travelling 30 miles per day running at 30mpg.
- Annex 6, table 6a

No. of vans	Daily mileage	No. of days	MPG	total gallons *	Conversion Into litres	litres	defra conversion factor	kgco ₂ e
3	30	60	30	180	4.5461	818.298	2.6694	2,184.36
Total								2,184.36

*number of vans x mileage x days
MPG

- **CHS**

- Annex 6 table 6i

TRANSPORT TYPE	Defra conversion factor				total Q1 mileage	yearly mileage	total kgco ₂	% of use for sentinel	final kgCO ₂
Medium/large diesel van (>1.25 ≤3.5t)	0.485	*1706	1706	1706	5118	20472	9928.92	50	4964.46
Medium/large diesel van (>1.25 ≤3.5t)	0.485	**1895	1576	2214	5685	22740	11028.9	20	2205.78
Medium/large diesel van (>1.25 ≤3.5t)	0.485	1956	3093	2605	7654	30616	14848.76	50	7424.38

Medium/large diesel van (>1.25 ≤3.5t)	0.485	403	873	1256	2532	10128	4912.08	50	2456.04
Medium/large diesel van (>1.25 ≤3.5t)	0.485	1298	878	1283	3459	13836	6710.46	25	1677.62
Small diesel van (≤1.25t)	0.2607	2170	2119	3878	8167	32668	8516.55	25	2129.14
Small diesel van (≤1.25t)	0.2607	**1687	607	1147	3441	13764	3588.85	25	897.07
Medium/large diesel van (>1.25 ≤3.5t)	0.485	2392	583	1725	4700	18800	9118	50	4559
Small diesel van (≤1.25t)	0.2607	1314	794	1240	3348	13392	3491.3	50	1745.65
Medium/large diesel van (>1.25 ≤3.5t)	0.485	2490	1630	2025	6145	24580	11921.3	50	5960.65
Small diesel van (≤1.25t)	0.2607	1879	1481	2311	5671	22684	5913.72	50	2956.86
								Total	36976.64

* only one month provided

** month 2 and 3 provided, took average of both

- **CBS**

- Assuming one trip per week from CBS offices to Fleet office, a total of 40 miles.
- Assuming two trips per week from CBS offices to Basingstoke offices, a total of 20 miles.
- Assumes small diesel van, Annex 6 table 6i

Weekly Mileage	Yearly Mileage	Defra conversion factor	kgCO ₂ e
60	3120	0.2607	813.38
Total			813.38

- **Wiltshire & Wiley**

- Annex 6, table 6a

Monthly Miles	yearly mileage	Average MPG	gallons used	litres used (gallons * 4.5461)	defra conversion factor	kgCO ₂ e
2442	29304	28.29	1035.8	4709	2.66	12526
1726	20712	29.70	697.37	701.92	2.66	1867.1
1104	13248	36.06	367.39	1670.18	2.66	4442.7
1711	20532	36.53	562.06	2555.18	2.66	6796.8
887	10644	40.90	260.25	1183.1	2.66	3147
Total						28780

- **Faulkners**
 - Annex 6, table 6a

Gallons of Diesel	convert into litres	litres	Defra conversion factor	total kgCO ₂ e
1562	4.5461	7101.008	2.6694	18955.43
Total				18955.43

- **Kincraig]**
 - Due to lack of accurate data and assumption has been made that the emissions of Kincraig would be between CBS and Shore as they are a local company. Based on this, 10,000 kgCO₂e has been estimated. We would like to see a more accurate figure in the future.

Breakdown by supplier

Supplier	Total kgCO ₂ e
Mitie	105282
Bowater	61651
Shore	18819.27
A&E	2184.36
CHS	36976.64
CBS	813.38
Wiltshire & Wiley	28780
Faulkners	18955.43
Kincraig	10000
Total	283462.1

Company Owned Vehicles

- Data provided by finance
- Vans 1&2 are Diesel class II and data is 18 months of mileage
- Van 3 is Diesel class III and data is 12 months mileage

	18 month mileage	into 12 months	into km *91.609340	Defra conversion factor	total kgCO ₂
van 1	16584	11056	17792.86	0.22645	4029.194
van 2	10800	7200	11587.25	0.22645	2623.932
Total					6653.13

	12 month mileage	into km 91.609340	Derfa conversion factor	total kgCO ₂
van 3	6169	9928.018	0.30138	2992.11
Total				2992.11

Total kgCO ₂ e	
Van 1	4029.19
Van 2	2623.93
Van 3	2992.11
9645.23	

Business Travel Totals

Emission Source	Total kgCO ₂ e Per year	Total tCO ₂ e per year
Car	102602.45	102.60
Train	1585.96	1.56
Contractors	283462.1	283.46
Company owned Vehicles	9645.23	9.65
	Total	397.27

Appendix 3 Commuting

Data sourced via a staff questionnaire on daily commuting habits. There were 85 respondents.

- **Cars**

Conversion factors from Annex 6, tables 6c, 6d and 6e, 2009 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting (published July 2009).

Car Type	Defra conversion factor	mileage	kgCO ₂ e per day	kgCO ₂ per working year (5 days, 47 weeks)
Small petrol car, up to 1.4 litre engine	0.2929	487.4	142.76	33548.47
Medium petrol car, from 1.4 - 2.0 litres	0.3459	658	227.60	53486.52
Large petrol cars, above 2.0 litres	0.479	156.5	74.96	17616.42
Small diesel car, up to 1.7 litre or under	0.2459	22	5.41	1271.30
Medium diesel car, from 1.7 to 2.0 litre	0.3048	548.9	167.30	39316.61
Large diesel car, over 2.0 litre	0.4146	284.8	118.08	27748.35
Medium petrol hybrid car	0.2063	70	14.44	3393.64
			Total	176381.31

- **Motorcycle/Scooter Data**

Annex 6 table 6j

Motorcycle Type	Defra conversion factor	mileage	kgCO ₂ e per day	kgCO ₂ per working year (5 days, 47 weeks)
Scooter or Small petrol motorbike up to 125cc	0.1407	25.7	3.62	849.76
			Total	849.76

- **Bus**

Annex 6, table 6k

	Defra conversion factor	Passenger mile	Passenger km	kgCO ₂ e per day	kgCO ₂ per working year (5 days, 47 weeks)
Bus	0.1046	8	12.87	1.35	316.47
				Total	316.47

- **Hover Craft**

Calculations based on diesel use per round trip, provided by Hovercraft company

Annex 6, table 6a

	Defra conversion factor	litres of diesel per day	kgCO ₂ e per day	kgCO ₂ per working year (5 days, 47 weeks)
Diesel	2.6694	3	8.0082	1,881.93
			Total	1,881.93

- **Walking and cycling**

2 people walk some of the time, and 1 person cycles some of the time.

Totals

Vehicle Type	Total kgCO ₂ e Per year	Total tCO ₂ e per year
Car	176381.31	176.39
Motorcycle	849.76	0.85
Bus	316.47	0.32
Hovercraft	1,881.93	1.88
	179429.47	Total
		179.44

The commuting data is based on 85 respondents. There are 224 employees (205 FTE). The following calculation determined the assumed total commuting footprint:

$$179429.47 \text{ kgCO}_2\text{e}/85 \text{ employees} = 2110.93 \text{ kgCO}_2\text{e per employee}$$

$$205 \text{ Full time equivalent members of staff} * 2110.93 \text{ kgCO}_2 = 43,2740.65\text{kgCO}_2\text{e}$$

$$2.11 \text{ tCO}_2\text{e per employee, } 432.5 \text{ tCO}_2\text{e total}$$

Appendix 4 Water Calculations

Data provided by finance and water supplier.

Conversion factors from Annex 9, table 9a, 2009 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting (published July 2009).

Oakfern House

Data based on reporting period 05/08 to 04/09

Date of Reading	Reading	Cubic meters used	Defra Conversion Factor	Total kgCO ₂ e
27/05/2008	8781	-	-	-
16/07/2008	8976	195	0.2760	53.82
28/10/2008	9256	280	0.2760	77.28
22/04/2009	9733	477	0.2760	131.65
			Total	262.75

Fleet Office

Based on reporting period 08/08 to 08/08

Date of reading	Reading	Cubic meters used	Defra Conversion Factor	Total kgCO ₂ e
01/08/2008	5174	-	-	-
06/02/2009	5887	713	0.2760	196.79
05/08/2009	6617	730	0.2760	201.48
			Total	398.27

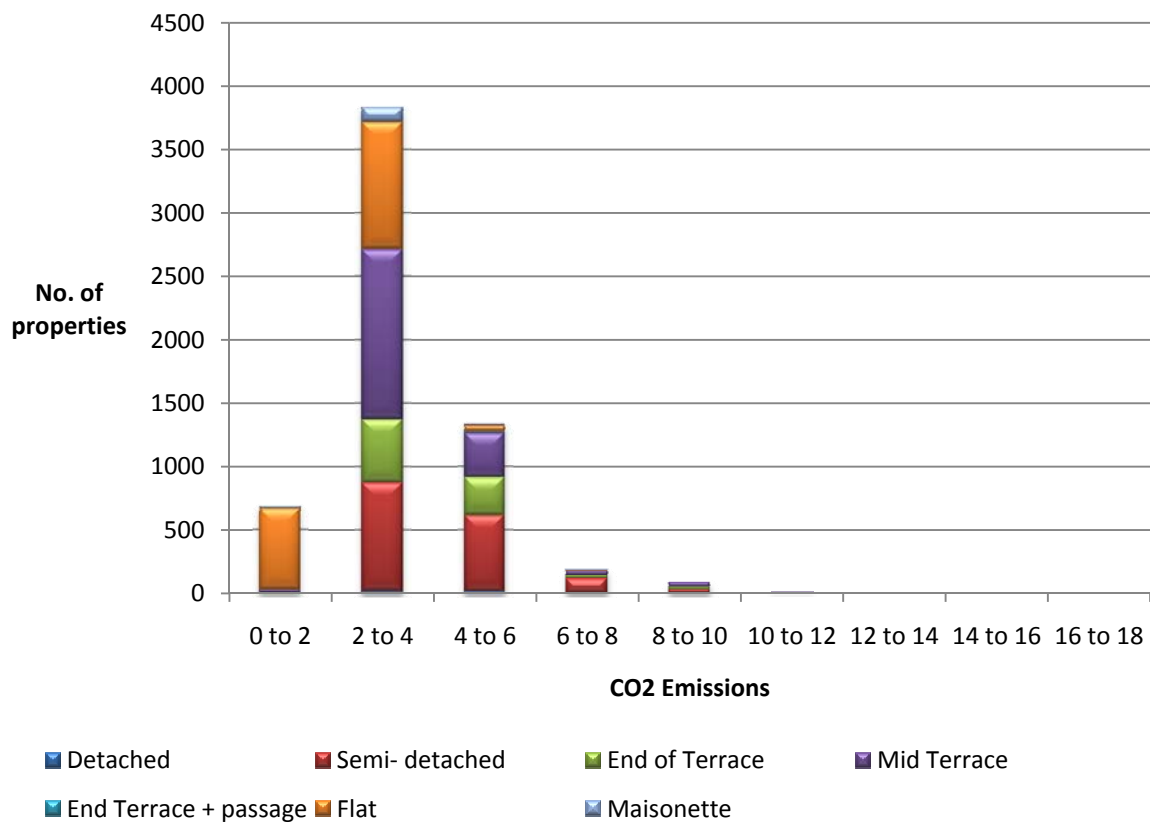
Total Water Use

Site	Total kgCO ₂ e	Total tCO ₂ e
Oakfern House, 56 Kingsclere Road	262.75	0.26
Office , 11 Church Road	398.27	0.40
	Total	0.66

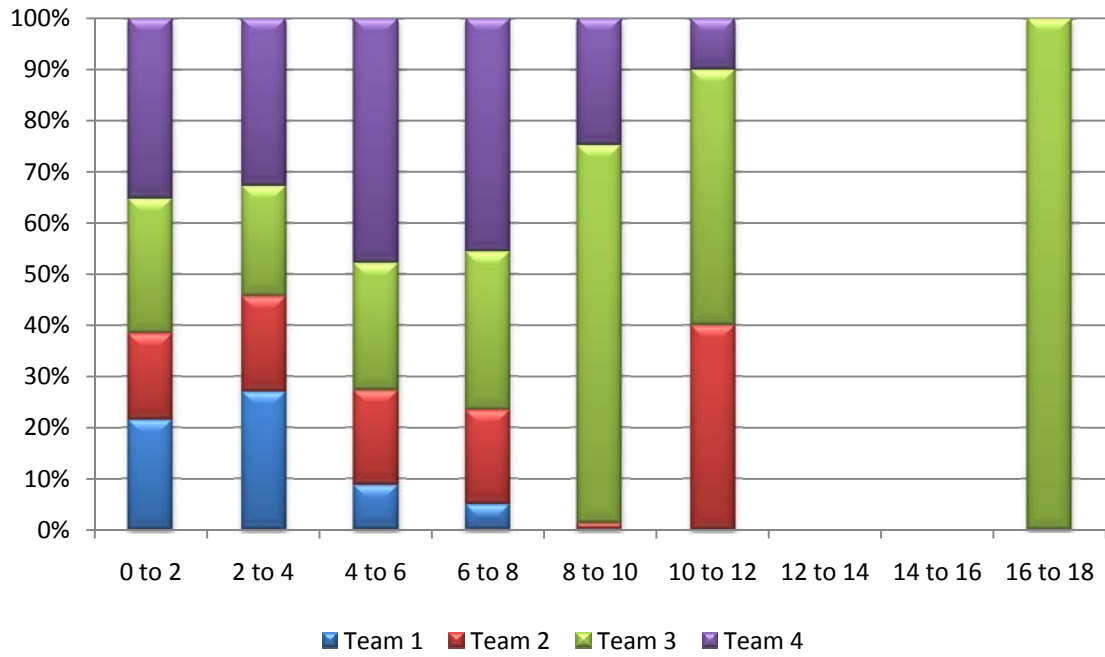
Appendix 5 Housing Stock Data Breakdown

Annual CO₂ Profile By Built Form across Sentinel Housing Stock

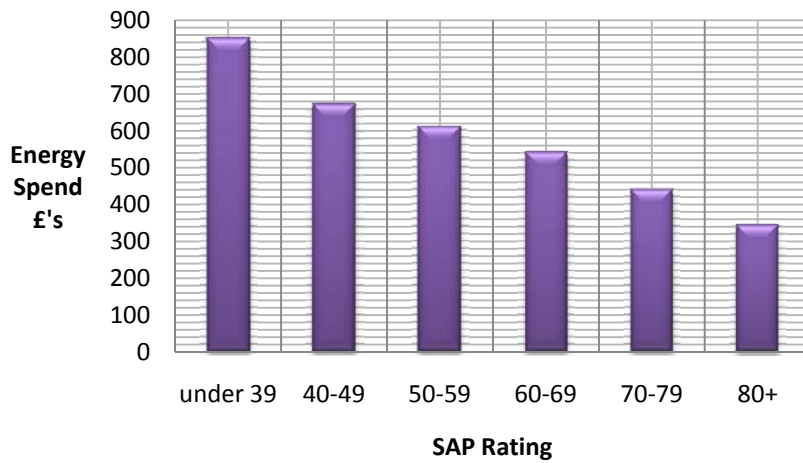
CO ₂	Detached	Semi-detached	End of Terrace	Mid Terrace	End Terrace + passage	Flat	Maisonette	TOTALS
0 to 2	0	1	6	21	0	638	18	684
2 to 4	19	854	499	1337	7	1001	114	3831
4 to 6	13	602	297	350	12	44	14	1332
6 to 8	1	113	23	37	0	5	5	184
8 to 10	1	31	21	32	0	0	0	85
10 to 12	4	3	1	2	0	0	0	10
12 to 14	0	1	0	0	0	0	0	1
14 to 16	0	0	0	0	0	0	0	0
16 to 18	0	2	0	0	0	0	0	2
Totals	38	1607	847	1779	19	1688	151	



Annual CO₂ breakdown by team and percentage



Average household energy spend in £s by SAP Rating

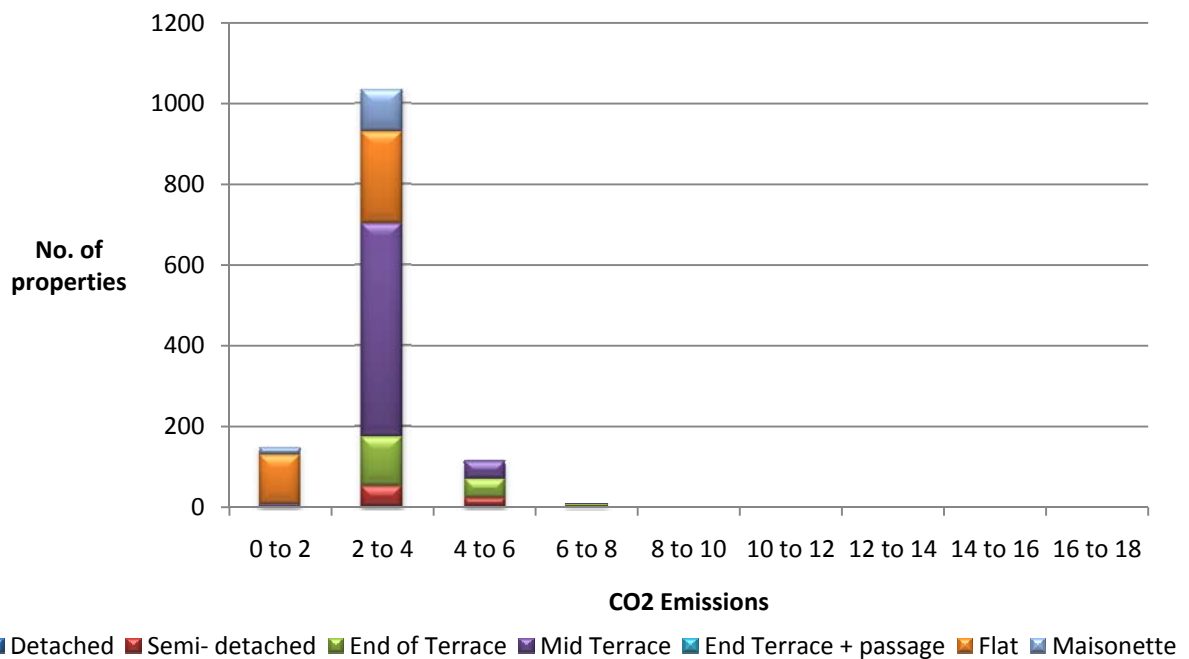


Appendix 6

TEAM 1 Annual CO₂ Profile By Built Form across Sentinel Housing Stock

The following data represents 1,305 properties of a total potential of 1,360 based on data availability. The geographic areas covered by Team 1 are Chineham, Hartley Wespall, Popley (Abbeys), Popley (poets), Sherbourne, Bramley, Polpley (Islands), Sherfield-on-Loddon, and Stratfield Saye.

CO ₂	Detached	Semi-detached	End of Terrace	Mid Terrace	End Terrace + passage	Flat	Maisonette	TOTALS
0 to 2	0	0	0	6	0	123	18	147
2 to 4	0	52	121	528	1	227	104	1033
4 to 6	1	21	48	45	0	0	1	116
6 to 8	0	0	5	4	0	0	0	9
8 to 10	0	0	0	0	0	0	0	0
10 to 12	0	0	0	0	0	0	0	0
12 to 14	0	0	0	0	0	0	0	0
14 to 16	0	0	0	0	0	0	0	0
16 to 18	0	0	0	0	0	0	0	0
Totals	1	73	174	583	1	350	123	

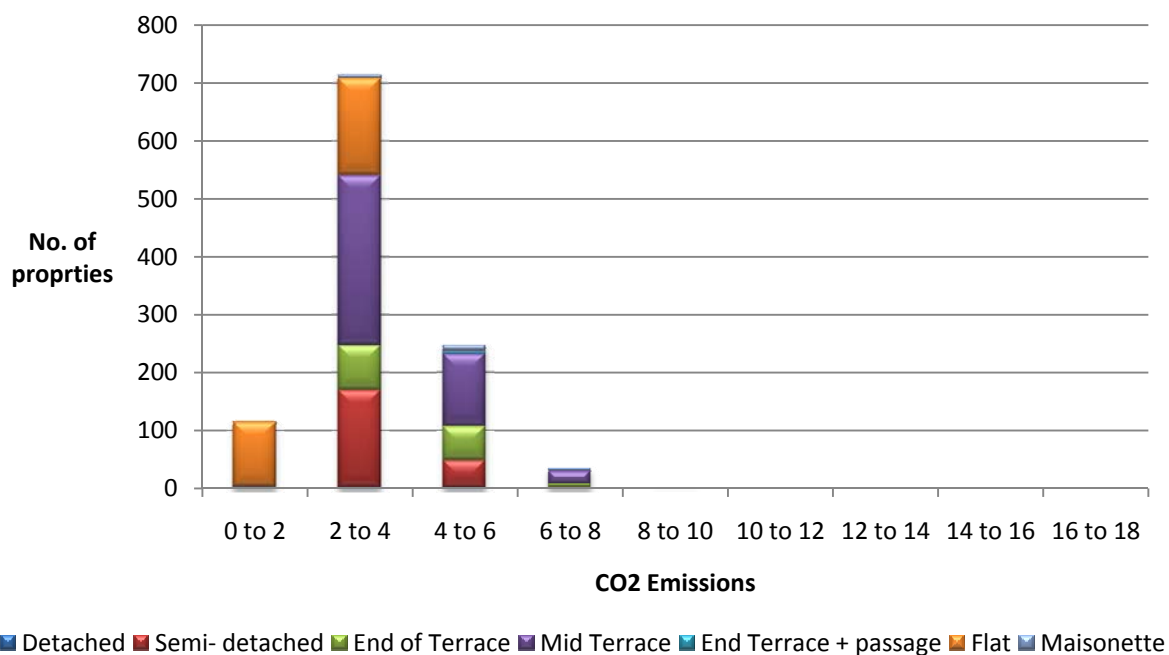


Appendix 7

TEAM 2 CO₂ Emissions per household type for Team 2

The following data represents 1,111 properties of a total potential 1,300 based on data availability. The geographic areas covered by Team 2 are Houndmills, Kempshott, Mapledurwell, Oakridge, Old Basing, Up Nately, Basingstoke Town Centre and South View.

CO ₂	Detached	Semi-detached	End of Terrace	Mid Terrace	End Terrace + passage	Flat	Maisonette	TOTALS
0 to 2	0	0	1	2	0	112	0	115
2 to 4	2	168	78	292	2	167	5	714
4 to 6	1	48	58	125	3	2	10	247
6 to 8	0	2	6	22	0	0	4	34
8 to 10	0	1	0	0	0	0	0	1
10 to 12	0	0	0	0	0	0	0	0
12 to 14	0	0	0	0	0	0	0	0
14 to 16	0	0	0	0	0	0	0	0
16 to 18	0	0	0	0	0	0	0	0
Totals	3	219	143	441	5	281	19	

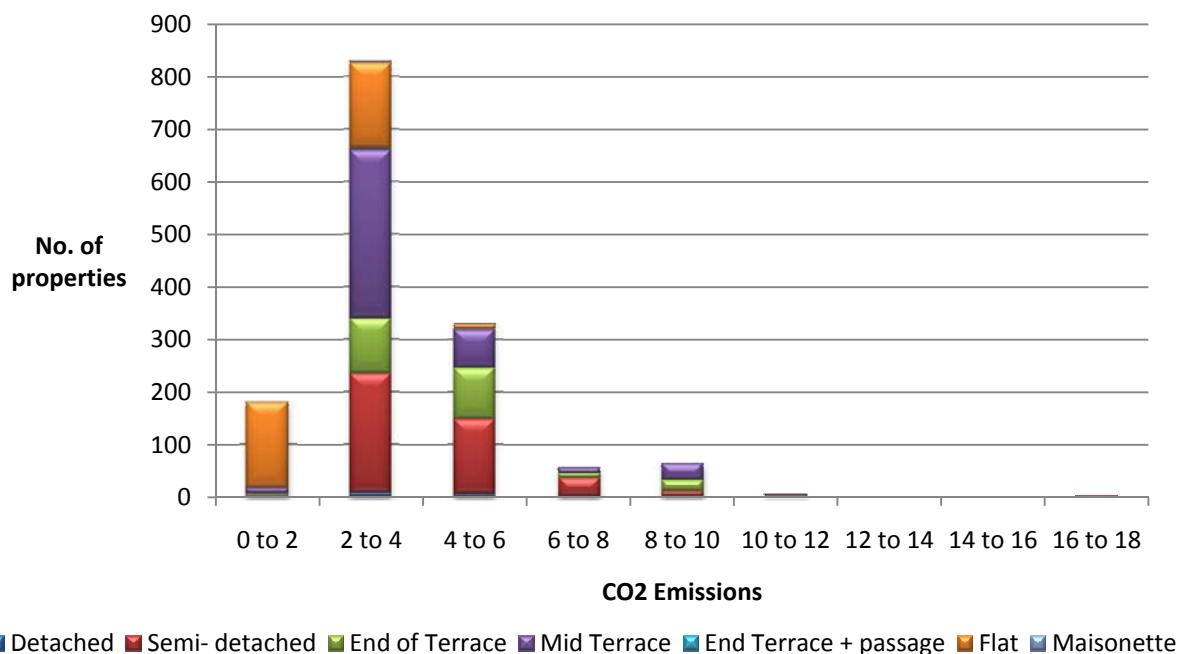


Appendix 8

TEAM 3 Annual CO₂ Profile By Built Form across Sentinel Housing Stock

The following data represents 1,469 properties of a total potential 1,609 based on data availability. The geographic areas covered by Team 3 are Ashford Hill, Ashmansworth, Baughurst, Bishops Green, Broadlayings, Burghclere, Ecchinswell, Hannington, Headley, Heath End, Highclere, Kingsclere, Newton Common, North End, Penwood, Tadley, Wolverton, Wolverton Common, Woolton Hill, Charter Alley, Little London, Monk Sherborne, Mortimer, Mortimer West End, Pamber Heath, Park Prewett, Park Village, Ramsdell, Silchester and Winklebury.

CO ₂	Detached	Semi-detached	End of Terrace	Mid Terrace	End Terrace + passage	Flat	Maisonette	TOTALS
0 to 2	0	1	5	10	0	164	1	181
2 to 4	7	227	105	321	3	162	5	830
4 to 6	6	142	97	73	2	8	3	331
6 to 8	0	37	9	11	0	0	0	57
8 to 10	0	10	21	32	0	0	0	63
10 to 12	0	2	1	2	0	0	0	5
12 to 14	0	0	0	0	0	0	0	0
14 to 16	0	0	0	0	0	0	0	0
16 to 18	0	2	0	0	0	0	0	2
Totals	13	421	238	449	5	334	9	

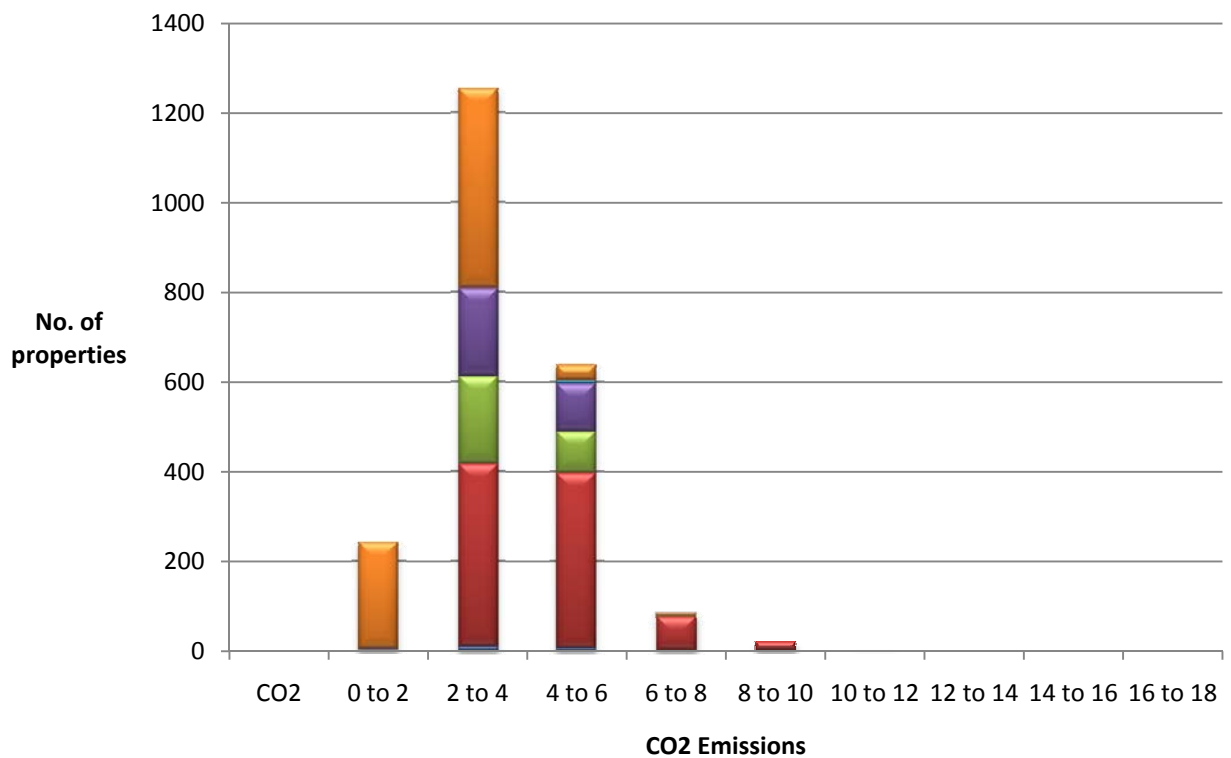


Appendix 9

TEAM 4 Annual CO₂ Profile By Built Form across Sentinel Housing Stock

The following data represents 2,240 properties of a total potential 2,555 based on data availability. The geographic areas covered by Team 4 are Bagshot, Blackwater, Bramshill, Camberley, Church Crookham, Cove, Crondall, Dogmersfield, Elvetham Heath, Eversley, Ewshot, Farnborough, Farnham, Fleet, Greywell, Hartley Wintney, Hook, Hound Green, Long Sutton, Mattingley, North Warnborough, Odiham, Phoenix Green, Rotherwick, South Warnborough, Tongham, Winchfield, Wormley and Yateley

CO ₂	Detached	Semi-detached	End of Terrace	Mid Terrace	Terrace + passage	Flat	Maisonette	TOTALS
0 to 2	0	0	0	3	0	239	0	242
2 to 4	10	407	195	196	1	445	0	1254
4 to 6	5	391	94	107	7	34	0	638
6 to 8	1	74	3	0	0	5	1	84
8 to 10	1	20	0	0	0	0	0	21
10 to 12	0	1	0	0	0	0	0	1
12 to 14	0	0	0	0	0	0	0	0
14 to 16	0	0	0	0	0	0	0	0
16 to 18	0	0	0	0	0	0	0	0
Totals	17	893	292	306	8	723	1	



■ Detached
 ■ Semi-detached
 ■ End of Terrace
 ■ Mid Terrace
 ■ End Terrace + passage
 ■ Flat
 ■ Maisonette

Appendix 10

SAP – Standard Assessment Procedure

SAP ratings are adjusted for the floor area and are therefore independent of the size of the dwelling. They consider a range of factors that affect energy usage within the dwelling:

1. Thermal insulation of the fabric
2. Efficiency and control of the heating system
3. Ventilation characteristics of the dwelling
4. Solar gain characteristics of the dwelling
5. The fuel used for space and water heating

It is unaffected by factors such as:

1. Household size and composition
2. Ownership and efficiency of particular domestic appliances
3. Individual heating patterns and temperatures

<http://wales.gov.uk/topics/housingandcommunity/housing/social/whqs/toolkit/rationale/immediate/cash/energy/sapratings/?lang=en>

The Standard Assessment Procedure (SAP) for energy rating of dwellings is a calculation of a building's energy efficiency. SAP ratings are scored on a scale from 1 to 100 where 1 is the worst and 100 will indicate no heating/hot water cost. It is possible to achieve a higher score than 100 with the use of micro generation exported to the national grid.

A Target Carbon Dioxide Emission Rate (TER) has to be calculated within the Standard Assessment Procedure (SAP).

This will be based on a notional dwelling built to the 2002 standards with a target reduction of 20%. The actual Dwelling Carbon Dioxide Emission Rate (DER) must then be no worse than the TER. The new SAP 2005 incorporates all these calculations.

<http://www.sapratings.com/sapratings.html>

Appendix 11

SAP Rating Case Studies

To determine how cyclical work would effect the SAP rating and tCO₂ per household, it was necessary to understand the impact each type of work would have on the SAP rating. Whilst there are a high number of variables effecting this, the following scenarios have been used as a basis of scoring works for the purpose of target setting.

Sophie Gribbon of Sentinel Housing ran a different scenarios of measures to households to determine some benchmark SAP scores for works done.

The case studies assumes a worst case scenario as standard so as to demonstrate the improvements that can be made and the potential SAP point difference.

Case Study 1:

Property Description

The property comprises a three bed mid terrace house constructed in 1974. It is located in a sub-urban area. External walls are of cavity construction under a pitched roof. There is full gas central heating and windows and doors are of double glazed type.

Initial SAP score 59 (D)

Loft Insulation:	0mm
Windows:	Pre 2002(i.e. before low e coatings were introduced into the Building Regulations in 2002)
Energy Fittings:	None
Boiler:	None condensing, no TRV's, no thermostat to HWC and limited insulation.
Walls:	No insulation (pre 1976)

Provide energy bulbs to all fittings:	+ 2 pts
Provide photovoltaic panels: <i>(To cover 25% of the total roof covering)</i>	+ 7 pts
Solar Water Heating:	+2 pts
Wind Turbine:	+ 1 pt
Upgrade glazing with low e glazing: <i>(Building Regs changed in 2002 and low e glazing was introduced)</i>	+ 2 pts
Install Cavity Wall Insulation:	+ 5 pts
Increase loft insulation from 0mm to 250mm:	+ 7 pts
Provided TRV's throughout:	+ 2 pts
Provide thermostat to HWC:	+ 4 pts
Upgrade gas boiler to condensing type: <i>(This includes Thermostat, Programmer, TRVS, HWC thermostat & 80mm cylinder insulation)</i>	+ 10 pts
<u>Potential Increase:</u>	<u>+ 36 pts (95)</u>

I have applied each improvement individually and not all at one time. At the end of the assessment I applied all the possible improvements which gave me a score of 89 (B) however you would expect a score of 95 (A). We have discussed the various reasons for this. For example, if we provided cavity wall insulation to the property you will see an increase in the SAP score of 5pts. If in addition we then provide 250mm loft insulation you would expect to see an additional increase of 7 SAP points totally 12pts. This would increase the SAP score from 59 to 71, in reality there is an increase of 11pts only.

Case Study 2:

Property Description

Two bed semi detached bungalow constructed in 1969. It is located in a sub-urban area. External walls are of cavity construction under a pitched roof. There is full gas central heating and windows and doors are of double glazed type.

Initial SAP score 52 (E)

Loft Insulation:	0mm
Windows:	Pre 2002(i.e. before low e coatings were introduced into the Building Regulations in 2002)
Energy Fittings:	None
Boiler:	None condensing, no TRV's, no thermostat to HWC and limited insulation.
Walls:	No insulation (pre 1976)

I have highlighted in red where there is a difference in SAP points between the case studies.

Provide energy bulbs to all fittings:	+ 2 pts
Provide photovoltaic panels: (To cover 25% of the total roof covering)	+ 10 pts
Solar Water Heating:	+2 pts
Wind Turbine:	+ 1 pt
Upgrade glazing with low e glazing: (Building Regs changed in 2002 and low e glazing was introduced)	+ 1 pts
Retro Cavity Wall Insulation:	+ 4 pts
Increase loft insulation from 0mm to 250mm:	+ 9 pts
Provided TRV's throughout:	+ 0 pts
Provide thermostat to HWC:	+ 4 pts
Upgrade gas boiler to condensing: (This includes Thermostat, Programmer, TRVS, HWC thermostat & 80mm cylinder insulation)	+ 10 pts
<u>Potential Increase:</u>	<u>+ 36 pts (91)</u>

As with case study one I then applied all the improvements at the same time and came up with a SAP score of 90 (B).

These points can only be used as guidance as each property has to be assessed on its own merits. I do hope this makes sense; it's a challenge to explain this on paper. If you could only use this for your own information it would be much appreciated as I have put this together quickly so is not my best work to date. I am happy to work with you to some more so we establish a range of potential SAP points for each improvement.

Case Study 3:

Property Description

Two bed semi detached bungalow constructed in 1955. It is located in a sub-urban area. External walls are of cavity construction under a pitched roof. Heating is provided by storage heaters (old style, large volume) and windows and doors are of double glazed type.

Initial SAP score 26 (F)

Loft Insulation: 0mm
Windows: Pre 2002(i.e. before low e coatings were introduced into the Building Regulations in 2002)
Energy Fittings: None
Storage Heaters: Old style – large volume
Walls: No insulation (pre 1976)

Provide energy bulbs to all fittings: + 1 pts

Provide photovoltaic panels: + 7 pts
(To cover 25% of the total roof covering)

Solar Water Heating: +2 pts

Wind Turbine: + 1 pt

Upgrade glazing with low e glazing: + 1 pts
(Building Regs changed in 2002 and low e glazing was introduced)

Retro Cavity Wall Insulation: + 8 pts

Increase loft insulation from 0mm to 250mm: + 15 pts

Upgrade to air source: + 9 pts

Upgrade to gas central heating: + 35 pts

To the basic model I have applied the following improvements; cavity wall insulation, 250mm loft insulation and low energy fittings throughout. The SAP for the property when running old style storage heaters would be **53 (E)**, when upgraded to air source the SAP score increases to **59 (D)**. I have discussed my findings with ECMK and they agree with the SAP score, the glitch in the system is that there is only one option for air source within the ECMK software which does not necessarily reflect the energy efficiency of modern systems. Juts out of interest I ran the EPC again but with gas central heating installed and the SAP score came out at **76(C)**.

Case Study 4:

Property Description

Three bed semi detached house constructed in 1920. It is located in a sub-urban area. External walls are of solid construction under a pitched roof. Heating is provided by a traditional modern (condensing) gas fired boiler serving radiators with thermostatic radiator valves. The system is run by a programmer and room

thermostat. Hot water is stored in a copper cylinder with 80mm fitted insulation and a thermostat has been provided. Windows and doors are of double glazed type installed before 2002. The roof space has 250mm insulation at ceiling joist level.

Initial SAP score 63 (D)

Provide external insulation to solid walls: +10 pts

Housing Stock – proposed cyclical work SAP reduction calculations

2010/11

Heating upgrades budget £650,000, (at £4,500 per property) 144 properties. This up to 10 SAP points for a boiler.

All boiler work: **1,440** total additional sap points

Insulation (cavity and roof) budget £85,000, cavity is up to 5 SAP points, loft is up to 9 SAP points. Cavity is £80 and loft is £200 per property including grants. 303 properties (303 x 14 sap points)

Combination cavity and loft: **4242** sap points

Door and window replacement budget £40,000 (£3,400+vat per property), 11 properties. Up to 2 SAP points.

Windows & doors: **11** sap points

Abbey Road Cladding and insulation budget £50,000 (£5000 per property) 10 properties. Solid wall sap points 10

Solid wall insulation: **100** sap points

Dukes Park windows and doors budget £210,000 (£4,200 +vat per property), 50 properties Up to 2 SAP points

Windows & doors: **100** sap points

2011/12

Heating upgrades budget £961,033 (at £4,500 per property) 213 properties. This up to 10 SAP points for a boiler.

All boiler work: **2130** sap points

Insulation (cavity and roof) budget £135,000 cavity is up to 5 SAP points, loft is up to 9 SAP points. Cavity is £80 and loft is £200 per property including grants. (135000/280 = 482 properties)*(14 sap)

Combination cavity and loft: **6750** sap points

Door and window replacement budget £130,642 (£3,400+vat per property), 38 properties, Up to 2 SAP points

Windows & doors: **76** sap points

2012/13

Heating upgrades budget £961,033 (at £4,500 per property), 213 properties. This up to 10 SAP points for a boiler

All boiler work: **2130** sap points

Door and window replacement budget £130,642 (£3,400+vat per property), 38 properties Up to 2 SAP points.

Windows & doors: **76** sap points

New Builds

The SAP of the new builds needs to be added to the average SAP rating as well.

This chart shows the average SAP Ratings of New Builds across England. (source ww.communities.gov.uk)

Quarter	House	Bungalow	Flat	Maisonette
2008 Q4	79.7	78.4	77.8	80.0
2009 Q1	79.7	76.5	76.1	78.0
Q2	79.6	77.1	77.3	79.2
Q3	79.4	75.8	77.8	75.2

The current projection for new builds:

- 2010/11 : 302 completed new builds
- 2011/12 : 525 completed new builds
- 2012/13 : 121 completed new builds

Calculations

Current SAP	69.2
Over this number of properties	7015
Current total SAP	485438

year 1 cyclical work increase to total SAP by	5893
year 2 cyclical work increase to total SAP by	8956
year 3 cyclical work increase to total SAP by	2206

Year 1 total new builds	302 @	82 SAP each	total SAP =	24764
Year 2 total new builds	525 @	82 SAP each	total SAP =	43050
Year 3 total new builds	500 @	82 SAP each	total SAP =	41000

YEAR 1 CALCS	
SAP + cyclical work SAP + new build SAP	516095
(properties + new properties)	7317
divided by properties for new SAP	70.5

YEAR 2 CALCS	
SAP + cyclical work SAP + new build SAP	568101
(properties + new properties)	7842
divided by properties for new SAP	72.4

YEAR 3 CALCS	
SAP + cyclical work SAP + new build SAP	611307
(properties + new properties)	8342
divided by properties for new SAP	73.3

Appendix 12

Operations Reductions

These will be made up of:

- Boiler controls (cost approx £4k)
- Voltage Optimisation (cost approx £8k)
- Behaviour change in the work place

Quote for boiler controls shows savings of 70 tCO₂ and pay back of initial cost of approx £4k of three years.

Quote for voltage optimisation shows savings of approx 13 tCO₂ and pay back of initial cost of approx £8k as 54 months

Appendix 13

Housing Stock SAP and CO₂ calculations

The reductions will be made up of:

- Year one 2010/11
 - Heating upgrades
 - Insulation (cavity and roof)
 - Door and window replacements
 - External cladding (solid wall insulation)
- Year two 2011/12
 - Heating upgrades
 - Insulation (cavity and roof)
 - Windows and doors
- Year three 2012/13
 - Heating upgrades
 - Insulation (cavity and wall)
 - Windows and doors

Appendix 14b

CURRENT POSITION		SAVINGS			
Emission Source	2009/10 Actual	2010/11 Target	2011/12 Target	2012/13 Target	Total Target
Operations					
tCO2	774.9	31	23.5	23.5	78
Operations	-	4%	3%	3%	10%
cumulative tCO2	-	743.9	720.4	696.9	
per FTE	3.8 tCO ₂	0.15 tCO ₂	0.115 tCO ₂	0.115 tCO ₂	3.42 tCO ₂
Contractors Total Travel					
% reduction	-	1%	1%	1%	3%
tCO2	283.46 tCO ₂	282.09	280.74	279.40	
per FTE	1.38 tCO ₂	0.014 tCO ₂	0.014 tCO ₂	0.014 tCO ₂	1.34 tCO ₂
Housing Stock					
SAP	69.2	70.5	72.4	73.3	73.3 SAP
tCO2 Saving per property	tCO2	0.2	0.2	0.1	0.5
%	-	6%	6%	3%	15%
Number of new builds		302	525	500	1,372
Total No. of properties	7015	7317	7842	8342	8342
tCO2 per property	3.3	3.1	2.9	2.8	
Housing total footprint tCO2	23149.5	22978.8	22857.5	23315	
Per FTE tCO ₂	112.9				
Total Carbon Footprint	24207.86	24004.8	23858.6	24291.3	
FTE tCO ₂	118.1	117.1	116.4	118.5	Based on 205 FTE baseline

Customer Energy Spend	Baseline	2010/11	2011/12	2012/13	Total Target
Saving per household (excl new builds)	£491.07	£7.50	£17.09	£3.82	£28.41
Baseline stock total footprint showing reductions	Baseline	2010/11	2011/12	2012/13	
Properties	7015	7015	7015	7015	
tCO2 per property	3.288937	3.203810488	3.047664	3.013420151	
Total	23071.89	22474.73057	21379.36	21139.14236	
Total Saving		597.2	1095.4	240.2	1932.7

New build stock total footprint	2010/11	2011/12	2012/13	
Properties	302	525	500	
tCO2 per property	1.862886529	1.862887	1.862886529	
tCO2	562.5917319	978.0154	931.4432647	
Total tCO2	562.6	1540.6	2472.1	4575.2