

South East England Regional Assembly

Regional Carbon Emission Trajectories

**March 2008
3rd Draft**

Table of Contents

1. Introduction	2
PART 1	
2. Process	5
Policy Context	5
3. Data.....	7
4. Baseline Carbon Emissions	9
5. ‘Without Additional Measures’ trajectories	11
PART 2	
6. Carbon Trajectories for Different Scenarios	15
Residential Trajectories	17
Commercial Trajectories.....	22
Transport Trajectories.....	23
7. Carbon Dioxide Reductions in the South East.....	26
8. Conclusions and Recommendations.....	30
Glossary	35

Appendices

Appendix I – Data Quality Check.....	33
--------------------------------------	----

Graphs

Graph 1: ‘Without Additional Measures’ Trajectories.....	14
Graph 2: Comparison between the Completion Trend (53% flats) Trajectories and ‘Without Additional Measures’ Trajectories	16
Graph 3: Impact of delivering zero carbon homes.....	18
Graph 4: Delivery of Zero Carbon Homes with 20% of Completions Meeting the Zero Carbon Standard by.....	19
Graph 5: Delivery of Zero Carbon Homes with 8,100 Public Sector Dwellings Complying with Higher Standards of Building Regulations	21
Graph 6: Possible Carbon Trajectories for Zero Carbon Non Domestic Development	23
Graph 7: Impact of Fuel Efficiency Improvements on CO ₂ Emissions from Transport.....	24
Graph 8: CO ₂ Reductions in the South East	28
Graph 9: Potential CO ₂ Trajectory for the South East compared to National Targets in the Climate Change Bill	29

I. Introduction

I.1 The PPS on Planning and Climate Change highlights that Regional Planning Bodies (RPBs) should be monitoring the performance of the Regional Spatial Strategy (RSS) in terms of mitigation and adaptation to climate change. To be in a position to do this the South East England Regional Assembly has established a robust baseline position for carbon emissions in the South East.

This report includes a detailed methodology used to establish the baseline for residential, commercial and transport emissions. The baseline will enable data collection and monitoring to determine the effectiveness of mitigation policies delivered nationally and through the RSS.

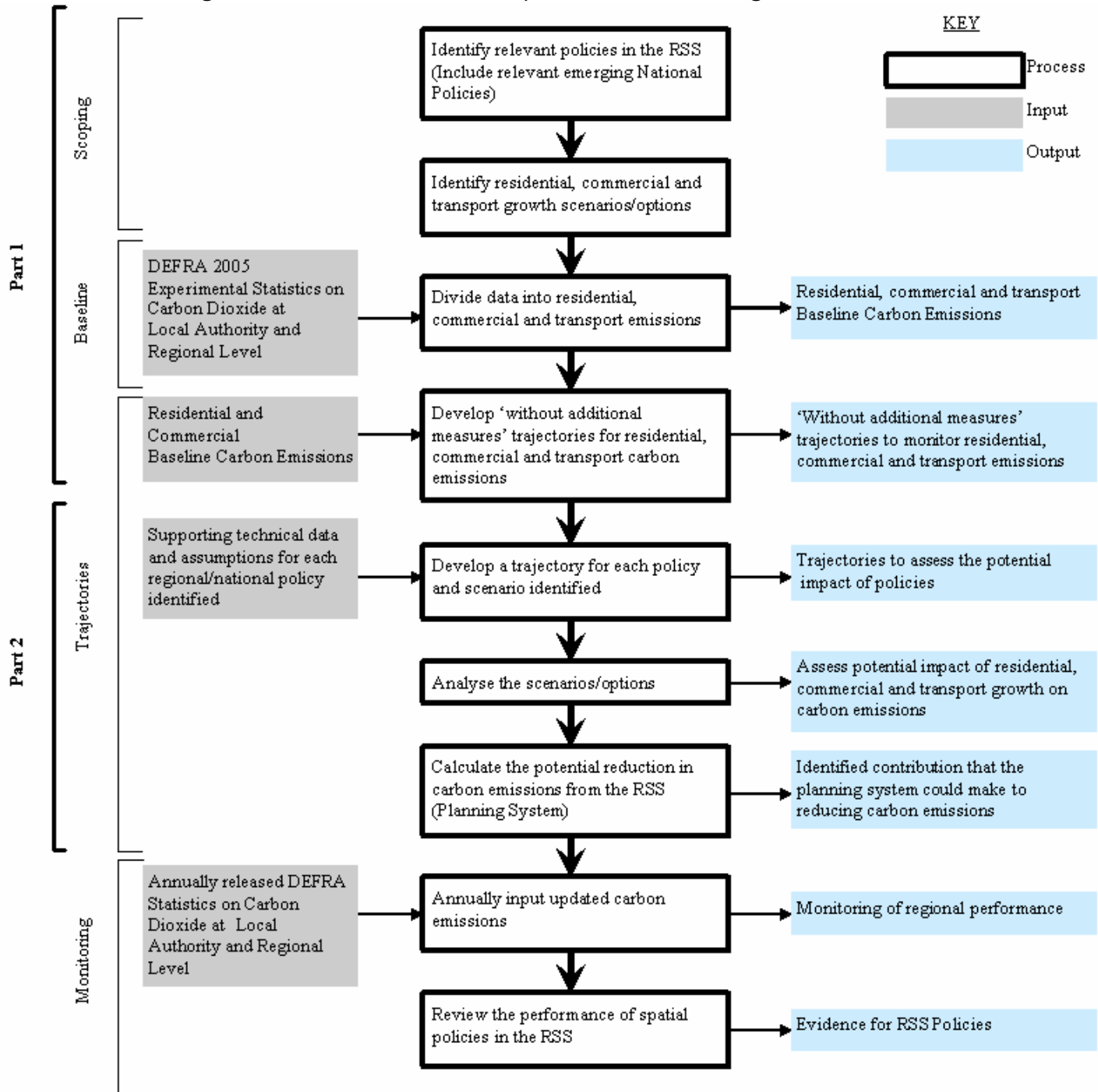
I.2 PPSI states the Government's intention is to establish trajectories for anticipated carbon performance of new development in each region. To provide a fuller analysis of the impact that the RSS could have in mitigating carbon emissions this paper also considers residential, transport and commercial emissions.

I.3 The trajectories prepared for each of these sectors will be used:

- as a strategic tool to shape policies and test the level of ambition of RSSs, demonstrating the extent to which residential, transportation and commercial development, over time, can become more carbon efficient; and
- to contribute to the annual monitoring and reporting of RPBs against key performance indicators

I.4 The process for the preparation of carbon baselines and trajectories is set out in figure 1 and detailed in section 2. The dataset and methodology applied to establish the trajectories can be viewed in the spreadsheet that accompanies this report (SE Carbon Emission Trajectories.xls).

Figure 1: Carbon Baselines and Trajectories to Monitor Regional Performance



Structure of the Report

- 1.5 The report has been divided into two parts. Part one sets out the methodology that has been applied and part two details the policy analysis that has been undertaken to assess the impact of the draft South East Plan and other measures in mitigating against future climate change.

PART 1

Section 2 – Sets out the process and policy context.

Section 3 – Identifies the dataset that will be used to determine the baseline carbon dioxide emissions and trajectories.

Section 4 – Establishes the baseline carbon emissions for each sector.

Section 5 - Summarises the methodology that has been applied to establish ‘without additional measures’ trajectories for residential, transportation and commercial sectors in the South East.

PART 2

Section 6 – sets out the methodology that has been applied to establish carbon trajectories reflecting different policy scenarios and trends.

Section 7 – Summarises the ability of given policy measures to deliver against targets in the draft South East Plan and the Climate Change Bill.

Section 8 –Concludes and summarises the impact of the mitigation measures modelled in the trajectories.

2. Process

- 2.1 The Planning Policy Statement (PPS) on climate change sets out to ensure that climate change is taken into account throughout the preparation of RSSs. Regional Planning Bodies (RPBs) should be monitoring the impact of the RSSs over the plan period. To be in a position to do this RPBs should seek to establish a robust baseline position for existing carbon emissions from residential dwellings and commercial activities.
- 2.2 This paper looks at residential, commercial and transport emissions individually before providing a fuller picture of projected carbon emissions in the South East (section 7).
- 2.3 To achieve this part I of this report first establishes the baseline carbon emissions for 2005.

Policy Context

- 2.4 The Government is currently committed to a target of 60% reduction in carbon emissions from 1990 levels (Climate Change Bill). However there is increasing pressure for this to be increased to 80% to prevent global temperatures rising more than 2 degrees Celsius which would result in irreversible climate impacts.¹
- 2.5 The Regional Sustainability Framework (RSF) has identified the need to reduce greenhouse gas emissions in the South East as a priority. The regional context is also set by Objective 17 in the RSF which identifies the need to monitor and establish trajectories for carbon dioxide emissions and action C14 in the climate change implementation plan also recommends that an inventory of greenhouse gas emissions is established.
- 2.6 Policy CC2 in the draft South East Plan also sets targets to reduce carbon dioxide emissions by at least 20% below 1990 levels by 2010 and by at least 25% below 1990 levels by 2015.
- 2.7 The policies within the draft South East Plan that could contribute towards a reduction in carbon emissions are listed below;

CC3 Resource Use

CC4 Sustainable Construction

CC8b: Regional Hubs

RE4: Information Communications Technology and Changing Working Practices

H1: Housing Provision

H4: Affordable Housing

H5: Housing Density and Design

H6: Type and Size of New Housing

H7: Making Better Use of the Existing Stock

T1: Manage and Invest

¹ WWF, IPPR & RSPB, 2007. 80% Challenge - Delivering a low carbon UK

T5: Mobility Management
T8: Travel Plans and Advice
NRM7: Air Quality
EN1: Development Design for Energy Efficiency and Renewable Energy
EN2: Combined Heat and Power
EN3: Regional Renewable Energy Targets

2.8 In their consultation document, *Building A Greener Future* the Government is proposing to gradually improve Building Regulations, so all new development will be zero carbon by 2016. This will reduce the energy demand of the new housing stock and the associated carbon emissions. This emerging policy framework has been considered when developing carbon trajectories within this report.²

² Communities and Local Government, 2006. *Building A Greener Future: Towards Zero Carbon Development*

3. Data

- 3.1 The Department for Environment Food and Rural Affairs (DEFRA) commissioned a study to estimate emissions of CO₂ at a local authority and regional level for 2005 in the UK. This study uses these emission estimates as the primary data source. This work is currently labelled as experimental, but will become a formal statistical release in 2008. DEFRA has suggested that this dataset is used to meet the requirements of the Local Government Performance Framework which requires the monitoring of emissions. Use of this dataset will potentially align monitoring of Regional Spatial Strategies (RSS), Local Development Frameworks (LDF) and Local Area Agreements.
- 3.2 As detailed, from 2006 the dataset will no longer be labelled as “experimental” and will eventually be given full National Statistics status in 2008. The dataset will continue to be published annually and any changes to the methodology will be backcast to 2005 to provide a robust time series to monitor against in the future.
- 3.3 This data, which is set out by sector and is shown in table I, has been used to establish the South East figures for residential, commercial and transport emissions.
- 3.4 The dataset is compiled from the National Atmospheric Emissions Inventory and experimental regional energy statistics. The dataset reallocates carbon emissions from the production and processing of fuels including electricity to where the demand from the end user arises rather than attributing emissions to where energy is produced. The dataset represents the best estimates available and that some uncertainties do exist. These are due to:
- Errors in the national emissions inventory;
 - Errors in the spatial distribution of emissions; and
 - Uncertainty in the apportionment of emission from each sector in each local authority.³

³ DEFRA, 2007. 2005 Experimental Statistics on Carbon Dioxide emissions at Local Authority and Regional Level. www.defra.gov.uk/environment/statistics/globalatmos/galocalghg.htm

Table 1: DEFRA CO₂ emissions by sector 2005

DEFRA CO₂ emissions by sector	South East - 2005 (kt CO₂)
Residential	
Domestic Electricity	8828
Domestic Gas	9821
Domestic Oil	1208
Domestic Solid Fuel	288
Domestic Home And Garden Machinery	46
Domestic Household Products	205
Residential Sub Total	20397.1
Commercial	
Industrial Electricity	12410
Industrial Gas	6503
Industrial Gas (Exclusions) ¹	0
Industry Process Gases	62
Industry Non Fuel	59
Industry Off-Road Machinery	876
Railways	315
Industry Commercial Oil	1507
Industry Commercial Solid Fuel	445
Industry Commercial Wastes And Biomass	28
ETS Installations*	1479
Agriculture Oil	351
Agriculture Solid	2
Agriculture Non fuel	4
LULUCF Emissions: Agricultural Soils And Deforestation	103
LULUCF Emissions: Other	1325
LULUCF Removals	-1613
Commercial Sub Total	23857.2
Transport	
Road Transport Petrol (A roads)	5271
Road Transport Petrol (Motorways)	3424
Road Transport Petrol (Minor Roads)	3755
Road Transport Diesel (A roads)	4036
Road Transport Diesel (Motorways)	3793
Road Transport Diesel (Minor Roads)	2395
Road Transport Other	86
Transport Sub Total	22761.8
Total	67016

Source: DEFRA, 2005 Experimental Statistics on Carbon Dioxide emissions at Local Authority and Regional Level (www.defra.gov.uk/environment/statistics/globatmos/index.htm)

Note: ¹ Data field is blank as no data is available.

* Emissions from ETS Installations (Emission Trading Schemes) are included because the emissions arise within the South East.

4. Baseline Carbon Emissions

4.1 To calculate the baseline residential figure the following sectors have been selected from the DEFRA data:

- Domestic Electricity
- Domestic Gas
- Domestic Oil
- Domestic Solid Fuel
- Domestic Home And Garden Machinery
- Domestic Household Products

These sectors are then combined to produce a sub total for the residential (housing) element of the baseline.

Residential = 20,397 (kt pa CO₂)

4.2 To calculate the baseline commercial figure the following sectors have been selected from the data:

- Industrial Electricity
- Industrial Gas
- Industrial Gas (Exclusions)
- Industry Commercial Oil
- Industry Commercial Solid Fuel
- Industry Commercial Wastes And Biomass
- Industry Process Gases
- Industry Non Fuel
- ETS Installations
- Industry Off-Road Machinery
- Railways
- Agriculture Oil
- Agriculture Solid
- Agriculture Non fuel
- LULUCF Emissions: Agricultural Soils And Deforestation
- LULUCF Emissions: Other
- LULUCF Removals

These sectors are then combined to produce a sub total for the commercial element of the baseline.

Commercial = 23857 (kt pa CO₂)

4.3 To calculate the baseline transport figure the following sectors have been selected from the data:

- Road Transport Petrol (A roads)

- Road Transport Petrol (Motorways)
- Road Transport Petrol (Minor Roads)
- Road Transport Diesel (A roads)
- Road Transport Diesel (Motorways)
- Road Transport Diesel (Minor Roads)
- Road Transport Other

These sectors are then combined to produce a sub total for the transport element of the baseline.

Transport = 22762 (kt pa CO₂)

- 4.4 The baseline figures above have been used to establish trajectories that enable a fuller analysis of carbon emissions in the South East.

5. 'Without Additional Measures' Trajectories

- 5.1 One of the aims of this paper is to determine the potential carbon emission savings that can be achieved from different policy approaches. This requires trajectories that monitor the effectiveness of policies in the draft South East Plan. To do this accurately 'without additional measures' trajectories are necessary to reflect what the carbon dioxide emissions would be without any *future technological and policy interventions*. However the future mix of electricity generation as identified in the Energy White Paper⁴ is included, as this will have a direct impact on the carbon emissions attributable to the region. The forecast, in the Energy White Paper, for the generation of electricity from renewables is 20% in 2020 (3% in 2005)⁵ and this study assumes that policy EN3 from the draft South East Plan will form part of this.
- 5.2 The forecasted change in electricity generation has been applied to the residential and commercial 'without additional measures' trajectories. Trajectories have been produced for each sector and growth scenario identified to provide a basis for actual emissions comparisons in the future. The 'without additional measures' trajectories will enable the potential carbon emission savings from different policy approaches to be calculated and will provide a position from which the Assembly can monitor the effectiveness of policies in the draft South East Plan.
- 5.3 For the residential 'without additional measures' trajectories it has been assumed that the changes to building regulations requiring zero carbon homes will not be implemented and Part L of the building regulations is the standard that new residential development must comply with.

What is the 'without additional measures' trajectory?

The 'without additional measures' trajectories use the 2005 DEFRA statistics on Local Authority and Regional CO₂ emissions as the primary data source. These figures, as set out in section 4, are used to project forward to 2026 to indicate what the CO₂ emissions would be:

- Without any additional policy implementation or technical advances;
- If growth targets are achieved; and
- If the future energy mix identified in the Energy White Paper is achieved (applied to residential and commercial trajectories).

- 5.4 New residential development and future economic growth will have an impact on transport in the South East and therefore carbon emissions. A range of scenarios have therefore been developed to improve the accuracy of the 'without additional measures' trajectories.

⁴ DBERR, 2007. Meeting the Energy Challenge, A White Paper on Energy.

⁵ For the remaining six years of the plan period it has been assumed that the percentage of electricity from renewables will continue to grow by 1.13% pa. (2026 = 26.78%)

The levels of growth being used to establish the ‘without additional measures’ trajectories in this report for the residential and transport sectors are outlined below:

Residential – Growth in Housing stock 2005 -2026:

- 32,000 dwellings per annum
- 36,000 dwellings per annum
- 46,000 dwellings per annum⁶

Transport – Percentage growth in travel:

- 13.49% growth from 2005 to 2026
- 15.17% growth from 2005 to 2026
- 19.39% growth from 2005 to 2026

5.5 The growth in transport is based on data from the Regional Strategic Transport Model (STM). This highlights that transport patterns/trips will increase by 11.8%, if 28,000 new dwellings are delivered per annum⁷. By using this figure, we can apply the following assumptions to develop ‘without additional measures’ trajectories.

Table 2: Percentage Increase in trips related to housing growth

	Total Increase in Trips
32,000 new dwellings	13.49%
36,000 new dwellings	15.17%
46,000 new dwellings	19.39%

These figures differ from the Department for Transport (DFT) National Transport model which forecast that traffic will grow by 31% by 2025.⁸

5.6 The ‘without additional measures’ trajectories for the commercial sector are more complex to model because the decline in industry and manufacturing and the growth in the service sector will have a direct impact upon carbon emissions. Therefore the baseline emissions for the commercial sector have been split according to broad GVA data for 2005.

- Manufacturing emissions = 10.65%
- Commercial emissions = 89.35%⁹

5.7 To model the change in the economy data from the REEIO econometrics model (which makes future predictions about the economy) has been used. To reflect the fact that emissions from manufacturing are generally in decline, an annual decline of

⁶ Figures based on scenarios in the National Housing and Planning Advice Unit publication, Developing a target range for the supply of new homes across England (2007).

⁷ South East Plan, March 2006. Technical Note 3, Transport. www.southeast-ra.gov.uk/southeastplan/plan/march_2006/tech_notes/technical_note_3-transport-march_2006.pdf

⁸ DFT, 2007. Road Transport Forecasts for England 2007 – Results from the Department for Transport’s National Transport Model. www.dft.gov.uk/pgr/economics/ntm/071023_AnnualForecast07.pdf - Note scenario’s have been broken down into per annum figures.

⁹ Experian Business Strategies, Autumn 2007.

1.83% in emissions has been factored into the trajectories¹⁰. For the remaining 89.35% the following growth trends have been applied.

Commercial – Annual increase in Gross Value Added per capita:

- 3% per annum¹¹
- 3.4% per annum¹²

5.8 To compliment the two commercial scenarios, data on commercial and industrial floorspace from Communities and Local Government (CLG) has been used to calculate the annual growth in floorspace. This equates to 3.16% growth pa (Medium) and therefore approximately matches the GVA scenarios included.¹³

5.9 Data on the existing dwelling stock is required to compile the residential ‘without additional measures’ trajectory.¹⁴ The example below sets out the assumptions and methodology used to produce a ‘without additional measures’ trajectory for housing growth of 32,000 dwellings per annum (which is the low growth assumption). The detailed workings are shown in the accompanying spreadsheets.

Example of calculations for Residential – Housing

- Equal apportionment of CO₂ emissions amongst the existing housing stock and new housing stock;
- Annual growth in housing stock of 32,000 dwellings per annum.
- 40% improvement in the energy efficiency of new dwellings (Part L)
- 26.73% of energy from renewable sources by 2026.

1. (Residential baseline (housing) /existing housing stock) = (CO₂ emissions per dwelling) x 32,000 = CO₂ emissions from annual housing growth

2. CO₂ emissions from annual housing growth x 21 = Total growth in CO₂ emissions/100 x 60 = Impact of Part L on CO₂ emissions

3. Impact of Part L on CO₂ emissions x percentage of energy from non renewable sources = CO₂ emissions from residential growth when Energy White Paper Renewable Targets are delivered and Part L Building Regs complied with.

¹⁰ Emissions are forecast to decline by 22% between 2003 and 2015. Application of this rate of decline from 2005 to 2026 equates to 1.83% annual decline. Forecast data taken from REEIO econometric model, 8/11/2007.

¹¹ Target in the Regional Economic Strategy

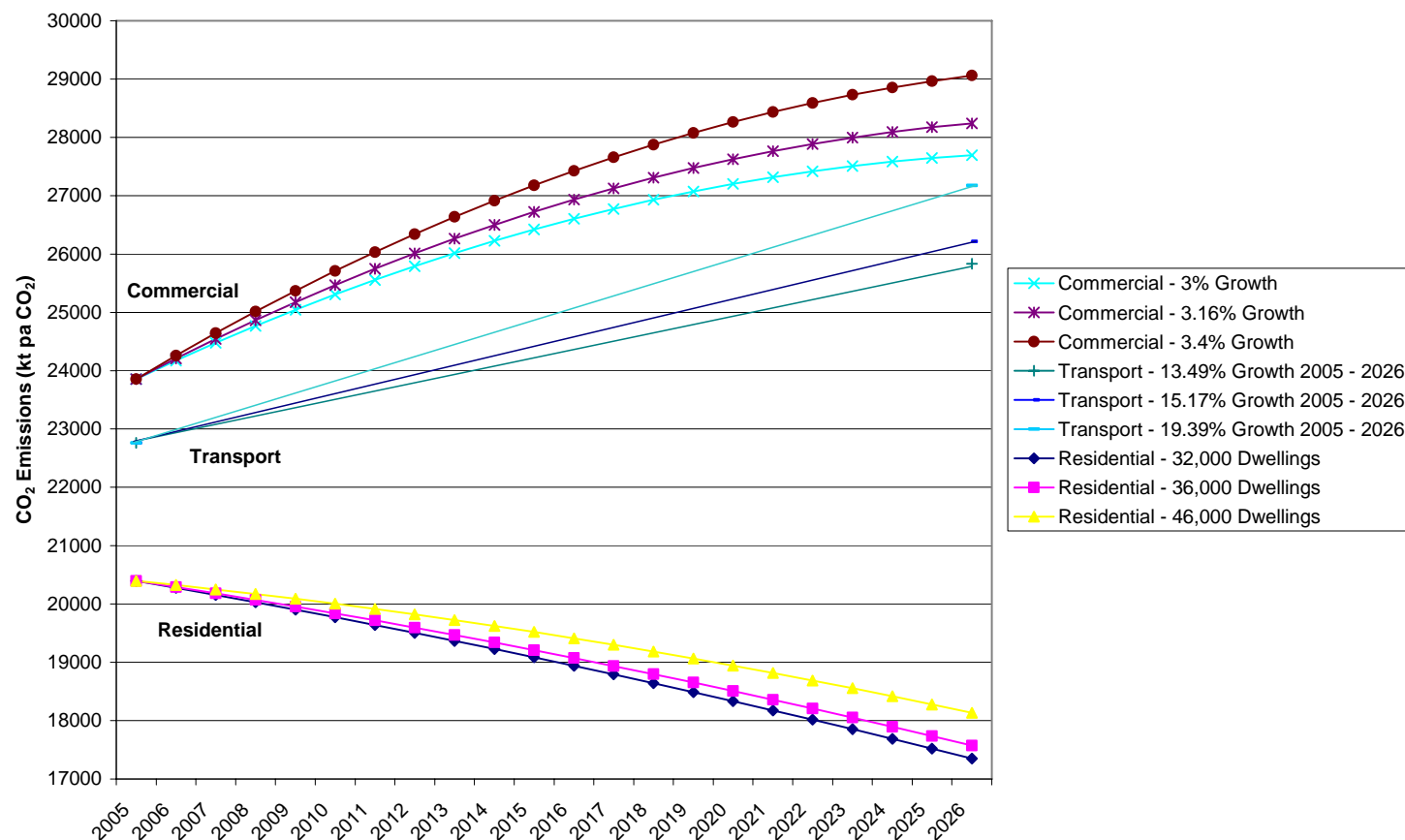
¹² Performance of the South East Economy between 1997 and 2003. Data taken from the Regional Sustainability Framework.

¹³ Data from CLG Live Tables on Commercial and Industrial Floorspace and Rateable Value Statistics 2006.

www.communities.gov.uk/planningandbuilding/planningbuilding/planningstatistics/livetables/tablescommercialindustrialfloors/ (See accompanying spreadsheet for more information)

¹⁴ Data recorded at April 2005. Joint return with CLG on completions.

Graph I: 'Without Additional Measures' Trajectories



5.10 The table below summaries the results from the trajectories and shows the difference between the scenarios for each sector.

Table 3: Summary of 'Without Additional Measures' Trajectories

	CO ₂ Emissions (kt pa CO ₂)		Percentage Change	Percentage Difference
	2005	2026		
Residential - 32,000 Dwellings	20397	17350	-14.9%	-
Residential - 36,000 Dwellings	20397	17574	-13.8%	1.3%
Residential - 46,000 Dwellings	20397	18134	-11%	3.2%
Commercial - 3% Growth	23857	27694	16%	-
Commercial - 3.16% Growth	23857	28240	18.4%	2%
Commercial - 3.4% Growth	23857	29059	21.8%	2.9%
Transport – 13.49% Growth	22762	25832	13.5%	-
Transport – 15.17% Growth	22762	26215	15.2%	1.5%
Transport – 19.39% Growth	22762	27175	19.4%	3.7%

PART 2

6. Carbon Trajectories for Different Scenarios

6.1 PPSI recommends that trajectories are produced to monitor the performance of the RSS and to influence policy implementation. This section sets out the methodology that has been applied to develop trajectories for a range of scenarios. The trajectories will be used:

- as strategic tools to shape policies and test the level of ambition of RSS demonstrating the extent to which development, over time, is expected to become more carbon friendly
- to contribute to the Regional Assembly's annual monitoring and reporting function.

Residential Trajectories – Existing Completion Trends

6.2 **Potential Trend** - The residential 'without additional measures' trajectories in graph 1, assume that new dwellings comply with Part L building regulations and the emissions arising are uniform. However this is unlikely to be true because of changes in the type of housing delivered and improved energy efficiency. Therefore a revised trajectory for residential emissions, below, has been prepared for comparative purposes.

6.3 The emissions arising from the Residential proportion of the DEFRA CO₂ emissions for 2005 have been split into weighted categories that represent the mix of housing stock in 2001 (Census). Data from the Energy Savings Trust¹⁵ (EST) has been used to determine an approximate CO₂ emissions rate for each dwelling type. Variations in building specification, construction material and heating were factored into this calculation. Table 3 below summaries the split of CO₂ emissions from different dwelling types.

Table 4: Energy use of different dwelling types

	Average energy efficiency of different property types	Total dwellings	Total dwellings (%)	Emissions/housing split	CO ₂ Emissions per dwelling type (kt x10 ⁻³)
Detached	35.7	1049669.1	30	7285.8	6.9
Semi	27.4	1014680.1	29	5580.6	5.5
Terrace	22.2	804746.3	23	4528.1	5.6
Flat	14.7	629801.5	18	3002.4	4.8
Total	100	3498897	100	20397.1	5.8

6.4 The housing completion trends from the South East Housing Type and Size report show an increase in the number of flats being built. In 2005/06, 53% of completions on the open market were flats. The effect of this rate staying constant is reflected in the trajectory modelled in graph 2.

¹⁵ Energy Saving Trust, 2006. Refurbishing dwellings – a summary of good practice. www.energysavingtrust.org.uk/uploads/documents/housingbuildings/CE189%20-%20refurbishing%20dwellings%20-%20a%20summary.pdf

6.5 If the percentage of completions was to remain at 53% then the percentage split of completions per annum would be as follows:

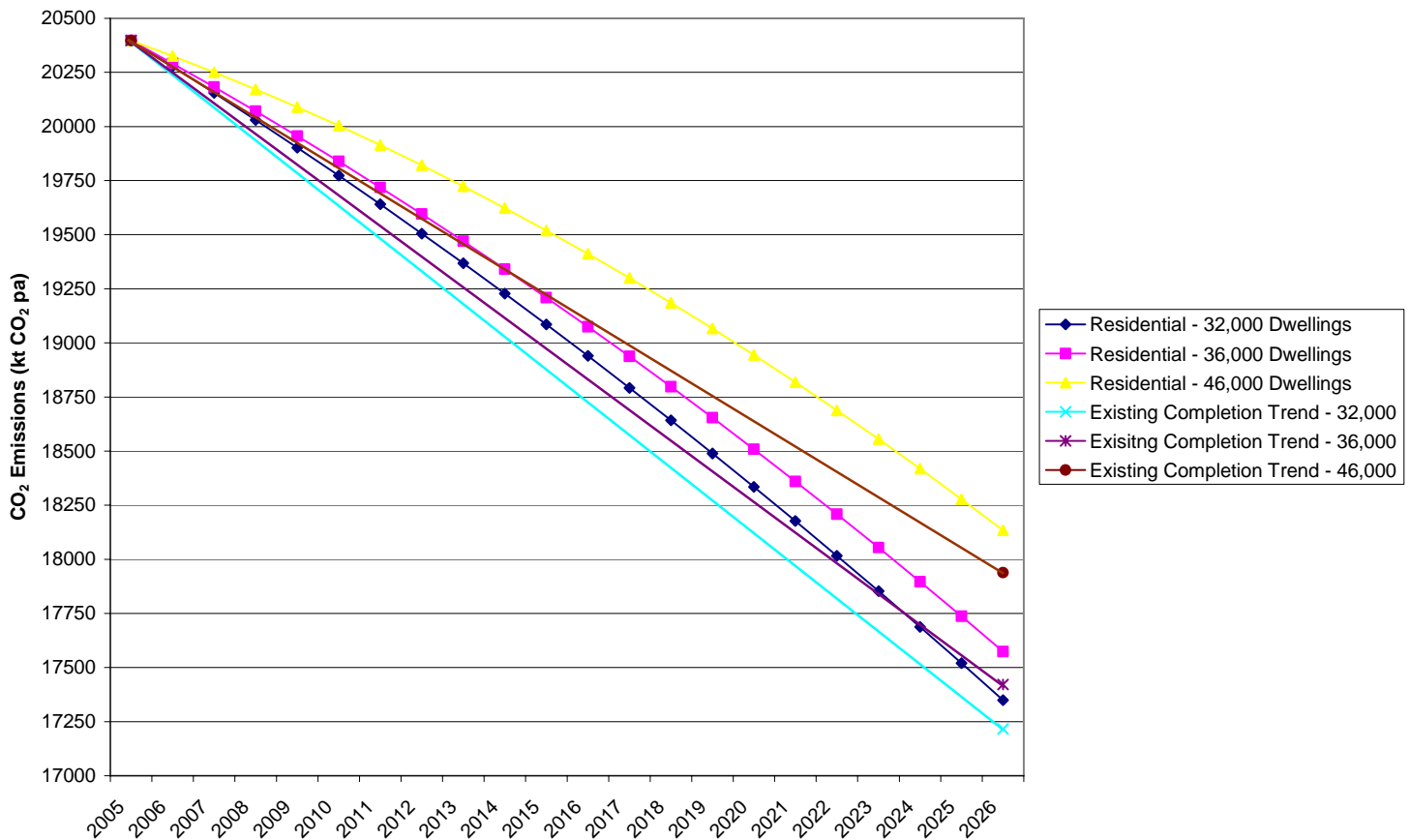
Table 5: Variations in per annum housing completions for each scenario

	Percentage	32,000	36,000	46,000
Detached	16.8%	5376	6048	7728
Semi Detached	16.2%	5184	5832	7452
Terrace	14%	4480	5040	6440
Flats	53%	16960	19080	24380
Total	100	32000	36000	46000

6.6 By applying these percentages across the plan period (until 2026) it is possible to predict how the overall housing stock may change if the existing rate of delivery of flats continues. Trajectories for each scenario have been developed to reflect the impact this would have on carbon emissions.

6.7 The graph below compares the ‘without additional measures’ trajectories and the completion trend (53% flats) trajectories. Each of the existing completion trend trajectories show that if the current percentage split was to continue (with the total housing provision being dominated by flats) then growth in CO₂ emissions would be minimally reduced when compared to the relevant ‘without additional measures’ trajectory shown below in graph 2.

Graph 2: Comparison between the Completion Trend (53% flats) Trajectories and ‘Without Additional Measures’ Trajectories



What's included in the completion trend (53%) flats trajectories?

Compliance with Building Regs – Part L	Energy White Paper Targets	Completion Trends – 53% Flats	Zero Carbon Homes by 2016	Earlier delivery of Zero Carbon Homes	32% Non compliance with Building Regs
✓	✓	✓	✗	✗	✗

6.8 **Potential Impact** - When compared against the ‘without additional measures’ trajectories (which assume that the housing stock remains constant), delivering 53% of completions as flats to 2026 would achieve:

- 32,000 Dwellings= 135 kt CO₂ pa reduction
- 36,000 Dwellings= 152 kt CO₂ pa reduction
- 46,000 Dwellings= 196 kt CO₂ pa reduction

Residential Trajectories – Impact of Proposed Changes in Building Regulations Requiring Zero Carbon Homes

6.9 **Policy Context-** The housing figures from the draft South East Plan Examination in Public Panel Report and the other two scenarios provide a basis for predicting what the impact of housing growth in the South East could be. However, the Government is proposing that by gradually improving building regulations, all new development will be zero carbon development by 2016.

6.10 Table 6 sets out when the improvements to building regulations are due to occur and the resulting energy/carbon efficiencies and graph 3 shows the relevant trajectory and potential impact on CO₂ emissions. One of the main ways of delivering the anticipated improvement in energy efficiency will be through incorporating on site renewable energy sources into new developments in accordance with Policy EN1 in the draft South East Plan. This policy has therefore been included within the trajectory on zero carbon homes because it will help to deliver the Government’s target.

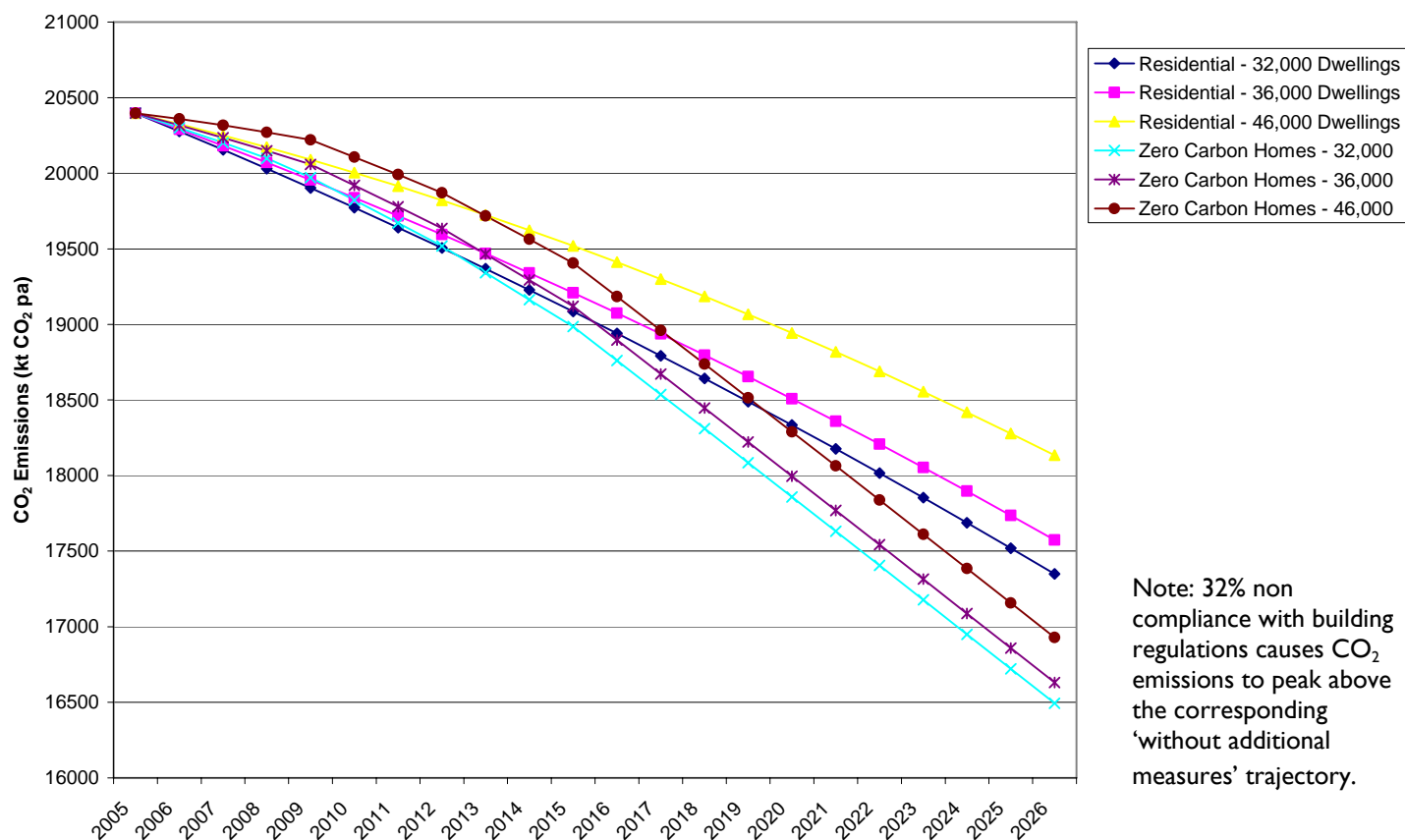
Table 6: Phasing for achieving zero carbon homes (Building A Greener Future)

Code 3: 2010 - 2012	25% improvement in energy/carbon performance compared to Part L (Building Regs)
Code 4: 2013 - 2015	44% improvement in energy/carbon performance compared to Part L (Building Regs)
Code 6: 2016+	‘Zero Carbon’

6.11 Current research into compliance with building regulations carried out by the Building Research Establishment (BRE) has shown that 32% of new build fails to meet Building Regulations¹⁶. Therefore to get an accurate estimate of what the impact of the changes to building regulations will be during the plan period we have incorporated this rate of non compliance into the modelling for the trajectories. For modelling purposes the 32% of dwellings failing to meet the required standard have been assigned the emissions value of the previous building regulations requirement for energy efficiency.

¹⁶ Assessment of energy efficiency impact of Building Regulations compliance, Brown M (2004), Building Research Establishment

Graph 3: Impact of delivering zero carbon homes



Note: 32% non compliance with building regulations causes CO₂ emissions to peak above the corresponding 'without additional measures' trajectory.

What's included in the zero carbon homes trajectories?

Compliance with Building Regs – Part L	Energy White Paper Targets	Completion Trends – 53% Flats	Zero Carbon Homes by 2016	Earlier delivery of Zero Carbon Homes	32% Non compliance with Building Regs
✓	✓	✗	✓	✗	✓

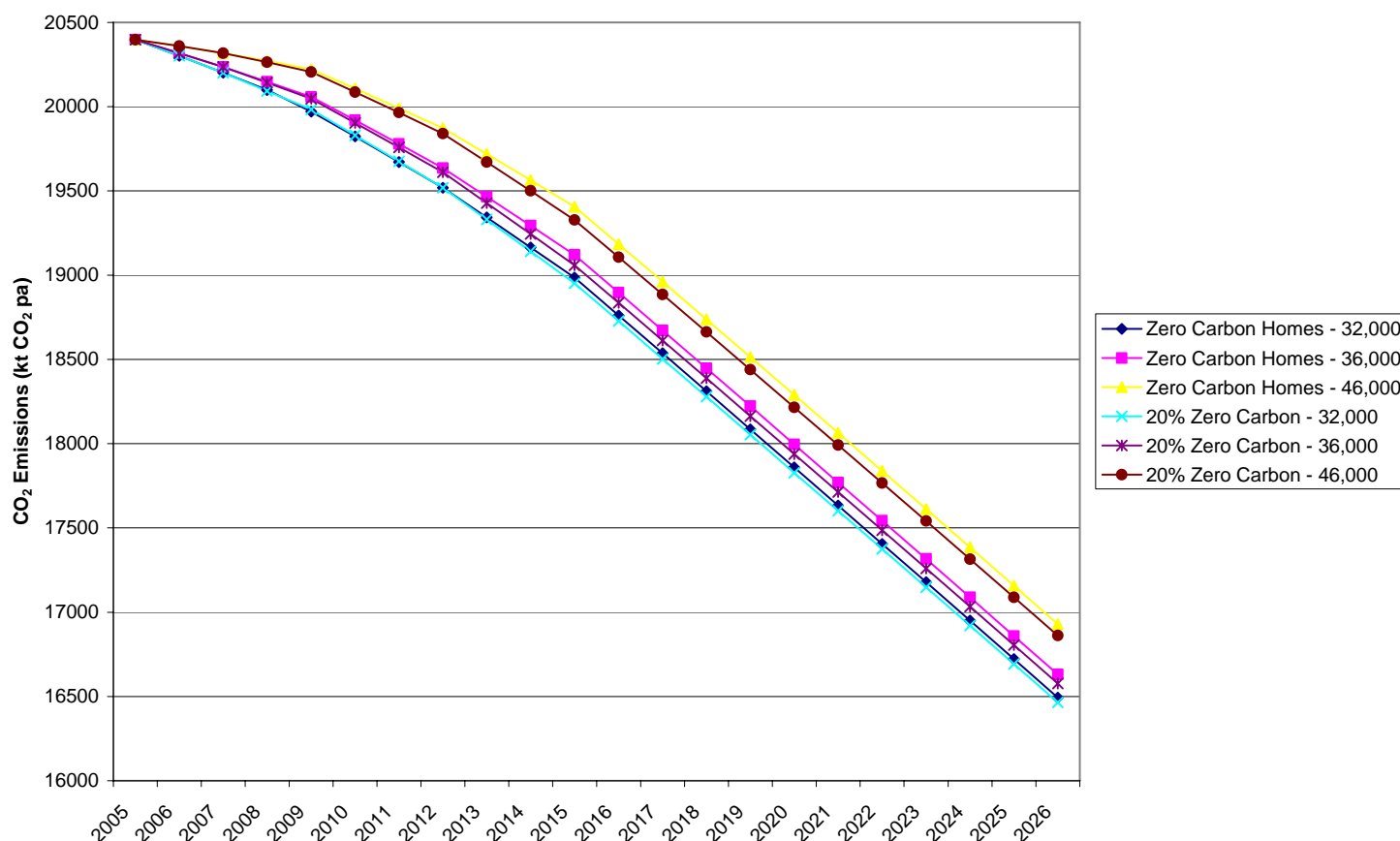
6.12 Potential Impact - Graph 3 predicts the impact of delivering the improvements in building regulations. The primary difference between the zero carbon homes trajectories and the residential 'without additional measures trajectories' is due to enforcement of the building regulations in the future. By 2026 this would result in 857 kt CO₂ pa being saved for the 32,000 scenario, 943 kt CO₂ pa for the 36,000 scenario and 1205 kt CO₂ pa for the 46,000 scenario.

6.13 Policy Context- The trajectories on the new building regulations above are based on a proposed national standard. However some local authorities wish to retain the flexibility to set more stringent standards and view building regulations as a minimum. To reflect this trajectories have been prepared for local authorities seeking compliance with the zero carbon standard by 2013. To illustrate the potential impact, the trajectories prepared are based on 20% of the housing growth being delivered to these higher standards. These trajectories provide an indication of what may be achievable and should be reviewed once a clearer picture of local authority's ambitions emerge. The phasing in table 6 below has been used to develop the trajectories.

Table 7: Phasing for achieving zero carbon homes applied to 20% of the housing growth

Code 3: 2008 - 2009	25% improvement in energy/carbon performance compared to Part L (Building Regs)
Code 4: 2010 - 2012	44% improvement in energy/carbon performance compared to Part L (Building Regs)
Code 6: 2013+	'Zero Carbon'

Graph 4: Delivery of Zero Carbon Homes with 20% of Completions Meeting the Zero Carbon Standard by 2013



What's included in the 20% zero carbon homes trajectories?

Compliance with Building Regs – Part L	Energy White Paper Targets	Completion Trends – 53% Flats	Zero Carbon Homes by 2016	Earlier delivery of Zero Carbon Homes	32% Non compliance with Building Regs
✓	✓	✗	✓	✓ (See paragraph 6.12)	✓

6.14 **Potential Impact** - Graph 4 indicates that if 20% of the housing growth is delivered to more stringent standards, residential CO₂ emissions in the South East could potentially be reduced by the following when compared to the zero carbon homes trajectories (graph 3).

- 32,000 Dwellings= 28 kt CO₂ pa reduction
- 36,000 Dwellings= 53 kt CO₂ pa reduction

- 46,000 Dwellings= 67 kt CO₂ pa reduction

The potential reductions above should be treated with caution because of the various assumptions and because some local authorities will set higher standards than those currently proposed in 'Building a Greener Future'. If local authorities with higher growth targets set more stringent standards then the impact could be more significant.

Public Sector Housing

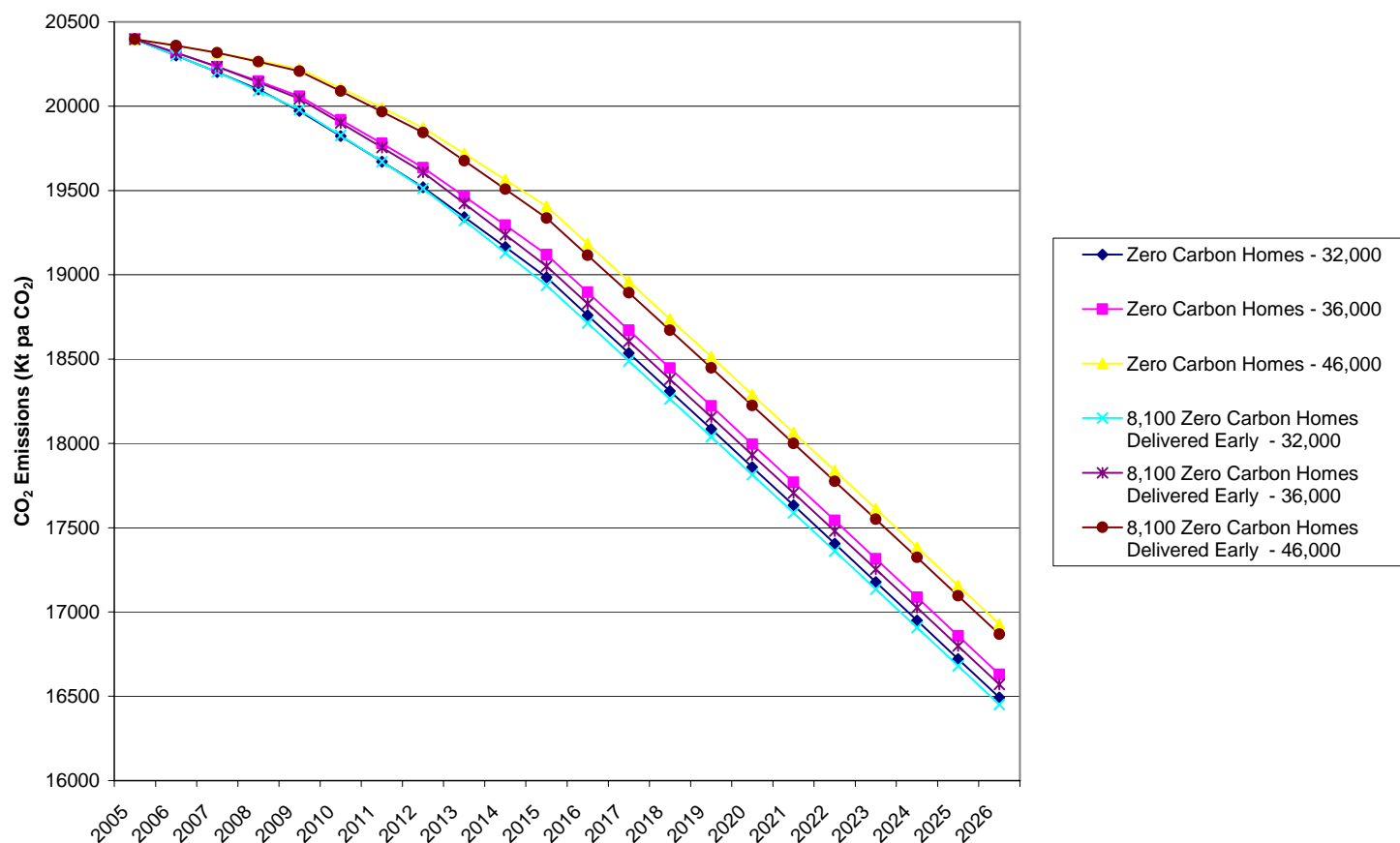
6.15 **Policy Context-** In 'Building A Greener Future' the Government identifies that all publicly funded housing is expected to comply with Code Level 3 prior to 2010 which requires a certain level of improved energy/carbon performance. We have therefore assumed that this trend will continue and that publicly funded housing will always need to meet a higher standard (including carbon and energy efficiency) than that being required of the private sector.

6.16 In 2006/7 - 8,121 publicly funded affordable homes were delivered with 8,100 expected in 2007/8. Therefore the assumption is that a minimum of 8,100 publicly funded dwellings will be delivered per annum, in accordance with the phasing set out below.

Table 8: Phasing of publicly funded housing

Code 3: 2008 - 2009	25% improvement in energy/carbon performance compared to Part L (Building Regs)
Code 4: 2010 - 2012	44% improvement in energy/carbon performance compared to Part L (Building Regs)
Code 6: 2013+	'Zero Carbon'

Graph 5: Delivery of Zero Carbon Homes with 8,100 Public Sector Dwellings Complying with Higher Standards of Building Regulations



What's included in the Public Sector Compliance with Higher Standards of Building Regulations trajectories?

Compliance with Building Regs – Part L	Energy White Paper Targets	Completion Trends – 53% Flats	Zero Carbon Homes by 2016	Earlier delivery of Zero Carbon Homes	Non compliance with Building Regs
✓	✓	✗	✓	✓ (8,100 publicly funded)	✓

6.17 Potential Impact – The 8,100 publicly funded dwellings are included within the housing growth figures and graph 5 demonstrates the savings that can be achieved in comparison to the zero carbon homes trajectories. These are summarised below:

- 32,000 Dwellings= 41 kt CO₂ pa
- 36,000 Dwellings= 60 kt CO₂ pa
- 46,000 Dwellings= 59 kt CO₂ pa

Commercial Trajectories – Zero Carbon non-domestic buildings

- 6.18 **Policy Context** - A timetable for reducing carbon emissions from commercial buildings, similar to the phasing for zero carbon homes in 'Building a Greener Future' has yet to be formulated or consulted upon. However in PPSI, Communities and Local Government (CLG) confirm that a timetable for reducing carbon emissions from new non domestic buildings will emerge in the future.¹⁷
- 6.19 To model the potential benefits of improved energy efficiency, research by the UK Green Building Council on possible trajectories towards zero carbon non domestic development have been used¹⁸. This provides an indication of what maybe achievable but should be revised once definitive proposals towards achieving zero carbon non domestic development emerge.
- 6.20 The phasing towards achieving zero carbon non domestic development for a range of potential options is shown in table 9 below.

Table 9: Possible options for achieving zero carbon non domestic development

	Option 1	Option 2	Option 3¹⁹
Code Level 3 - 25% Reduction in energy efficiency/carbon emissions (Building Regs 2006)	2010	2013	2010
Code Level 4 - 44% Reduction in energy efficiency/carbon emissions (Building Regs 2006)	2013	2025	2015
Code Level 6 - Zero Carbon	2016	2050	2020

- 6.21 It will be impossible to achieve zero carbon non domestic development for some sectors. Therefore the phasing towards zero carbon non domestic development has only been applied to the service sector economy (68%)²⁰.
- 6.22 Although a range of options are being considered the difference in potential carbon emission savings are minimal and therefore not visible in graph 6 below.

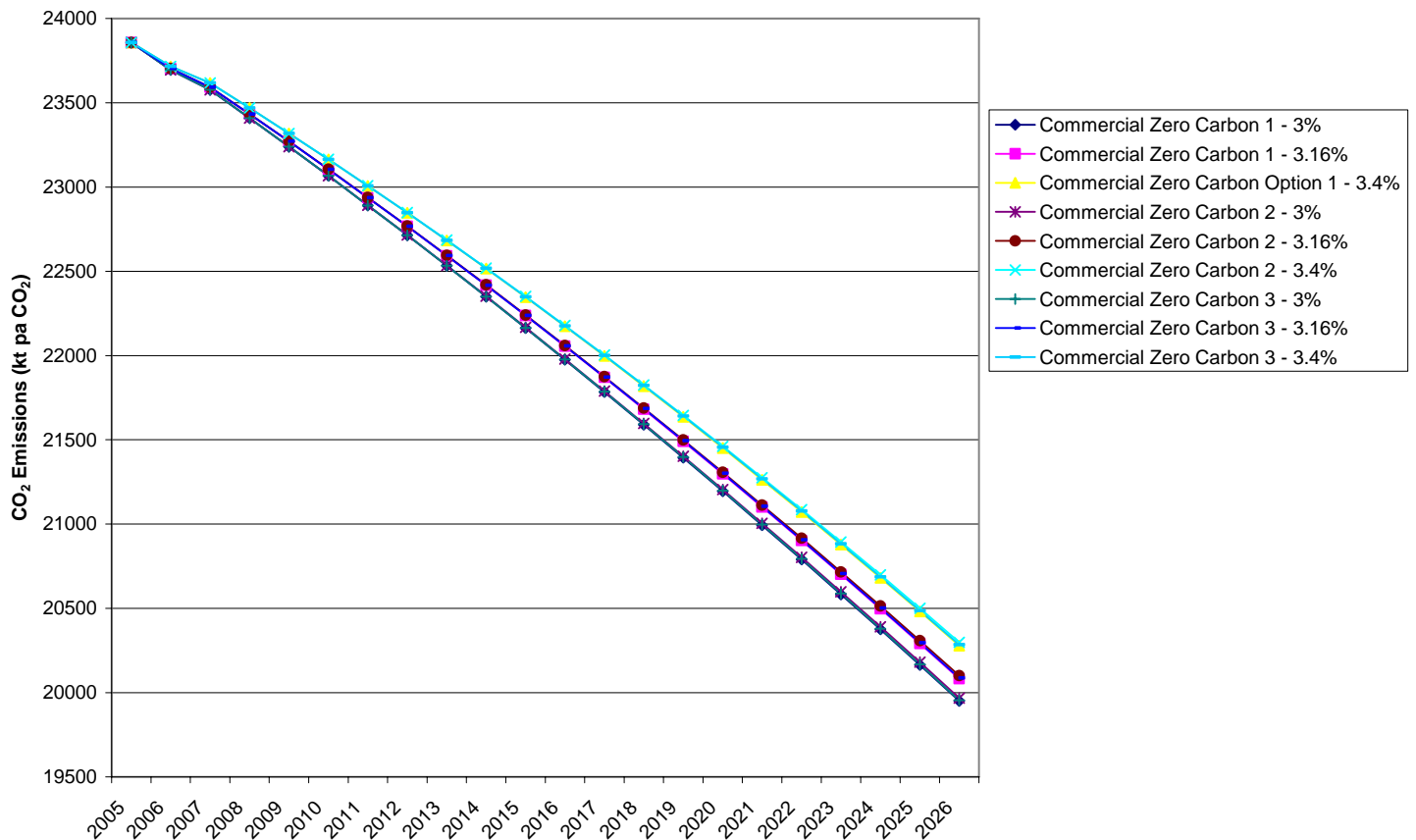
¹⁷ Also see Planning, 14th March 2008. *Date set for Zero Carbon.*

¹⁸ UK Green Building Council and CLG, 2007. Report on carbon reductions in new non-domestic buildings.

¹⁹ The 2020 deadline would be for achieving 'zero regulated energy' and the phasing towards achieving this deadline is assumed for modelling purposes.

²⁰ Data taken from Experian Business Strategies, Autumn 2007.

Graph 6: Possible Carbon Trajectories for Zero Carbon Non Domestic Development



What's included in the zero carbon non domestic development trajectories?

Energy White Paper Targets	Decline in CO ₂ emissions from manufacturing	Commercial growth targets	Variable phasing for non domestic zero carbon development
✓	✓	✓	✓

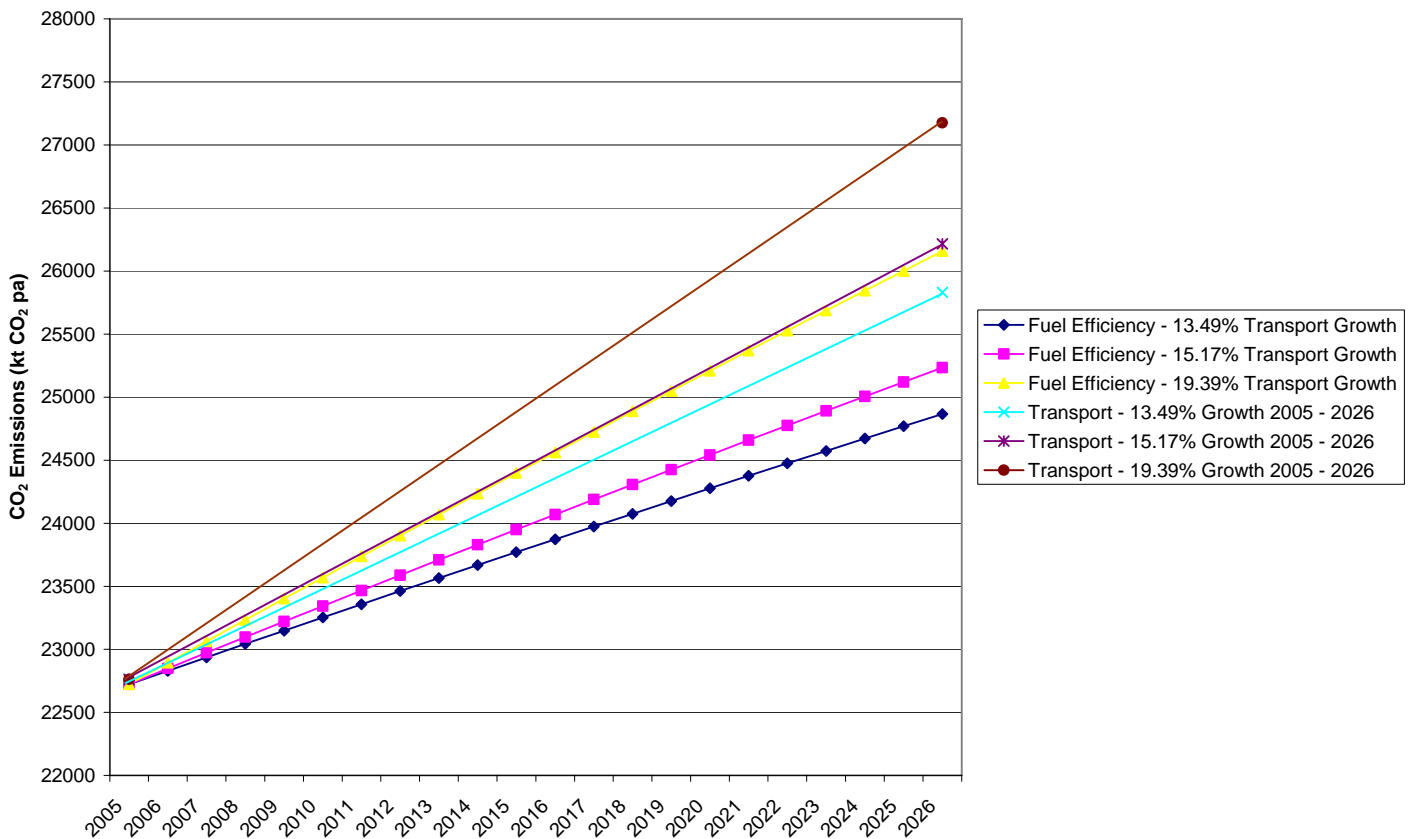
6.23 Potential Impact – The ‘without additional measures’ commercial trajectories shown in graph I indicate a rise in emissions from commercial growth. Delivering a zero carbon policy for commercial development could help to achieve significant reductions in carbon emissions as shown above. The potential carbon emissions that could be saved by implementing this policy equate to approximately 8227 kt CO₂ pa. Options one and three would have the most impact in reducing carbon emissions due to the earlier implementation of the proposed policy.

Transport Trajectories

6.24 Policy Context - The ‘without additional measures’ trajectories highlights that despite sustainable land use policies, there inevitably will be a rise in CO₂ emissions from transport due to the associated growth within the South East.

6.25 However as the energy efficiency of vehicles improves the CO₂ emitted per trip will reduce. This has been taken into account when modelling the trajectories in graph 7 and provides an insight into the reductions that could be delivered through such technological improvements. It is anticipated that improvements in efficiency will reduce transport emissions by 6.2% by 2010 and 7.9% by 2020²¹. The percentage increase in improvements equates to 0.17% annually between 2010 and 2020. It has been assumed that this improvement rate will occur incrementally from 2004 to 2026. Therefore in 2005 fuel efficiency will equate to a 5.35% improvement and in 2026, an 8.92% improvement.

Graph 7: Impact of Fuel Efficiency Improvements on CO₂ Emissions from Transport



What's included in the growth in fuel efficiency trajectories?

Improvements in vehicle fuel efficiency	Growth in future transport demand arising from housing growth
✓	✓

6.26 **Potential Impact** – Despite reductions from improved fuel efficiency due to technological improvements emissions associated with transport will still only decrease by 3.7% by 2026 in comparison to the transport ‘without additional measures’ trajectory. This demonstrates that other measures, such as those which achieve modal shift, will be required if CO₂ emissions are to be reduced.

²¹ UKE, 2006: UK Energy and CO₂ emissions projections. Updated projections to 2020.

Table 10: Summary of possible reductions in CO2 emissions from improvements in vehicle fuel efficiency

Scenario	CO₂ emissions in 2026 arising from residential growth (kt pa CO₂)	CO₂ emissions in 2026 with improvements to fuel efficiency (kt pa CO₂)	Reduction in CO₂ emissions
32000 dwellings	25832.36	24866.23	3.7%
36000 dwellings	26214.76	25234.32	3.7%
46000 dwellings	27175.30	26158.95	3.7%

7. Carbon Dioxide Reductions in the South East

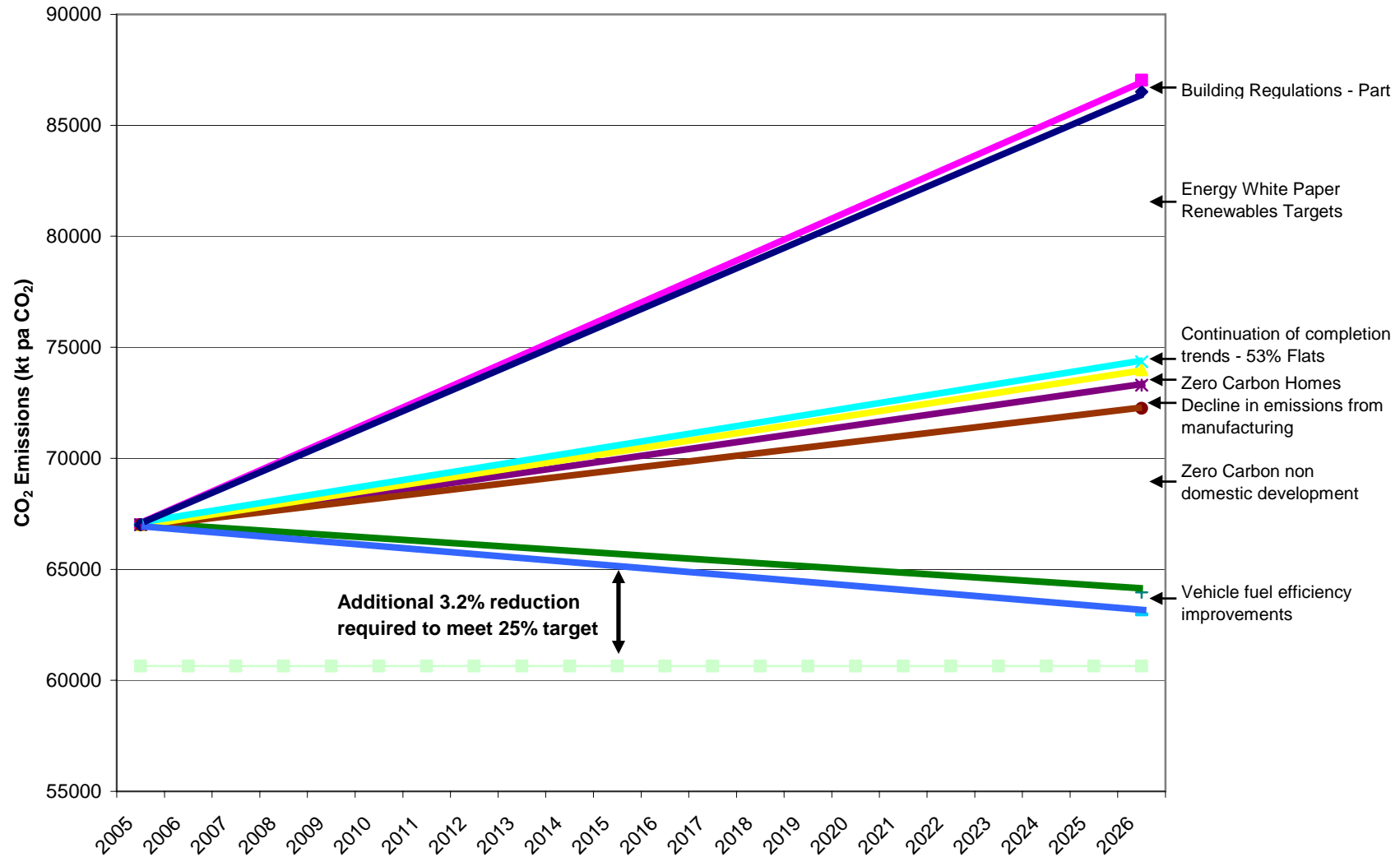
- 7.1 The trajectories are a predictive tool that enables the potential impact of regional and national policies, behavioural change and technological advancements to be quantified. They can be used to estimate the impact of measures in mitigating against future climate change in the South East and enable performance against existing targets to be determined.
- 7.2 Table 11 below summarises the potential carbon emission savings that could be achieved if the measures identified in section 6 are successfully implemented. The trajectories in graph 8 help to illustrate the contribution that each potential policy measure and technological improvement will have in mitigating against rising carbon emissions. Note, to enable the contribution of the Energy White Paper and Part L of the building regulations to be quantified a trajectory that excludes these two measures has been included in graph 8.
- 7.3 Policy CC2 on Climate Change in the draft South East Plan sets a target to reduce the region's carbon dioxide emissions by at least 25% below 1990 levels by 2015. By summarising the potential impact of the carbon trajectories it is possible to determine whether the target is achievable with the measures currently identified. It should be noted that the trajectories are estimates based on a series of evidenced assumptions. As the Government's climate change agenda progresses further, more data should emerge which will help to create more detailed projections of the capacity of policies and technologies to deliver carbon savings up to and past 2026.
- 7.4 To establish 1990 carbon dioxide emissions, national data on emissions in 1990²² has been broken down to a regional level by the relevant proportion of population.

²² DEFRA Statistical Release 27 March 2003. AEA Energy & Environment, DEFRA

Table II: Summary of carbon emissions displaced by scenarios calculated

	Scenarios	CO₂ Emissions - 2026 (kt pa CO₂)	Displaced Carbon Emissions (kt pa CO₂)	Average Displaced Emissions (kt pa CO₂)
Residential	Residential - 32,000 Dwellings (Without Energy White Paper Renewable Targets)	24314.54	-	-
	Residential - 36,000 Dwellings (Without Energy White Paper Renewable Targets)	24804.23	-	-
	Residential - 46,000 Dwellings (Without Energy White Paper Renewable Targets)	26028.44	-	-
	Residential - 32,000 Dwellings	17349.56	6964.98	7363.38
	Residential - 36,000 Dwellings	17573.65	7230.58	
	Residential - 46,000 Dwellings	18133.87	7894.57	
	Existing Completion Trend - 32,000	17215.46	134.10	160.39
	Existing Completion Trend - 36,000	17422.03	151.62	
	Existing Completion Trend - 46,000	17938.43	195.44	
	8,100 Zero Carbon Homes Delivered Early - 32,000	16451.57	897.99	1055.22
	8,100 Zero Carbon Homes Delivered Early - 36,000	16570.84	1002.81	
	8,100 Zero Carbon Homes Delivered Early - 46,000	16869.01	1264.87	
Commercial	Commercial - 3% Growth (Without Energy White Paper Renewable Targets and Decline in Emissions from Manufacturing)	34745.71	-	-
	Commercial - 3.16% Growth (Without Energy White Paper Renewable Targets and Decline in Emissions from Manufacturing)	35461.94	-	-
	Commercial - 3.4% Growth (Without Energy White Paper Renewable Targets and Decline in Emissions from Manufacturing)	36536.29	-	-
	Commercial - 3% Growth (Without Energy White Paper Renewable Targets)	33691.05	1054.66	1045.38
	Commercial - 3.16% Growth (Without Energy White Paper Renewable Targets)	34421.20	1040.74	
	Commercial - 3.4% Growth (Without Energy White Paper Renewable Targets)	35495.55	1040.74	
	Commercial - 3% Growth	27693.69	5997.36	6204.93
	Commercial - 3.16% Growth	28239.96	6181.24	
	Commercial - 3.4% Growth	29059.37	6436.18	
	Commercial Zero Carbon 1 - 3%	19950.94	7742.75	8226.60
	Commercial Zero Carbon 1 - 3.16%	20082.77	8157.19	
Commercial Zero Carbon 1 - 3.4%	20279.52	8779.85		
Transport	Transport - 13.49% Growth 2005 - 2026	25832.36	-	-
	Transport - 15.17% Growth 2005 - 2026	26214.76	-	-
	Transport - 19.39% Growth 2005 - 2026	27175.30	-	-
	Fuel Efficiency - 13.49% Transport Growth	24866.23	966.13	987.64
	Fuel Efficiency - 15.17% Transport Growth	25234.32	980.43	
	Fuel Efficiency - 19.39% Transport Growth	26158.95	1016.36	

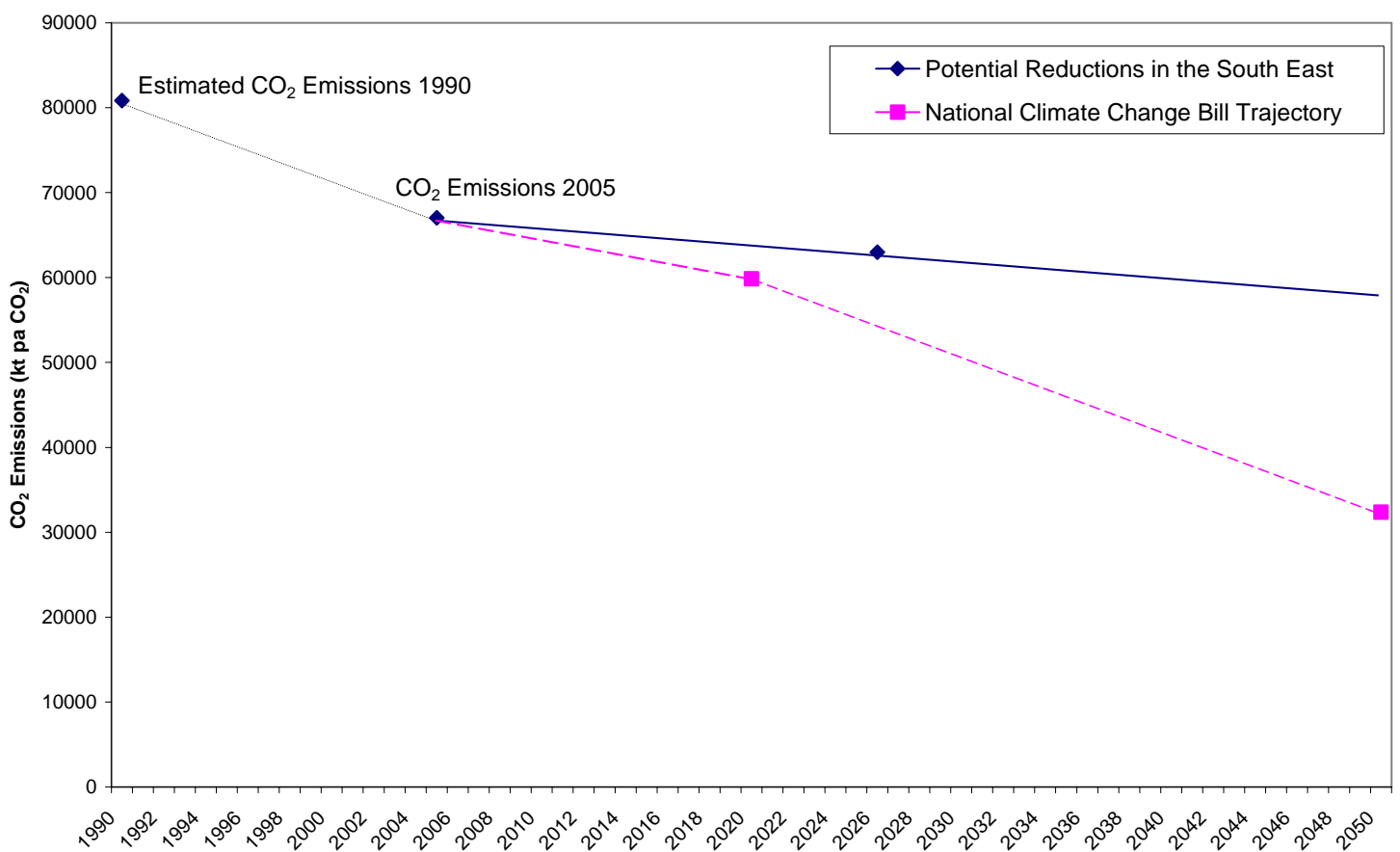
Graph 8: CO₂ Reductions in the South East



7.5 The cumulative impact of all the measures identified could potentially result in a 22% reduction in CO₂ emissions when compared to 1990 levels. This is 3.2% short of achieving the target to reduce carbon emissions by 25% below 1990 levels by 2015 (Policy CC2 in the draft South East Plan).

7.6 This indicates that current measures do little more than offset the emissions associated with growth in the South East. More action to reduce emissions is therefore required. This is especially true when considering the targets in the Climate Change Bill which sets out a new legal framework for the UK to achieve, through international and domestic action, a 26-32% reduction in emissions on 1990 levels by 2020 and a 60% reduction on 1990 levels by 2050.

Graph 9: Potential CO₂ Trajectory for the South East compared to National Targets in the Climate Change Bill



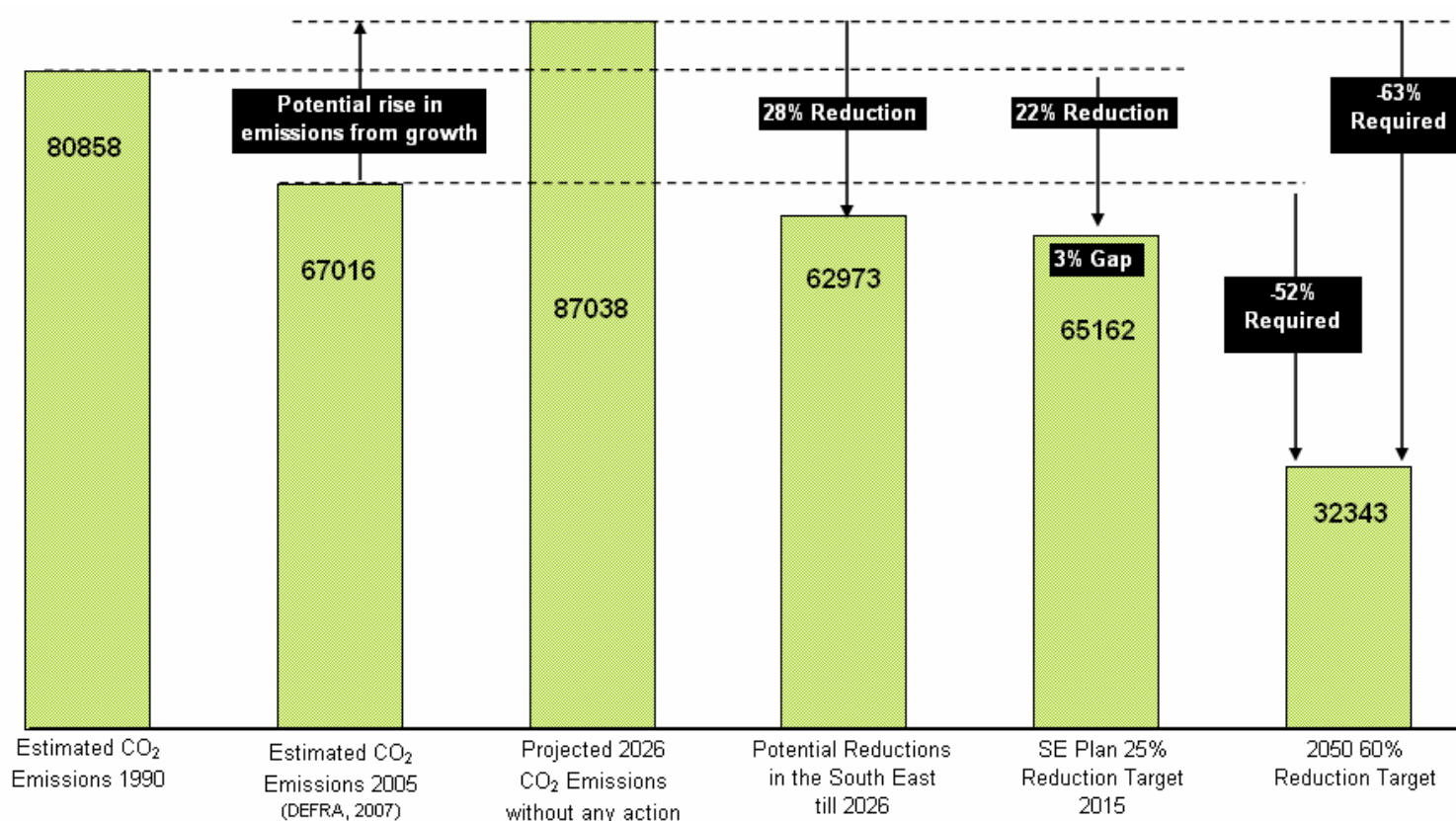
7.7 The calculated trajectory for the South East is more robust over a shorter timescale but helps to indicate that significant policy changes, implementation measures and behaviour change are required if the South East is to meet the Government’s 2050 targets.

7.8 With the exception of the improvements in fuel efficiency the draft South East Plan will have some impact on all the measures identified within the paper. The impact of the planning system in the South East will therefore mitigate against the carbon emissions arising from the growth in the region as shown in graph 8 but will have limited impact in delivering the necessary carbon reductions required.

8. Conclusions and Recommendations

- 8.1 The baseline and trajectories produced for the South East, are representative of what is achievable with the existing data. The DEFRA local and regional CO₂ emissions estimates for 2005 is currently the most robust and feasible source of data to establish a baseline and develop trajectories. DEFRA's commitment to backcasting up to 2005 means that this dataset will provide a robust time series to monitor against in the future.
- 8.2 The methodology applied within this report and the accompanying spreadsheet could provide the basis for monitoring regional carbon emissions in the future. The methodology cannot be used for inter regional comparisons which will require further national guidance.
- 8.3 The Government's publication of 'Building A Greener Future' and the Code for Sustainable Homes has made it easier to predict the changes or anticipated changes that may occur in CO₂ emissions from residential developments in the future. Therefore the predictions emerging from these trajectories are more robust because the assumptions relate directly to Government guidance. The Government should be encouraged to develop a similar policy timetable for achieving zero carbon non domestic development because of the reductions in emissions that can be achieved by delivering this policy agenda across the commercial sector.
- 8.4 Modelling growth in CO₂ emissions for the transport sector is problematic. The spatial distribution of housing is likely to affect this and guidance on trends or data to apply to this trajectory would be beneficial, especially given that CLG is trying to promote a more unified approach to the preparation of trajectories. Consideration should therefore be given to developing a detailed transport model that relates to the spatial distribution of existing transport infrastructure and future growth options.
- 8.5 Logical assumptions have been applied to develop the commercial 'without additional measures' trajectories. However if the robustness of this trajectory is to be improved, consideration should be given to the development of an economic model (that can be updated annually once DEFRA's local and regional CO₂ emissions estimates are released) to support the trajectories. If this approach is undertaken then the preferred methodology should be developed for all the regions to ensure consistency when developing trajectories.

Summary of CO₂ reduction measures in the South East



8.6 The trajectories for the South East enable the following conclusions to be drawn:

- Carbon emissions in the South East need to be reduced by a further 3% if the region's target (to cut emissions 25% below 1990 levels by 2015) is to be achieved.
- The reductions achievable are based on:
 - Energy White Paper Renewable Targets being achieved.
 - The majority of completions in the future being flats.
 - Zero carbon homes being delivered with 32% non compliance and zero carbon non domestic development being delivered.
 - Emissions from manufacturing continuing to decline.
 - New development being concentrated in areas that promote alternative modes of transport to the car; and
 - Improvements to vehicle fuel efficiency.

Without implementation of these measures carbon dioxide emissions in the South East would rise by a 1/3.

- To comply with the Climate Change Bill CO₂ emissions need to be reduced by 60% below 1990 levels by 2050. This research indicates that this translates to a 52% reduction below 2005 levels.²³
- This research also suggests that if the targets in the Climate Change Bill and the draft South East Plan are to be achieved then additional measures will be required at a range of levels in the imminent future.

²³ This could potentially be used as a baseline for monitoring purposes against the Governments 60% target if subsequent revisions of this research confirm that it is a robust figure.

Appendix I - Data Quality Check

The baseline data for this report comes from DEFRA's local and regional carbon dioxide emissions for 2005. This provides a robust baseline but a number of assumptions based on additional datasets have been made to develop the trajectories. Whilst this is the only way of modelling the impact of planning policies and future technological change, the validity of the data/figures emerging need to be checked to ensure the validity of the research.

Total carbon emissions 2005

Regional CO₂ emissions = 67016 kt CO₂ pa (DEFRA, 2007. 2005 Experimental Statistics on Carbon Dioxide emissions at Local Authority and Regional Level.)

UK CO₂ emissions = 557,545.91 kt CO₂ (UK GHG Inventory Data 2005)

Government Office Region	2006 Population	Breakdown of Emissions (Kt CO ₂)
North East	2555700.00	24214.51
North West	6853200.00	64932.08
Yorkshire and The Humber	5142400.00	48722.75
East Midlands	4364200.00	41349.53
West Midlands	5366700.00	50847.92
East	5606600.00	53120.91
London	7512400.00	71177.81
South East	8237800.00	78050.76
South West	5124100.00	48549.36
Wales	2965900.00	28101.04
Scotland	5116900.00	48481.14
Column Total	58845700.00	557547.80

UK Emissions = 557545.91
Emissions per person = 0.01

- $67016/100 = 670.16$
- $78050.76 - 67016 = 11034.76$
- $11034.76/670.16 = 16.47\%$

Percentage difference in figures = 16.5%

Residential emissions 2005

Residential emissions for the South East = 20397 kt CO₂ pa

East Midlands Regional Assembly Carbon Trajectories = 6.19 tCO₂ per household

- Dwellings in the SE in 2005 = 3498897

$$3498897 \times 0.00619 = 21658 \text{ kt CO}_2 \text{ pa}$$

Percentage difference in figures = 6.2%

Comparison with Projections from the Energy White Paper

Source: Department for Business Enterprise & Regulatory Reform, 2008. Updated Energy and Carbon Emissions Projections, The Energy White Paper.

www.berr.gov.uk/files/file39580.pdf

The carbon emissions projections from the Energy White Paper have been used to calculate approximate figures that the calculated savings from the residential, commercial and transport trajectories can be compared to.

	2020 UK estimates (DBERR)	2006 UK Population	UK per capita emissions	2006 South East Population	Estimated 2020 Emissions for the SE using DBERR data	Data from Trajectories	% difference in trajectory data and DBERR estimates for the SE
Residential	183,000	58845700	0.0031	8237800	25618.14	16570.84	35.32
Services & Industry	365,000	58845700	0.0062	8237800	51096.29	28239.96	44.73
Transport	408,000	58845700	0.0069	8237800	57115.85	25234.32	55.82

Glossary

Baseline – Initial breakdown of carbon emissions data that underpins the development of carbon trajectories for each sector.

Building Regulations – Regulations to ensure the health and safety of people and reduce the environmental impact of new development or alterations to existing buildings. E.g. Energy efficiency of buildings.

Climate Change Bill – Government legislation to address the causes and impacts of climate change. The Bill includes legally binding targets to reduce the UK's carbon dioxide emissions.

Code for Sustainable Homes – The Code measures the sustainability of a home against design categories, rating the 'whole home' as a complete package. The design categories included within the Code are: energy/CO₂, pollution, water, health and well-being, materials management, surface water run-off, ecology, waste.

Communities and Local Government (CLG) – The Government department responsible for establishing the policy framework for planning.

Department for Environment, Food and Rural Affairs (DEFRA) – The Government department responsible for protecting and reducing our impact on the environment.

Displaced Emissions – If a holistic approach to reducing carbon emissions is not pursued then the cause of emissions could shift from one source to another, therefore not achieving the potential reduction in emissions.

Energy White Paper Targets – Government targets for the percentage of energy from renewable sources by 2020 that will help to achieve a more sustainable and secure energy mix in the future.

GVA – Gross Value Added: A measure of the contribution that each individual producer, industry or sector makes to the economy of the UK.

kt – Kilo tonne, measure of carbon dioxide emissions used in this paper.

Modal Shift – Shift in transportation away from the car.

Pa – Per annum.

Planning Policy Statement (PPS) – Government's national policies on different aspects of spatial planning in England.

Regional Economy Environmental Input Output Model (REEIO) – Computer modelling tool that links economic policy, drawing upon a detailed regional economic model with environmental impacts.

Regional Accounting Matrix User Manual (RAMEA) – An environmental accounting tool designed to evaluate the economic and environmental interactions that exist within regions.

Regional Planning Body (RPB) – The organisation responsible for producing the South East Plan.

Regional Spatial Strategy (RSS) – The spatial planning strategy for a region. E.g. The South East Plan.

Scenarios – Combination of policies, likely implementation and technological advancements that have been modelled up to 2026 to determine the potential carbon dioxide emissions reductions associated with a range of eventualities.

South East Plan – The regional spatial strategy for the South East developed by the Regional Assembly, setting out a vision for the region from 2006 to 2026, addressing housing, transport, economy and the environment.

Trajectory – Prediction of the likely performance of policies and technologies in mitigating against carbon emissions. Strategic tool that can either reinforce policies or help to shape new policies that will help the region to become more carbon efficient.

'Without Additional Measures' – Trajectories for the residential, commercial and transport sectors that uses the baseline data to project forward to 2026 to indicate what the CO₂ emissions would be without any additional policy implementation or technical advances, if the growth targets identified are achieved and if the future energy mix from renewables identified in the Energy White Paper is achieved.

Zero Carbon – Net carbon dioxide emissions that equate to zero.

References

- Building Research Establishment, 2004. Assessment of energy efficiency impact of Building Regulations compliance, Brown M (2004).
- Communities and Local Government, 2006. Building A Greener Future: Towards Zero Carbon Development.
www.communities.gov.uk/archived/publications/planningandbuilding/buildinggreener
- CLG Live Tables on Commercial and Industrial Floorspace and Rateable Value Statistics 2006.
www.communities.gov.uk/planningandbuilding/planningbuilding/planningstatistics/livetales/tablescommercialindustrialfloors/
- DBERR, 2007. Meeting the Energy Challenge, A White Paper on Energy.
- DEFRA, 2007. 2005 Experimental Statistics on Carbon Dioxide emissions at Local Authority and Regional Level.
www.defra.gov.uk/environment/statistics/globalatmos/globalghg.htm
- DEFRA Statistical Release 27 March 2003. AEA Energy & Environment, DEFRA
- DFT, 2007. Road Transport Forecasts for England 2007.
www.dft.gov.uk/pgr/economics/ntm/071023_AnnualForecast07.pdf
- Energy Saving Trust, 2006. Refurbishing dwellings – a summary of good practice. www.energysavingtrust.org.uk/uploads/documents/housingbuildings/CEI89%20-%20refurbishing%20dwellings%20-%20a%20summary.pdf
- Experian Business Strategies, Autumn 2007.
- National Housing and Planning Advice Unit, 2007. Developing a target range for the supply of new homes across England.
- RAMEA, Regional Economic Environmental Accounts. (RAMEA User Manual - REEIO econometric model) 8/11/2007.
- SEEDA, 2006. The Regional Economic Strategy.
- South East Plan, March 2006. Technical Note 3, Transport. www.southeast-ra.gov.uk/southeastplan/plan/march_2006/tech_notes/technical_note_3-transport-march_2006.pdf
- South East Regional Sustainability Framework, 2008. www.southeast-ra.gov.uk/our_work/planning/sus_dev/rsf.html
- UKE, 2006: UK Energy and CO2 emissions projections. Updated projections to 2020.

UK Green Building Council and CLG, 2007. Report on carbon reductions in new non-domestic buildings.

WWF, IPPR & RSPB, 2007. 80% Challenge - Delivering a low carbon UK