



Sustainable Development Unit

# NHS England Carbon Emissions: Carbon Footprint modelling to 2020

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## 1. Introduction

In 2009 the NHS published the NHS Carbon Reduction Strategy.<sup>1</sup> The evidence base for this strategy is based on carbon footprint research, commissioned by the NHS Sustainable Development Unit (NHS SDU). The research has been undertaken in two phases:

- **Phase 1:** Carbon footprinting report<sup>2</sup> - the Sustainable Development Commission (SDC) in conjunction with the Stockholm Environment Institute (SEI) completed a carbon footprinting analysis of the consumption based footprint of all NHS England activities. This research was co-funded by the NHS SDU and the SDC.
- **Phase 2:** Carbon footprint modelling to 2020 – this is the project described in this report. An analytical model is constructed which firstly forecasts baseline NHS England emissions to 2020, and secondly develops the capability to quantify policy interventions in terms of carbon reduction potential ‘wedges’. The project has been completed by Arup, the NHS SDU and the SEI, and was funded entirely by the NHS SDU.

The key headlines from the Phase 2 carbon footprinting modelling project are:

- The NHS carbon footprint is projected to rise under current trends to 23 MtCO<sub>2</sub> in 2020, an increase of 55% on the 1990 baseline of 15 MtCO<sub>2</sub>.
- The model successfully incorporates the ability to quantify policy interventions in terms of carbon reduction wedges. This makes it a powerful strategic tool for investigating the policy interventions needed to meet the required emissions trajectory paths.
- Eight pilot interventions were used in the model’s development. Taken together, these ‘wedges’ total annual savings of 4 MtCO<sub>2</sub> by 2020, which illustrate both the model’s capabilities and the potential for significant carbon reduction in NHS England.

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<sup>1</sup> *Saving Carbon, Improving Health* – NHS Carbon Reduction Strategy for England. NHS England (2009) [www.sdu.nhs.uk](http://www.sdu.nhs.uk)

<sup>2</sup> *NHS England carbon emissions: carbon footprinting report* – September 2008. SDC (2008) [www.sdu.nhs.uk](http://www.sdu.nhs.uk)

## 2. Summary of Phase 1: NHS England carbon footprint results

### 2.1 Overview

The consumption footprint of NHS England is based on three primary sectors which form the overall footprint:

- **Procurement:** Goods and services purchased by NHS England (excluding energy and travel).
- **Building energy:** Heating, hot water, electricity consumption and cooling
- **Travel:** Movement of people (i.e. patients, visitors and staff)

Procurement emissions are calculated based on an Input-Output (I-O) top-down analytical methodology. This calculates carbon dioxide (CO<sub>2</sub>) emissions based on expenditure data (from national level supply-and-use tables) and industrial sector emissions factors (These are generated through I-O equations and direct sectoral emissions from environmental accounts ). Building energy emissions are calculated from NHS energy consumption data collated by the Estates Return Information Collection (ERIC) data system. Lastly, travel emissions calculated from National Travel Survey (NTS) data are added to the resultant footprint.

The carbon footprint analysis calculates emissions for the period 1992-2004, since that is the range of years for which full I-O datasets (required for procurement emissions) are available.

### 2.2 Carbon footprint results (2004)

The NHS carbon footprint in 2004 was calculated to be 18.6 MtCO<sub>2</sub>, representing 25% of England's public sector emissions. The breakdown of emissions in the three primary sectors was as follows:

- Procurement: 11.1 MtCO<sub>2</sub> (60%)
- Building energy: 4.1 MtCO<sub>2</sub> (22%)
- Travel: 3.4 MtCO<sub>2</sub> (18%)

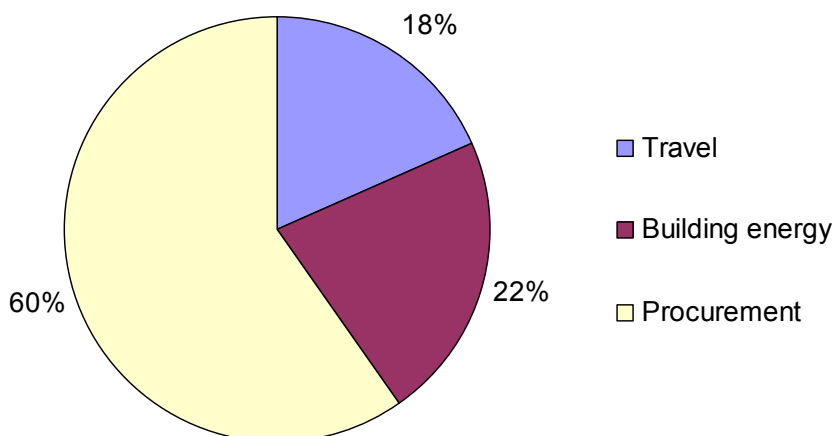
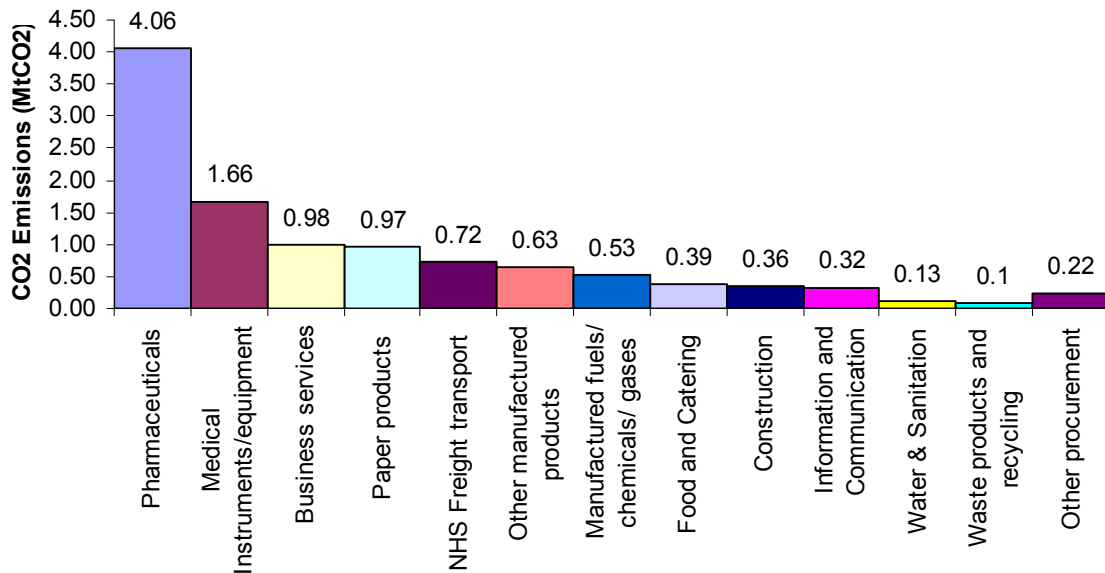


Figure 1: Breakdown of NHS England 2004 emissions

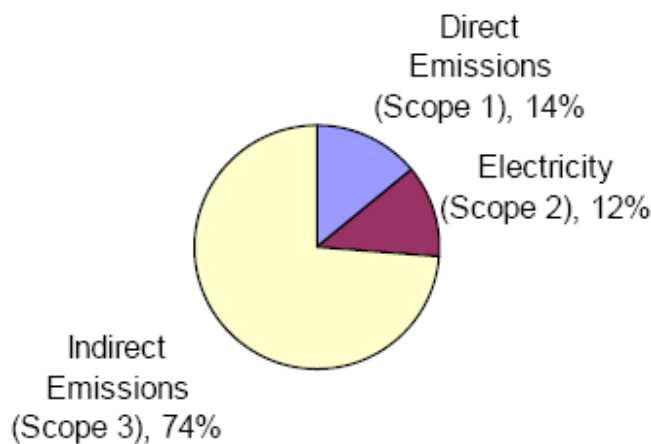
Procurement emissions are the embodied emissions in the manufacture and transportation of NHS purchased goods and services. The two largest procurement sub-sectors are pharmaceuticals and medical equipment, which total half of the procurement emissions as shown below. Pharmaceutical emissions are equivalent in size to either building energy or travel sectors.



**Figure 2: Breakdown of NHS England 2004 procurement emissions**

The importance of considering the total consumption footprint is revealed by the fact that only a quarter of NHS carbon emissions would be classified as scope 1 or 2 emissions defined below under the GHG protocol definitions, with the remainder (75%) being scope 3 emissions:

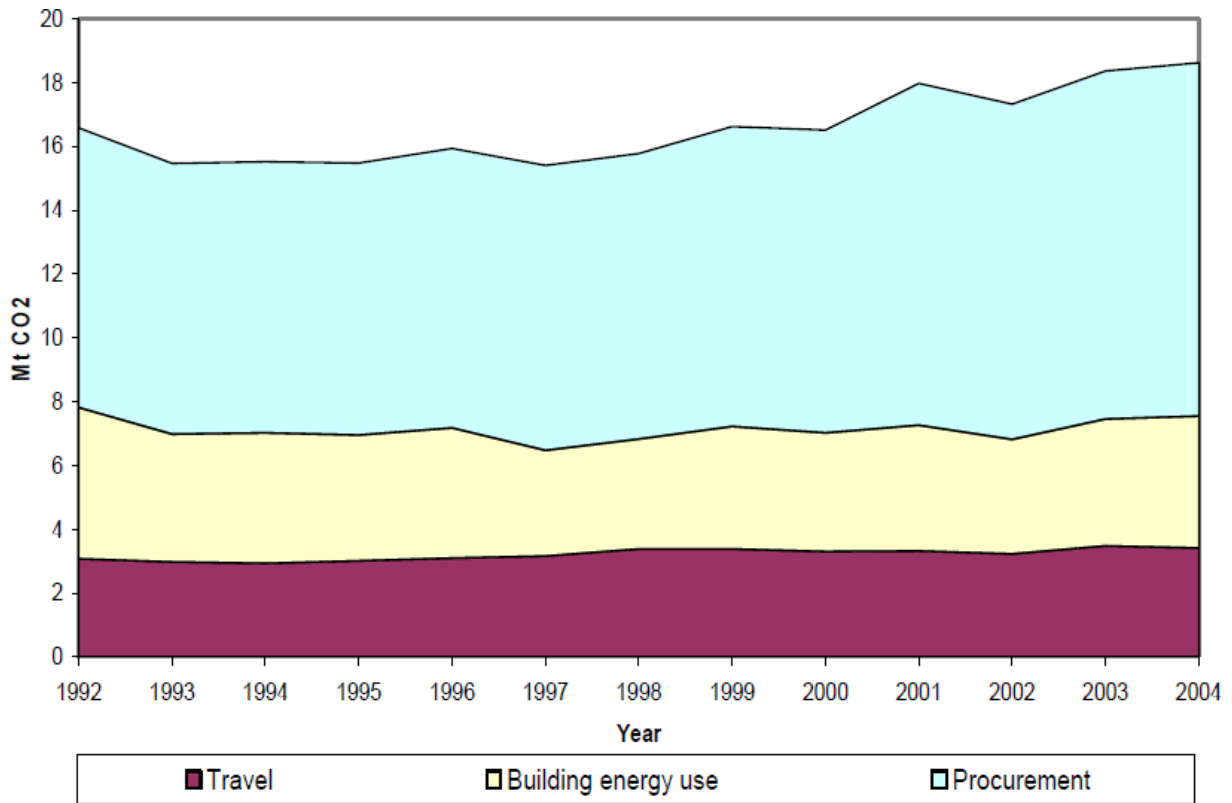
- Scope 1: Direct emissions (e.g. on-site energy production, NHS fleet travel)
- Scope 2: Electricity - indirect emissions (e.g. off-site electricity)
- Scope 3: Other indirect emissions (e.g. procurement, patient and visitor travel)



**Figure 3: GHG Protocol Scope 1-3 NHS England 2004 emissions breakdown**

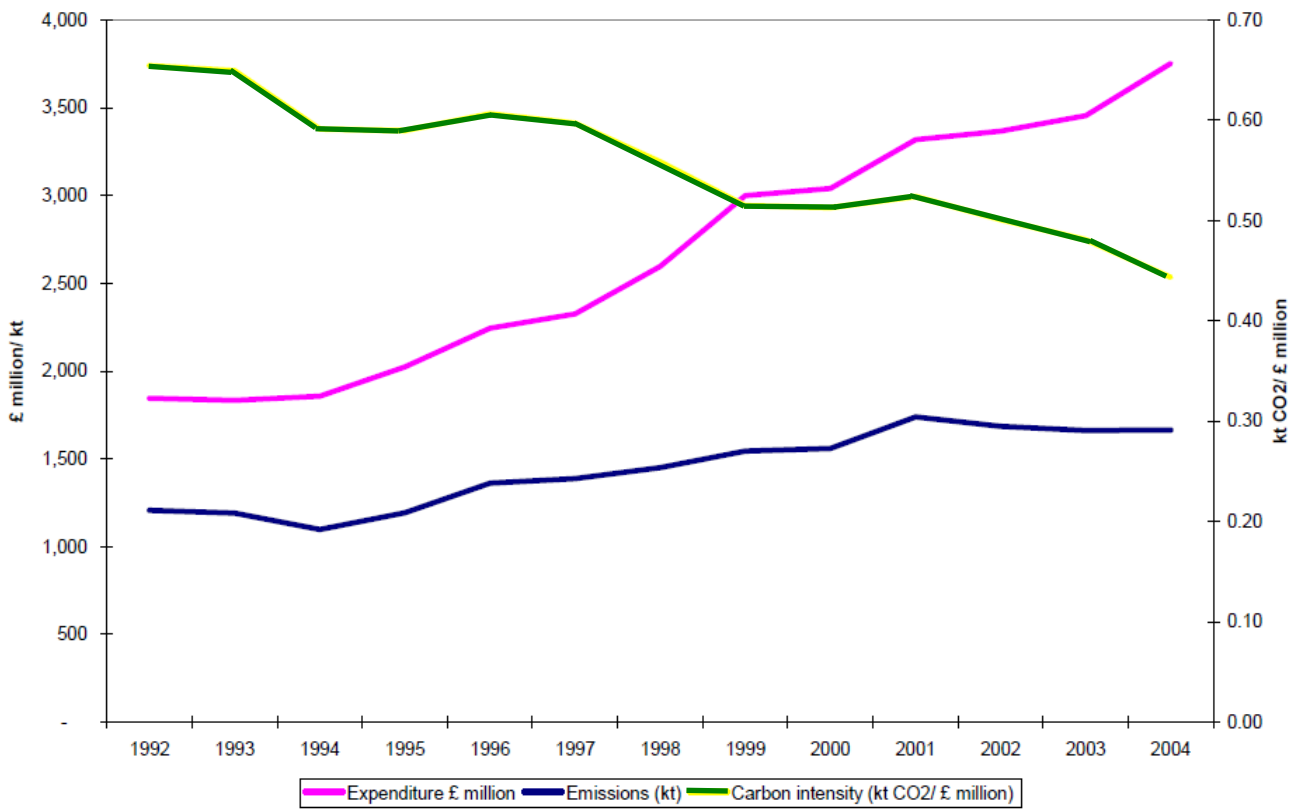
### 2.3 Timeseries carbon footprint results (1992-2004)

During 1992-2004, NHS England total consumption emissions rose by 12%, as shown below. Following a fall in emissions of 5% between 1992 and 1998, emissions then rose from 1998 to 2004 by 20%, representing a 3% rise per year in this latter period.



**Figure 4: NHS England emissions 1992-2004**

Procurement emissions rose 26% in the period 1992-2004, the largest increase of the three key sectors. Figure 5 shows a common theme in the analysis results, that emissions rose because consumption (expenditure) increased faster than reductions in carbon intensity.



**Figure 5: NHS England medical equipment expenditure, emissions and carbon intensity 1992-2004**

## 3. Phase 2a: Baseline NHS England carbon emissions projection to 2020

### 3.1 Defining the Baseline

This section summarises the data and assumptions used to build the baseline projection to 2020 – for a detailed description refer to Appendix A. The model which projects baseline emissions to 2020 integrates historical emissions data from Phase 1, NHS consumption profiles and forecast emissions intensity values for 123 economic sectors.

The ‘baseline’ scenario is not the same as a ‘Business-As Usual’ (BAU) scenario, which assumes changes in consumption but not in efficiencies. The baseline projection is therefore more akin to a ‘continuing trends’ model, where trends in consumption and efficiency are continued, unless data exists to modify this assumption. Three examples help delineate the baseline projection from a BAU projection:

1. **Grid supplied electricity** mix – Defra projections are used for the utility mix in 2020, whereas a BAU model would assume the utility mix in 2008 is the same at 2020.
2. **NHS Expenditure:** from 2000-2007, average expenditure in real terms on the NHS has increased by 6% per year. Under a BAU scenario this would continue, but in our baseline this is modified by known future estimates of expenditure, which show annual real terms growth slowing to 2.4% by 2020.
3. **Fleet vehicles:** By 2020, under a continuing trend scenario, the NHS will be purchasing and running only the most efficient vehicles. Under a BAU scenario, the NHS would continue to use the same vehicle fuel efficiency.

The original carbon footprinting analysis (see section 2) estimated emissions for the period 1992-2004. The assumptions that extend this analysis to form the baseline model of emissions to 2020 are as follows:

- Sections 3.1.1 – 3.1.3 outlines the assumptions underpinning the projection of future emissions 2008-2020, and the infill period 2004-2008.
- Section 3.1.4 covers the assumptions used to backcast emissions to 1990 and 1991.

#### 3.1.1 Procurement (purchase of goods and services)

##### (a) Expenditure

- This follows the Wanless<sup>3</sup> projections. Expenditure growth in real terms slows from current ~7%/year to 2.4%/year in real terms by 2020, as shown in Table 1.
- By 2020, following the Wanless spend profile, health expenditure is around 10% of GDP, which is in line with other OECD countries.

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<sup>3</sup> Wanless, D., Appleby, J., Harrison, A., Patel, D. (2007) *Our Future Health Secured? A Review of NHS funding and performance*, [http://www.kingsfund.org.uk/publications/kings\\_fund\\_publications/our\\_future.html](http://www.kingsfund.org.uk/publications/kings_fund_publications/our_future.html)



### UK health spending summary

	Projections				
	2002-03 <sup>(a)</sup>	2007-08	2012-13	2017-18	2022-23
<b>Total health spending (per cent of money GDP)<sup>(b)</sup></b>					
Solid progress	7.7	9.4	10.5	10.9	11.1
Slow uptake	7.7	9.5	11.0	11.9	12.5
Fully engaged	7.7	9.4	10.3	10.6	10.6
<b>Total NHS spending (£ billion, 2002-03 prices)</b>					
Solid progress	68	96	121	141	161
Slow uptake	68	97	127	155	184
Fully engaged	68	96	119	137	154
<b>Average annual real growth in NHS spending (per cent)<sup>(c)</sup></b>					
Solid progress	6.8	7.1	4.7	3.1	2.7
Slow uptake	6.8	7.3	5.6	4.0	3.5
Fully engaged	6.8	7.1	4.4	2.8	2.4

**Table 1: Projected NHS expenditure to 2020 (Wanless et al, 2007)**

#### (b) Emissions intensity factors

- Standard Industrial Classification (SIC) sector production efficiencies based on the I-O tables exist for 1992-2004. The 1992 sector production efficiencies are normalised at 100% in 1992. The values for 1992-2004 are then extrapolated to 2020.
- Limits are placed on the extrapolated values as follows: lower limit = 20% of 1992 value; higher limit = 300% of 1992 value. This limitation affects only 2 sectors, which are shown below:

SIC Code/Sector	Production efficiencies							
	1990*	1992	1995	2000	2005	2010	2015	2020
86 gas distribution	102%	100%	121%	201%	255%	300%	300%	300%
121 recreational services	102%	100%	93%	59%	45%	33%	25%	20%
Average sector efficiency (non weighted)	102%	100%	95%	93%	85%	82%	78%	75%

\* Backcast values – see section 3.1.4

**Table 2: Standard Industrial Classification (SIC) sector production efficiencies**

#### 3.1.2 Building energy consumption

The energy consumption data available from the ERIC system for 1999-2007 is used as the basis for consumption extrapolation for 1992-1999 and 2008-2020:

##### (a) On-site energy

- Overall consumption remains broadly constant, rising 11% from 9,465 GWh (in 2008) to 10,504 GWh (in 2020).
- Oil and coal consumption continue to decrease, from 11% in 2008 to a 4% share in 2020.
- DEFRA's emissions intensity factors are used

## (b) Electricity

- Between 1999-2007, electricity consumption rose at an average of 6% per year, which is almost identical to the real terms increase in NHS expenditure during that period. The consumption pattern for 2008-2020 is therefore aligned to the Wanless spend projections, which show real terms NHS expenditure growth decreasing to 2.4% per year in 2020.
- Under this assumption, forecast electricity consumption rises from 4,258 GWh in 2008 to 6,481 GWh in 2020, a rise of 52%.
- The utility supplied electricity mix in 2020 assumes the following mix of energy supply, based on projections from Defra, modified to include an assumed 7% local CHP component:

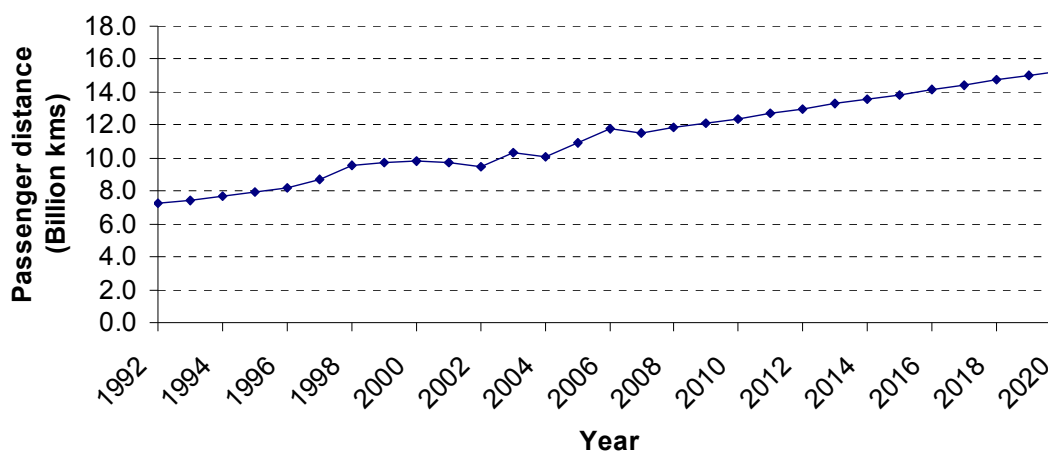
Electricity supply source	% of electricity supply from this source in 2008	% of electricity supply from this source in 2020
Grid - Natural Gas	39%	65%
Grid - Oil	1%	0%
Grid - Coal	33%	12%
Grid - Nuclear	17%	7%
Grid - Renewables	4%	10%
On -site / local CHP	7%	7%
<b>Total</b>	<b>100%</b>	<b>100%</b>

**Table 3: assumed electricity grid supply sources 2008 / 2020**

- The emissions factors used for electricity generation are calculated using the DEFRA carbon intensity factors for direct energy and the efficiency of electricity by source. This allows us to distinguish between the different sources of electricity and gives a combined weighted total conversion factor for electricity, which will change depending on the mix. This gives a higher factor than the Defra electricity factor, for example, overall emissions electricity generation factor for 2007 is taken as 0.57 kgCO<sub>2</sub>/kWh, vs the Defra figure of 0.43 kgCO<sub>2</sub>/kWh.

### 3.1.3 Travel consumption

The overall travel distances used in the analysis follow a linear projection, based on the travel data used for 1997-2007, as shown below. This assumption is considered realistic for 2008-20, given the rising cost of fuel which will act to constrain travel growth.



**Figure 6: NHS England patient/visitor/staff total passenger distance 1992-2020.**

### 3.1.4 Backcasting 1990 and 1991 NHS England emissions

Various assumptions need to be made in order to backcast NHS England emissions to 1990 and 1991 as summarised below:

- **Procurement:** Expenditure follows the known NHS profile for 1990 and 1991. In terms of production efficiencies, Table 2 showed on average a 1% efficiency improvement per year is achieved for 1992-2020. Thus the sector efficiencies for 1991 and 1990 are set at 101% and 102% respectively of the 1992 values.
- **Building energy:** Overall energy consumption (in GWh) and the electricity supply mix are backcast from the 1992-1997 values, as shown below:

Energy consumption type		Energy consumption (GWh) for years 1990-1997							
	Fuel source	1990	1991	1992	1993	1994	1995	1996	1997
On-site energy	Gas	6,425*	6,550*	6,686	6,809	6,932	7,055	7,177	7,300
	Oil	1,950*	1,850*	1,740	1,654	1,568	1,482	1,396	1,310
	Coal	1,240*	1,190*	1,142	1,094	1,046	997	949	901
	Sub-total	9,615*	9,590*	9,568	9,557	9,545	9,534	9,523	9,512
	Electricity consumption	1,800*	1,850*	1,896	1,890	1,900	1,905	2,035	2,090

\* Backcast values

**Table 4: Back-cast energy consumption (GWh) for 1990 & 1991**

Electricity generation source	Electricity supply mix for years 1990-1997							
	1990	1991	1992	1993	1994	1995	1996	1997
Grid - Gas	1%*	2%*	2%	9%	13%	17%	21%	27%
Grid - Oil	13%*	12%*	11%	8%	5%	5%	5%	3%
Grid - Coal	63%*	62%*	61%	52%	49%	46%	41%	36%
Grid - Nuclear	22%*	23%*	24%	28%	28%	27%	27%	28%
Grid - Renewables	1%*	1%*	1%	0%	1%	1%	0%	1%
On-site CHP	0%*	1%*	2%	3%	3%	4%	5%	6%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

\*Backcast values

**Table 5: Back-cast electricity generation mix for 1990 & 1991**

- **Travel:** The overall travel emissions values for 1992-1997 are used as the basis for backcasting emissions for 1990 and 1991 as shown below:

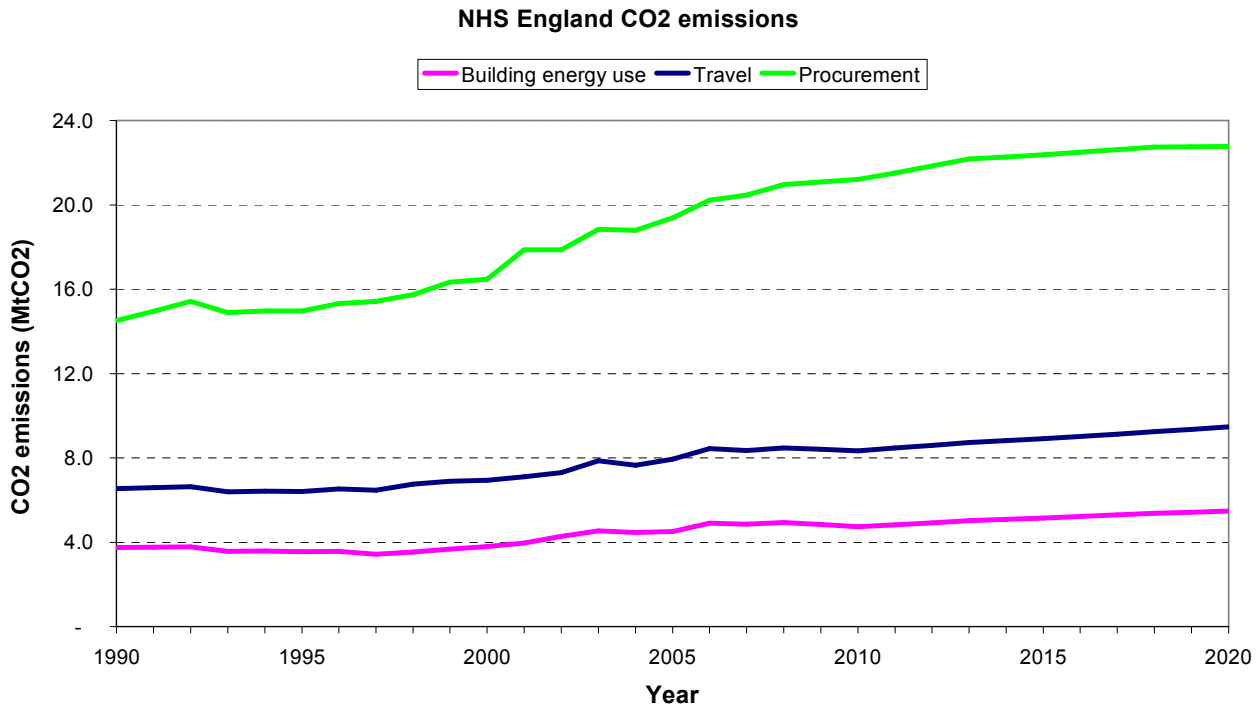
Travel sector emissions (MtCO <sub>2</sub> ) for years 1990-1997							
1990*	1991*	1992	1993	1994	1995	1996	1997
2.79	2.83	2.86	2.83	2.84	2.86	2.96	3.03

\* Backcast values

**Table 6: Back-cast travel emissions for 1990 & 1991**

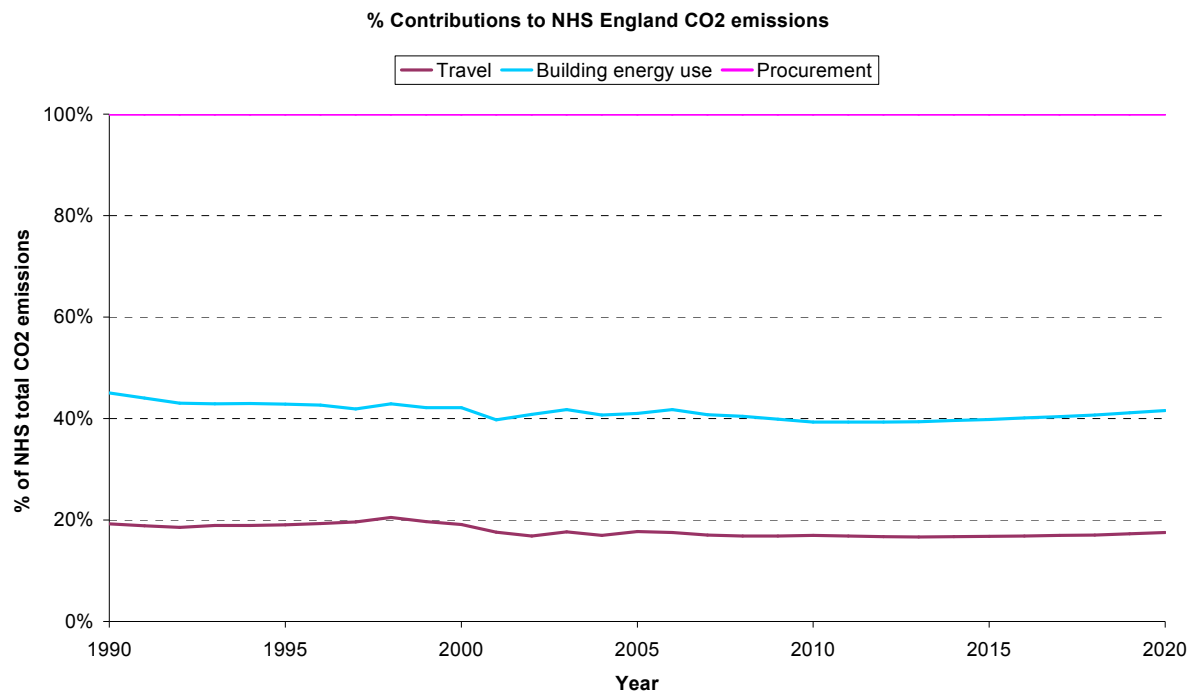
### 3.2 Baseline emissions projection to 2020

Using the data and assumptions previously outlined, an analytical model was constructed to project NHS England emissions to 2020. The model's results shown below illustrate the baseline projection to 2020 is for annual emissions to rise to 22.8 MtCO<sub>2</sub>, an increase of over 50% on 1990 levels (14.7 MtCO<sub>2</sub>)



**Figure 7: NHS England baseline emissions forecast to 2020**

Further investigation shows broadly similar contributions of sub-sector emissions over this period as shown below:



**Figure 8: Percentage breakdown of NHS England baseline emissions 1990-2020**

A detailed breakdown of NHS sub-sector emissions from the analysis is given below:

Sector	Sub sector	Emissions MtCO <sub>2</sub>		
		1990	2020	% change <sup>a</sup>
Procurement	Pharmaceuticals	2.47	5.32	+115%
	Medical Instruments/equipment	1.10	1.88	+71%
	Business services	0.67	1.36	+103%
	Paper products	0.62	1.20	+94%
	NHS Freight transport	0.66	0.64	-3%
	Other manufactured products	0.51	0.82	+61%
	Manufactured fuels/ chemicals/ gases	0.37	0.59	+59%
	Food and Catering	0.57	0.25	-56%
	Construction	0.32	0.31	-3%
	Information and Communication Technologies (ICT)	0.16	0.38	+138%
	Water & Sanitation	0.13	0.09	-31%
	Waste products and recycling	0.09	0.07	-23%
	Other procurement	0.23	0.38	+65%
	<b>Procurement: sub total</b>	<b>7.90</b>	<b>13.26</b>	<b>+65%</b>
Building energy use	Electricity - sub total	1.45	2.66	+83%
	Heating/hot water - gas	1.46	2.69	+84%
	Heating/hot water – coal	0.55	0.09	-84%
	Heating/hot water - oil	0.43	0.04	-91%
	Heating/hot water - subtotal	2.43	2.83	+16%
	<b>Building energy use: sub total</b>	<b>3.88</b>	<b>5.48</b>	<b>+41%</b>
Travel	Patient: own travel	1.22	1.95	+60%
	Visitor travel	0.30	0.49	+60%
	Staff: commuting	0.59	0.85	+44%
	NHS travel: business mileage/fleet/Patient Travel Services (PTS)	0.76	0.75	-1%
	<b>Travel: sub total</b>	<b>2.87</b>	<b>4.04</b>	<b>+41%</b>
<b>Total NHS England emissions</b>		<b>14.65</b>	<b>22.78</b>	<b>+55%</b>

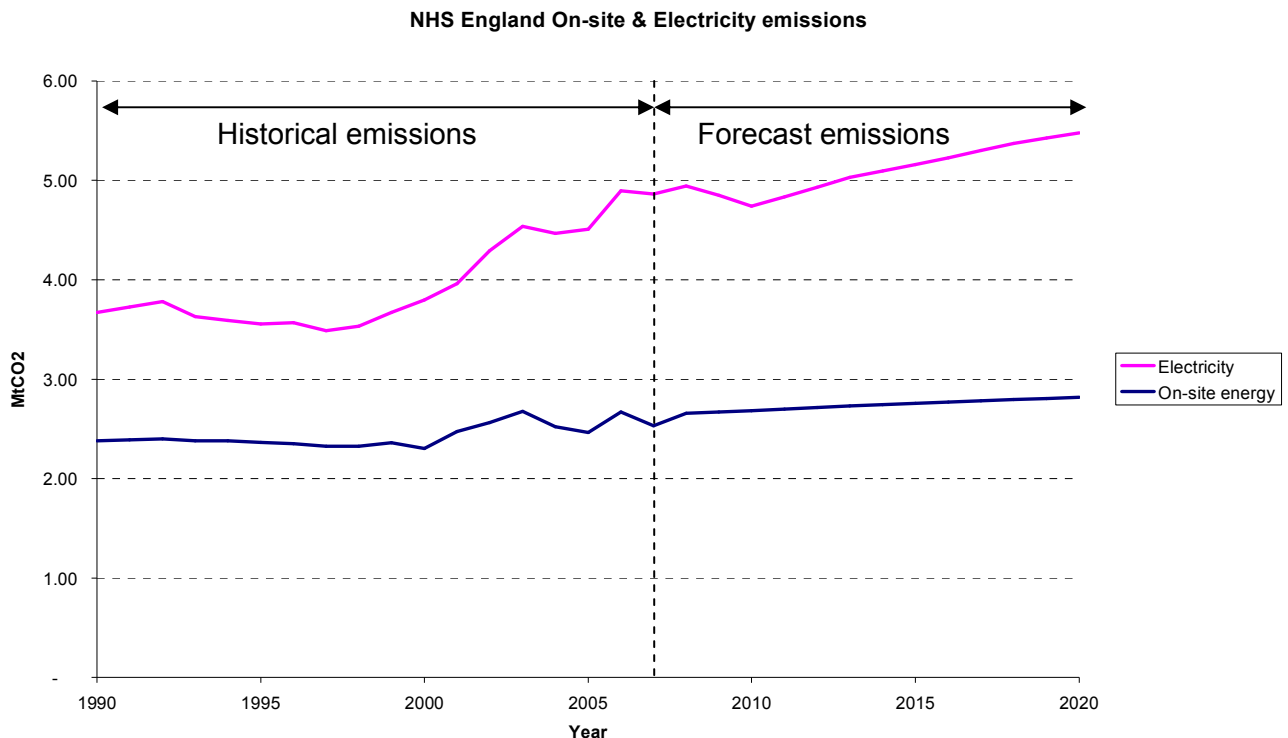
<sup>a</sup> Values rounded to nearest whole %

**Table 6 – NHS England CO<sub>2</sub> emissions in 1990 & 2020: Sub-sector breakdown**

### 3.3 Discussion of baseline results

Taking each sector in turn:

- **Procurement:** Emissions have shown the largest sector rise in emissions (+65%) in the period 1990-2020. Emissions growth slows in the period 2010-2020 due to lower growth in expenditure (as per the Wanless projections), in conjunction with continued increases in production efficiencies.
- **Building energy:** Emissions grew by 41% over the period 1990-2020. Emissions from on-site fossil fuels increase by only 10%, due to significant focus and investment in energy efficiency (e.g. insulation, CHP, modern boilers). However, electricity emissions rise by 83%, such that by 2020 electricity emissions contribute 49% of overall building energy emissions, rising from 35% in 1990. The growth of electricity as a share of overall building energy emissions is illustrated below:



**Figure 9: NHS England on-site energy and grid-electricity emissions**

- **Travel:** The 41% growth in emissions are a result of a doubling in passenger kms (distance travelled), mitigated by a reduction in average vehicle emissions factors from 290 g/km in 1992 to 215 g/km in 2020. The growth in passenger kms is primarily due to greater numbers of people (i.e. more staff, patients and visitors), rather than increases in distance travelled by each person on each journey.

Overall, the projected 55% growth in baseline NHS emissions over the period 1990-2020 equates to an annual increase in emissions of 1.5%. This is the opposite direction to that which is needed, as a desired 80% cut in emissions by 2050 from 1990 levels translates to an annual equivalent cut in emissions of 3.3%. Based on current emissions (14.7MtCO<sub>2</sub>), an equivalent annual emissions cut of 3.8% if required to meet the 2050 target (2.9MtCO<sub>2</sub>).

### 3.4 Phase 1 versus Phase 2 results

The more detailed analysis in Phase 2 differs slightly from that in Phase 1, as set out below:

- **Procurement:** There are no differences in the 1992-2004 emissions values between the two analyses, as the same expenditure and carbon intensity factors are used.
- **Building energy:** The previous top-down data (in Phase 1) is replaced by known bottom-up data in Phase 2 from the ERIC data system for 1999-2007. The consumption is then forecast/backcast based on this known ERIC dataset.
- **Travel:** Emissions are slightly lower in the Phase 2 model, due to a rounding error in the original Phase 1 analysis, which is corrected in the Phase 2 analysis.

Sector	1992 NHS Emissions estimated from Phases 1 & 2		
	Phase 1 analysis (MtCO <sub>2</sub> )	Phase 2 model (MtCO <sub>2</sub> )	% difference Phase 2 vs Phase 1
Procurement	8.8	8.8	+0%
Building energy	4.8	3.9	-19%
Travel	3.1	2.9	-6%
<b>TOTAL</b>	<b>16.6</b>	<b>15.5</b>	<b>-7%</b>

**Table 7: Comparison of 1992 NHS estimated emissions between Phase 1 & 2 analyses**

Sector	2004 NHS Emissions estimated from Phases 1 & 2 (MtCO <sub>2</sub> )		
	Phase 1 analysis	Phase 2 model	% difference Phase 2 vs Phase 1
Procurement	11.1	11.1	+0%
Building energy	4.1	4.5	+10%
Travel	3.4	3.2	-6%
<b>TOTAL</b>	<b>18.6</b>	<b>18.8</b>	<b>+1%</b>

**Table 8: Comparison of 2004 NHS estimated emissions between Phase 1 & 2 analyses**

Whilst building energy is the only sector with key differences between Phase 1 and 2 results, the effect on the overall footprint is not considered to be significant (-7% in 1992, +1% in 2004).

## 4. Phase 2b: Integrating the ‘carbon wedge’ analysis function into the baseline model

### 4.1 Overview

Once the baseline model had been constructed and verified, the second task was to build a function within the model to quantify policy interventions in terms of carbon emissions reductions.

Nine interventions were initially selected, covering a wide range of sectors as outlined in more detail in Appendix B. From this list, eight were then used to develop the function for determining the carbon wedge potential – these are summarised below in Section 4.2. A secondary benefit of the development of this function is that the potential carbon savings of the pilot wedges have been quantified – this is summarised in Section 4.3.

Overall, the pilot wedges successfully helped develop the function within the model to analyse the carbon reduction potential of policy interventions. The interventions examined are not an exhaustive set of carbon reduction measures, and it is anticipated that many more wedges will be developed and analysed in the future by the NHS SDU.

### 4.2 Summary of the 8 pilot wedges

#### **Procurement: Pharmaceutical consumption (P1a)**

Pharmaceutical emissions are around 20% of NHS England’s footprint. This wedge is designed to test the carbon implications of reducing pharmaceutical consumption below the 2020 baseline, by for example reducing unused medicines.

- Emissions ‘wedge’: Reduce pharmaceutical consumption by 10% below baseline projection by 2020.
- Variable affected in model: Pharmaceutical expenditure amended from 100% (2008) to 90% (2020) of baseline expenditure.

#### **Procurement: Medical equipment consumption (P2a)**

Medical equipment emissions are the second largest procurement emissions sector. Thus this wedge is aimed at determining the potential savings from reducing medical equipment consumption below the 2020 baseline, by for example reducing single use equipment.

- Emissions ‘wedge’: Reduce medical equipment consumption by 10% below baseline projection by 2020.
- Variable affected in model: Medical equipment expenditure amended from 100% (2008) to 90% (2020) of baseline expenditure.

#### **Procurement: Consumption of other goods/services (P3b)**

This wedge is aimed at determining the potential savings from reducing consumption of other goods procured by NHS England below the 2020 baseline, by for example procuring fewer items, or reducing unused (wasted) items.

- Emissions ‘wedge’: Reduce consumption of other goods by 10% below baseline projection by 2020.
- Variable affected in model: Expenditure on other goods amended from 100% (2008) to 90% (2020) of baseline expenditure.



### **Building energy: Existing estate – reduce electricity carbon intensity (B2a)**

There is a significant growth in electricity emissions under the baseline projections. A reduction in emissions could be achieved by greater adoption of on-site renewable electricity, eg solar PV, wind, or via off-site wind farms procured by the NHS. This wedge is testing the benefits of greater on-site renewable electricity.

- Emissions 'wedge': Increase % of on-site renewable electricity to 20% in 2020.
- Variable affected in model: Electricity mix adjusted, leading to reduction in carbon intensity of electricity.

### **Building energy: Existing estate – reduce electricity consumption (B2b)**

Electricity consumption is projected to more than double between 1990-2020. This wedge tests the benefits of reducing electricity consumption below this baseline scenario, via new lighting, improved controls, standby savers, better product choices etc.

- Emissions 'wedge': Reduce electricity consumption to 10% below 2020 baseline consumption in GWh
- Variable affected in model: Consumption of electricity amended from 100% (2008) to 90% (2020) of baseline consumption.

### **Building energy: Existing estate – increase CHP coverage (B2e)**

The use of Combined Heat and Power (CHP) can be very effective for large energy consumers such as NHS Trusts, as it avoids the losses from grid-electricity. This wedge is aimed at testing the carbon benefits of increasing the breadth and scale of CHP in NHS England.

- Emissions 'wedge': CHP provides 20% of NHS England's electricity demand by 2020, tripling the generation of electricity within NHS England from CHP.
- Variable affected in SEI model: Electricity mix adjusted, leading to reduction in carbon intensity of electricity.

### **Travel: Smart travel plans (T1)**

Adopting Smart Travel Plans (STPs) has been shown to reduce travel emissions by up to 10%, through reduced travel and shifts in modes of travel. This wedge tests the carbon implications of increasing the numbers of STPs fully implemented across NHS England by 2020.

- Emissions 'wedge': increase STPs coverage from 5% (2008) to 100% (2020).
- Variable affected in model: Passenger kms: 10% reduction applied to 95% of NHS estate, ie 9.5% reduction in total passenger kms travelled.

### **Cross sector: renewable electricity in UK (C1)**

The previous wedges have been used to examine the effects of NHS policy interventions in terms of carbon reduction. However, wedges can be used to study effects of Government policy, to enable the NHS to plan for the outcomes of such policies. This wedge examines the carbon benefits of increasing the proportion of renewable electricity generated in the UK to meet EU targets for 2020.

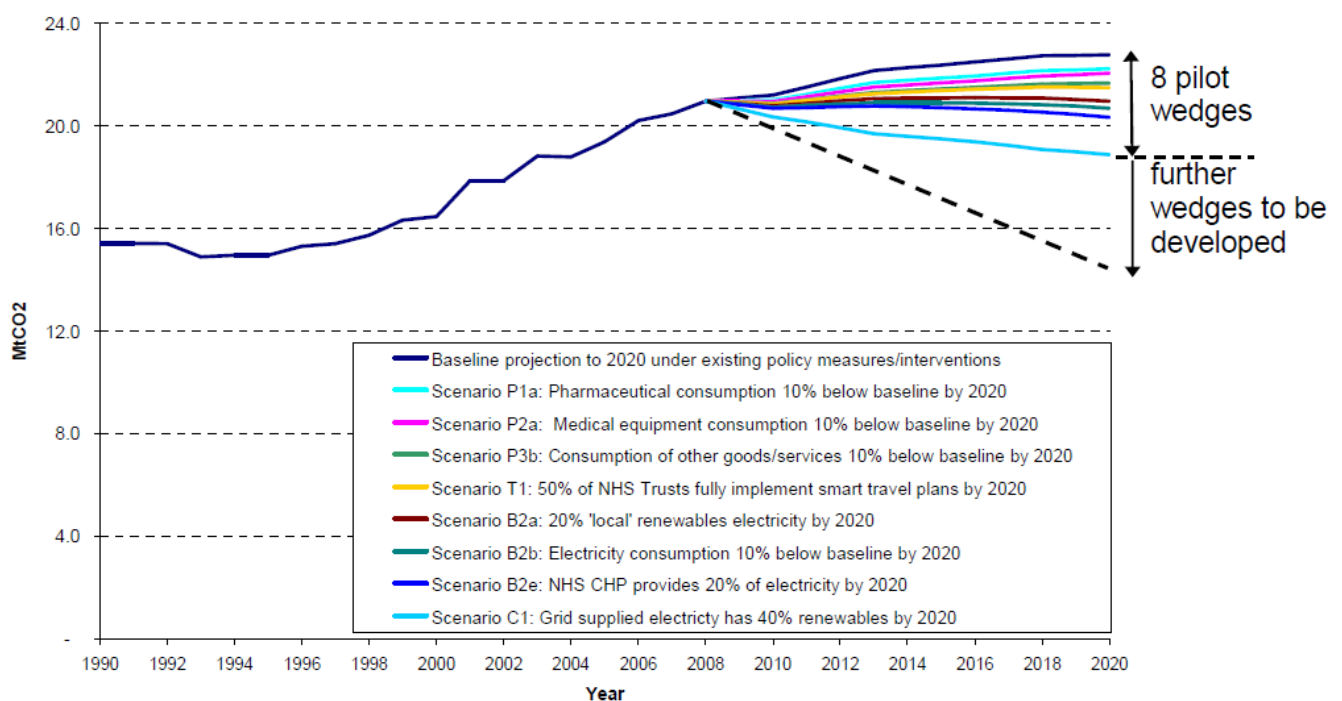
- Emissions 'wedge': 40% renewable electricity in use by 2020 in UK. 40% renewable electricity in use by 2020 in OECD Europe
- Variable affected in model: Carbon intensity of grid supplied electricity amended to NHS estates account for proportion of renewable electricity increasing to 40% in 2020. Also, the average carbon intensity of products purchased by the NHS is reduced, as products manufactured in the UK/EU will have lower carbon intensities.

### 4.3 Wedge analysis results

From the 8 pilot interventions, the individual carbon ‘wedges’ are obtained and summarised below:

Sector	Proposed Intervention	Annual emissions reduction below 2020 baseline projection
Procurement	P1a: Reduce unused pharmaceuticals	-0.53 MtCO <sub>2</sub> (-2.4%)
	P2a: Smart/lean procurement of medical equipment	-0.19 MtCO <sub>2</sub> (-0.8%)
	P3a: Smart/lean procurement of other expenditure	-0.38 MtCO <sub>2</sub> (-1.7%)
Building Energy	B2a: On-site renewable electricity	-0.53 MtCO <sub>2</sub> (-2.4%)
	B2c: Reduce electricity consumption	-0.27 MtCO <sub>2</sub> (-1.2%)
	B2e: Increase CHP to maximum potential by 2020	-0.35 MtCO <sub>2</sub> (-1.6%)
Travel	T1: Smart travel plans across NHS estates.	-0.36 MtCO <sub>2</sub> (-1.6%)
Cross-sector	C1: 40% of UK electricity from renewables by 2020	-1.46 MtCO <sub>2</sub> (-6.9%)
<b>Total</b>		<b>-4.08 MtCO<sub>2</sub> (-18.0%)</b>

**Table 9: Summary of ‘pilot’ wedges**



**Figure 10: Summary of ‘pilot’ wedges**

The results show that significant potential exists for carbon reduction, and also demonstrates the strategic merits of the carbon modelling tool to investigate different policy interventions.

## 5. Conclusions and recommendations

This second phase of the carbon research has strengthened and built upon the earlier footprinting project. By 2020, NHS consumption emissions are projected to rise under the baseline scenario to a level 55% higher than in 1990, with the majority (60%) of NHS England carbon emissions still originating from consumption of goods and services, compared to 25% from building energy. The implication for NHS England is that attention needs to focus on resource use and consumption across all activities, in addition to existing efforts in energy efficiency (of buildings).

The model has also successfully developed the capability to analyse policy interventions in terms of carbon 'wedge' potential. This is of great strategic advantage, as it will enable policy makers to decide which measures will deliver the largest carbon benefits, and help develop priorities for action. It also allows testing of outside policy interventions - such as Government policy on renewables for grid electricity.

From the pilot wedges analysed in the development of the model, measures to reduce carbon emissions in NHS England fall into two distinct areas:

- **Reducing consumption:** Examples include reductions in energy use (through building energy efficiency); consumption of goods/services; travel journeys (through Smart Travel Plans)
- **Reducing carbon intensity:** Examples include CHP, on-site renewables, choice editing in procurement.

The baseline model introduces a new methodology of trajectory based carbon management, that enables NHS England to plan ahead not only for the effects of its own policies, but also those originating outside the NHS.

Based on the results of this second phase of the carbon research project, the following five key recommendations to the NHS SDU are made:

1. **NHS Trust data:** The collection of good quality bottom-up data from NHS Trusts is crucial to future carbon action, not just at a strategic level but also at regional / trust levels. The NHS SDU should consider how best to develop system which collates full NHS England consumption data across procurement, travel and building energy sectors. Utilisation of Procurement Hubs, and sub-metering of energy consumption are among key issues to address.
2. **Data interpretation:** Following on from the collection of good quality data is the requirement to spend time analysing this data. This is a pre-requisite before moving on to detailed development of policy interventions and assessment of carbon wedge potential.
3. **Developing wedges:** Policy interventions can address either demand management or reductions in carbon intensity – both have key roles to play in carbon reduction. It is also important to look outside the NHS, for example to learn of new government policy, or to establish best practice in other private or public sector organisations.
4. **Upstream emissions:** A key aspect of the carbon research completed to date is that most emissions originate from upstream emissions in the manufacture of goods and services procured by NHS England. As the largest public sector procurer, the NHS can use this purchasing power to reduce emissions in the supply chain. The NHS SDU should work with key partners such as PASA and NHS Supply Chain to

embed requirements in contracts for suppliers to disclose scope 1 and 2 (and eventually scope 3) emissions, following the GHG Protocol conventions.

## **6. Citation and queries**

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Comments or queries relating to this report should be directed to [sdu@sdu.nhs.uk](mailto:sdu@sdu.nhs.uk)

## Appendix A – Baseline data

This appendix contains detail of the input data, assumptions and calculations used to establish the baseline NHS England projections from 1990 to 2020. We have attempted to model the impact of nine variables on NHS England consumer-based emissions up to 2020: direct energy use, energy carbon intensity factors, electricity use, electricity carbon intensity factors, procurement, patient, visitor and staff travel, electricity mix, efficiency of production sectors and efficiency of patient and staff travel.

These can be grouped according to the three main sectors that they influence, which make up the carbon footprint:

- **Procurement** - procurement excluding NHS business transport and energy
- **Building energy use** - direct energy use, energy carbon intensity factors, electricity use, electricity carbon intensity factors, electricity mix and gas distribution (extracted from procurement)
- **Travel** - patient, visitor and staff travel, efficiency of patient, visitor and staff travel, and NHS business transport which is extracted from procurement

Also in accordance with the Greenhouse Gas Protocol Standard these can be grouped into Scope 1, 2 and 3 emissions:

- **Scope 1 (Direct emissions)** - direct energy use and energy carbon intensity factors
- **Scope 2 (Electricity indirect emissions)** - electricity use and electricity mix and electricity carbon intensity factors
- **Scope 3 (Other indirect emissions)** - procurement, patient, visitor and staff travel, efficiency of production sectors and efficiency of patient and staff travel

Firstly, the input data for each variable is defined followed by the calculation of the baseline. The model is largely based on projections of past trends (i.e. our time series), which is available for 1992 –2004. We have backcast to 1990 as this is when most climate targets are measured against. NHS expenditure is constrained according to future NHS expenditure profiles<sup>8</sup>, the growth rate of which is expected to slow in the forthcoming years.

## A1.INPUT DATA

Each variable is defined in turn:

### 1.1. Direct energy use by the NHS England (GWh)

- Direct energy use of coal, oil, gas and renewables is extracted from ERIC accounts, available for 1999/00 – 2006/07. 1999/00 has been entered as 2000, 2000/01 as 2001 etc.
- Direct energy use has been backcast and forecast using the average change in energy use for each of the fuel types for the available years. For example, gas use increases at an average rate of 1.5% per year, whilst oil use is declining by 7% per year.
- The figure for oil use in 2007 was unusually low. Outliers skewing the results have been excluded from projections.

### 1.2. Energy carbon intensity factors (ktCO<sub>2</sub>/ GWh)

- DEFRA<sup>4</sup> provide carbon intensity factors for 2005. We have assumed a renewable energy factor of 0.01 ktCO<sub>2</sub>/ GWh. A small impact is attributed to infrastructure for renewable energy. There is no time series available for the energy intensity factors and so we have assumed they are constant.

### 1.3. Electricity use by the NHS (GWh)

- Electricity use is extracted from ERIC accounts, available for 1999/00 – 2006/07. 1999/00 has been entered as 2000, 2000/01 as 2001 etc.
- Electricity use has been projected assuming the same growth rate as NHS spending<sup>8</sup>, which equates to a 4.5% growth to 2013, a 3.1% growth until 2018 followed by a 2.4% growth. Between 1999 and 2007 electricity consumption rose at a very similar rate to real term increases in NHS expenditure across the same time period.

### 1.4. Electricity carbon intensity factors (ktCO<sub>2</sub>/ GWh)

- The energy carbon intensity factors provided by DEFRA<sup>4</sup> (see section 1.2) are divided by the efficiency of electricity by source<sup>5</sup> (again for 2005, which we assume to be constant). Where no data is available some assumptions have been made. We have assumed a nuclear electricity factor of 0.1 ktCO<sub>2</sub>/ GWh. We assume that the efficiency of converting renewable energy into electricity is an average of the others (coal, oil and gas). Lastly, we have assumed that CHP has a carbon intensity factor of 0.1. ktCO<sub>2</sub>/ GWh and the same efficiency as renewable electricity (i.e. an average of coal, oil and gas), equating to a CHP-electrical intensity factor of 0.03 ktCO<sub>2</sub> GWh.

### 1.5. Procurement by the NHS (£million)

- National accounts expenditure for government spending on health was collected for the previous report<sup>6</sup> for 1992 – 2004, showing NHS England expenditure in 178 sectors. Expenditure has been inflated to 2004 prices. In this phase of the project these have

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<sup>4</sup> DEFRA (2007) <http://www.defra.gov.uk/environment/business/envrp/pdf/conversion-factors.pdf>

<sup>5</sup> <http://www.berr.gov.uk/whatwedo/energy/statistics/source/electricity/page18527.html>

<sup>6</sup> SDC-SEI (2008) NHS England Carbon Emissions, Carbon Footprinting Report, draft report.

been aggregated to 123 sectors. Part of this stage was to investigate the potential of using a two-regional model instead of the single-regional model used in phase one. It would therefore be possible to distinguish between NHS purchases from the UK and abroad and to account for differing technologies abroad. For this, data was available only at 123 sector level. The decision was however made to remain with the single-regional model to maintain consistency, yet with the possibility of work to further develop a more detailed regional model.

- Overall expenditure has been cross checked with PESA<sup>7</sup> (England only): SEI model estimates total spend at £63,749 million (£76,499 UK) for 2004, of which £28,759 million (£34,511 UK) is intermediate consumption (i.e. all NHS England procurement, excluding wages). PESA estimates that for 2004 £66,725 million was spent at 2006 prices, which is £63,920 million in 2004 prices.
- Expenditure has been projected using the average change of each individual sector and then adjusted proportionally for projected annual real growth (in %) in NHS total spending<sup>8</sup>, which equates to a 4.5% growth to 2013, a 3.1% growth until 2018 followed by a 2.4% growth.

### 1.6. Patient, visitor and staff travel (km)

- Travel distances by mode of travel have been extracted from the National Travel Survey as there is no detailed record of travel collected by the NHS. This is available from 1995 – 2006.
  - i. Patient travel is estimated assuming 90% of 'Travel for personal business medical reasons' (km/ person/ year) is to and from the NHS. The other 10% we assume is for private health care. As this is an average distance travelled per person per year, this distance is multiplied by the England population. England population statistics are from UK National Statistics, which also give projections for 2011, 2016 and 2021.
  - ii. Visitor travel is estimated assuming 10% of 'Travel for other social reasons' and 10% of 'Travel for escort shopping/ personal business reasons' (km/ person/ year) is to visit friends and relatives in hospital. This distance is multiplied by population.
  - iii. Staff travel is estimated by multiplying the average commuter distance travelled (km/ person/ year) by the number of staff employed by the NHS. Staff numbers are from the Compendium of Health Statistics<sup>9</sup>.
- Travel distances are projected using a linear trend representing previous trends and the assumption that whilst population is expected to rise, this will be offset by higher fuel prices reducing the demand for car travel. When projecting visitor travel the transport mode 'other public transport' goes below 0 in 2006, therefore, this has been levelled off at the lowest positive value (1,865,615 km).

### 1.7. Electricity mix (%)

- Electricity mix is available from the Digest of UK Energy Statistics (DUKES) for 1992 – 2007.
- Projections are based on BERR projections for the UK electricity mix for 2010 and 2020<sup>10</sup>. In 2020 they predict electricity from gas will increase to 69%, electricity from oil

<sup>7</sup> HM Treasury (2008) Public Expenditure Statistical analyses 2008, Table 1.6, p. 17.

<sup>8</sup> Wanless, D. (2007) Future Health Secured, Chapter 5

<sup>9</sup> Hawe, E. (2007) Compendium of health Statistics, Radcliffe Publishing Ltd: Oxon, UK.

<sup>10</sup> Department for Business Enterprise and Regulatory Reform (2008) Estimates of primary energy demand and electricity generation, available at: <http://www.berr.gov.uk/files/file21353.pdf>

will remain at 0%, electricity from renewables will rise to 11% and electricity from coal and nuclear will drop from 23% and 18% to 13% and 7% respectively. We have however, added CHP to the mix, which we can see from the ERIC accounts provides 7% electricity used by the NHS. Therefore, the BERR estimates are proportioned to include this share.

### 1.8. Efficiency of production sectors in the UK (% change from 1992)

- Total carbon intensities of production for the UK were collected for the previous report<sup>6</sup> for 1992 – 2004. In the previous study 178 sectors were presented. In this phase these have been aggregated to 123 sectors.
- The intensity of production was projected using the average change over time in each individual sector. Outliers skewing the results were excluded (see Table 1)

Table 1

Sector	Excluded outliers
4 – coal extraction	99-00
44 – soap & toilet preparations	03-05
46 – man made fibres	01-02
84 - Miscellaneous manufacturing nec & recycling	92-96
98 – postal and couriers services	92-96

**Table 1 Sector outliers in projected UK sector efficiencies**

- Intensities are expressed as a percentage improvement/ decline from 1992 intensities of production. These have been constrained to ensure realistic results: if below 20% improvement or above 300% change in intensity then intensities are levelled off at these values (see Table 2).

Sector	Constraint
86 – gas distribution	300% in 2008
121 – recreational services	20% in 2019

**Table 2 Dramatic change in efficiencies from projections in UK sector efficiencies to 2020**

### 1.9. Efficiency of patient and staff travel (ktCO<sub>2</sub>/ km)

- Carbon intensities for the different modes of transport are taken from the SEI-REAP model. These are only available for 2004.
- The travel intensity factors are then projected assuming a 1% improvement in efficiency per year for each mode. The intensity factors are weighted by the distance travelled by each mode for medical purposes for the time series to give an overall conversion factor for each year that accounts for the range of transport modes.

### 1.10. Backcasting 1990 and 1991 emissions

Our methodology is based on input-output tables which are not available for 1990 and 1991; therefore we have backcast emissions for these two years based on some reasonable assumptions.

- Procurement: 1990 and 1991 expenditure is based on the NHS spending profile. The efficiency of production factors are backcast from 1992 – 2004 averages of all sectors, which equates to approximately a 1% efficiency improvement a year. Thus sector efficiencies for 1991 and 1990 are set at 101% and 102% of the 1992 values.



- Building energy: Both direct energy and electricity consumption (GWh) are backcast from 1992 – 1997 consumption values. The electricity (fuel source) mix is backcast from 1992 – 1997 data.
- Travel: overall emissions for travel are backcast based on a 1.01 growth rate per year between 1992 – 1997.
- Scope 1: overall scope 1 emissions are backcast based on 1.004 growth rate a year between 1992 – 2004.
- Scope 2: overall scope 2 emissions are backcast based on 1.033 growth rate a year between 1992 – 2004.
- Scope 3: overall scope 3 emissions are backcast based on 1.018 growth rate a year between 1992 – 2004.
- Scope 1, 2 and 3 emissions need to equal travel, building energy and procurement, therefore the sum of the first is proportioned according to the latter to make scope emissions add up to the travel, building energy and procurement combined..

## A2. CALCULATION

The nine variables outlined above are used in the calculation of the NHS England baseline footprint projection. The calculation steps are detailed in this section. The baseline is calculated in three stages according to Scope 1, 2 and 3 emissions. These are then summed according to the scope emissions and the three main sectors of travel, building energy and procurement.

### 2.1. Scope 1 calculation – emissions from on-site energy

- Energy intensity factors (ktCO<sub>2</sub>/ GWh) are multiplied by direct energy use (GWh) to give CO<sub>2</sub> emissions from on-site energy.

### 2.2. Scope 2 calculation – emissions from electricity

- To get a total electricity intensity factor, the electricity intensity factor for each source (ktCO<sub>2</sub>/ GWh) is multiplied by the percentage of electricity mix of that source, and these are added together. This gives a weighted intensity factor which is multiplied by electricity use (GWh) to give CO<sub>2</sub> emissions from electricity use.

### 2.3. Scope 3 calculation – emissions from procurement and personal travel

- UK expenditure (£million) is multiplied by production efficiencies (ktCO<sub>2</sub>/ GWh) to give emissions from procurement.
- Patient/ and visitor travel (kms) is multiplied by efficiency of travel (ktCO<sub>2</sub>/ km) to give CO<sub>2</sub> emissions from patient and visitor travel.
- Staff travel (kms) is multiplied by efficiency of travel (ktCO<sub>2</sub>/ km) to give CO<sub>2</sub> emissions from staff commutes.

### 2.4. Totals

The resultant carbon emissions are categorised according to the GHG Protocol Standard (i.e. the scope emissions), and can also be categorised into the three primary sectors of travel, building energy and procurement.

- Scope emissions
  - Scope 1: On-site energy (plus gas distribution sector 86)
  - Scope 2: Electricity
  - Scope 3: Procurement (excluding electricity production, gas distribution and health and veterinary i.e. on-site emissions which are sectors 85, 86 and 117 respectively, as these are calculated in scope 1 and 2 via ERIC data) and staff, patient and visitor travel
- 3 primary sectors: travel, building energy and procurement
  - Travel: patient, visitor and staff travel and NHS business transport (see appendix A.1.)
  - Building energy: Scope 1 and scope 2 (i.e. direct energy use and electricity use) includes gas distribution sector 86
  - Procurement: All the rest (including freight proportion of transport sectors see appendix A.1.)

### A3. MAPPING RESULTS FROM 123 ECONOMIC SECTORS TO NHS SUB-SECTORS

The original (Phase 1) carbon foot printing project used 178 economic sectors for the basis of the carbon footprint. These were allocated to various emissions sub-sectors as shown in table 1 below. The Phase 2 model uses a smaller number (123) of economic sectors according to the SIC coding system, and so these sectors must be mapped to the same sub-emissions sub-sectors for compatibility of results. This mapping process is now described below:

#### 3.1 Basic translation

The table below summarises how both the 178 (Phase 1) sectors and the 123 (Phase 2) sectors are allocated to the NHS England emissions sub-sectors:

Sector	Sub sector	178 industrial sector numbers	123 industrial sector numbers
Procurement	Pharmaceuticals	68	43
	Medical Instruments/equipment	103	76
	Business services	130, 144, 146-151, 157-163, 177	<b>92</b> , 98, 100-105, 108-114, 122
	Paper products	<b>50-54</b>	<b>32-34</b>
	NHS Freight transport	133, 137, 138, 140, 142, 143	<b>93-96</b> , 97
	Other manufactured products	42, 44, 46, 48, 71-76, 87-88, 108, 111	24, 26, 28, 30, 46-50, 60-61, 81, <b>84</b>
	Manufactured fuels/ chemicals/ gases	13, 56, 58-60, 69, 70	4, <b>35</b> , 36, 44, 45
	Food and Catering	1-7, 19-35, 131	1, 8-17, <b>92</b>
	Construction	77-79, 84, 122-124	51-53, 57, 88
	Information and Communication Technologies (ICT)	<b>55</b> , 96, 145, 154, 156	<b>34</b> , 69, 99, <b>106</b>
	Water & Sanitation	121, <b>170</b> , <b>173</b>	87, <b>119</b>
	Waste products and recycling	112, 113, <b>171-172</b>	<b>84</b> , <b>119</b>
	Other procurement (includes industrial sectors which have zero emissions)	8-12, 14-18, 36-41, 43, 45, 47, 49, 61-67, 80-83, 85-86, 89-95, 97-102, 105, 107, 109-110, 127-129, <b>153</b> , <b>155</b> , 164-167, 169, 174-176, 178	2-3, 5-7, 18-23, 25, 27, 29, 31, 37-42, 54-56, 58-59, 62-68, 70-75, 78, 80, 82-83, 90, 91, <b>106</b> , 115, 116, 118, 120-121, 123
Building energy	Heating/hot water and Electricity	114-120, 168	85-86, 117
Travel	NHS travel	<b>57</b> , 104, 106, 125-126, 132, 134-136, 139, 141, <b>152</b>	<b>35</b> , 77, 79, 89, <b>93-96</b> , <b>106</b>

**Table 1: Summary of 123/178 sector allocation to NHS England emissions sub-sectors**

### 3.2 Disaggregating sector overlaps

The sector numbers in bold in Table 1 indicate sectors which are split between two or more aggregated between to two or more of the NHS emissions sub-sectors. These overlaps in sectors are then split in proportion to their consumption profiles for 2004, as outlined below in Table 2:

123 sector classification	Split in proportion to 178 sector (2004) data	
34	54 - Paper (0.21 MtCO <sub>2</sub> ) 55 - ICT (0.01 MtCO <sub>2</sub> )	95% 5%
35	56 - Manufactured fuels (0.01 MtCO <sub>2</sub> ) – see also table 5 below 57 - Travel (0.31 MtCO <sub>2</sub> ) – see also table 5 below	5% 95%
84	111 - Other manufactured products (0.03 MtCO <sub>2</sub> ) 112 - Recycling (0.011 MtCO <sub>2</sub> )	71% 29%
92	130 - Business services (0.03 MtCO <sub>2</sub> ) 131 - Food & Catering (0.115 MtCO <sub>2</sub> )	20% 80%
93-96	See Table 3 below	
106	152 – Travel (0.0072 MtCO <sub>2</sub> ) 153 – Other procurement (0.0051 MtCO <sub>2</sub> ) 155 - ICT (0.0009 MtCO <sub>2</sub> )	50% 35% 15%
119	170/173 Water/Sanitation (0.094 MtCO <sub>2</sub> ) 171/172 Waste & Recycling (0.079 MtCO <sub>2</sub> )	55% 45%

**Table 2 –Allocating Sector overlaps to NHS emissions sub-sectors**

Including personal travel (i.e. patient, visitor and staff), there are some emissions associated with NHS business travel. These have been purchased directly by the NHS and are therefore included in the procurement part of the calculation, yet should be assigned to travel emissions.

As the model in this phase uses 123 sectors (not 178 sectors from the previous report<sup>6</sup>), passenger transport and freight transport have been aggregated into more general transport sectors (see Table 3).

Therefore, these sectors have been re-proportioned according to the average split between business and freight transport for 92-04 from the previous report to assign the correct emissions to travel (passenger travel) and procurement (freight travel), see Table 4.

Sector	Heading
93	Railway transport
94	Other land transport
95	Water transport
96	Air transport

**Table 3 Aggregated transport sectors**

Sector	92	93	94	95	96	97	98	99	00	01	02	03	04	Avg
93 - Rail passenger	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
93 - Rail freight	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
94 - Other land passenger	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2
94 - Other land freight	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8
95 - Water passenger	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95 - Water freight	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
96 - Air passenger	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
96 - Air freight	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

**Table 4 Average proportion of passenger and freight travel by transport mode**

For the same reason refined petroleum products, previously fully assigned to NHS business transport, has been aggregated into sector 35 'Coke ovens, refined petroleum & nuclear fuel'. This sector has been proportioned according to the 1992 - 2004 desegregation from the previous report to assign the correct emissions to travel (passenger travel) and procurement (coke and nuclear products), see Table 5.

	Coke oven products	Refined petroleum products	Processing of nuclear fuel	Share refined petroleum (%)
1992	21.86	351.3136	13.34532	91%
1993	16.59	330.8158	12.70137	92%
1994	17.03	327.6557	11.88431	92%
1995	16.72	322.0587	11.13868	92%
1996	21.45	339.8108	11.08641	91%
1997	21.14	317.5118	10.94165	91%
1998	20.43	314.849	7.463925	92%
1999	18.11	282.4113	7.790786	92%
2000	14.85	228.591	5.245854	92%
2001	13.23	265.6758	5.296663	93%
2002	10.93	283.4757	5.38822	95%
2003	10.84	313.7052	6.541672	95%
2004	9.06	310.4211	6.831902	95%

**Table 5 Average proportion of refined petroleum products**

Other sectors calculated in procurement which have been allocated to travel emissions include:

Sector	Heading
77	Motor vehicles
78	Shipbuilding & repair
79	Other transport equipment
89	Motor vehicle distribution & repair, automotive fuel retail

**Table 6 Sectors allocated to travel**

## Appendix B – Carbon emissions ‘wedges’

Phase 2b of the project was to develop the modelling capacity to quantify potential carbon reductions that can be achieved through different policy interventions. Nine policy wedges are piloted, with the intention of providing a model in which further policies can be measured beyond this project.

A baseline carbon footprint was built using nine variables (see Appendix A). Depending on the scenario different variables are affected, which in turn modify the total carbon footprint of the NHS England. This appendix outlines the analytical work in quantifying the carbon reductions, including what variables are affected under each scenario and by how much, followed by a look at the estimated reductions that can be achieved.

### B1. VARIABLES AFFECTED BY EACH SCENARIO

A set of scenarios were developed in order to build and develop the model, and to see the possible outcomes of some example policy options. Whilst there are many other policies which can, and are intended to be measured in the future using this model, nine options have been tested at this stage. These are defined in this section.

#### 1.1. Reduce pharmaceutical wastage

As the pharmaceutical sector is the single largest source of NHS England emissions, the potential carbon savings of reducing pharmaceutical wastage are estimated. This affects the procurement of pharmaceuticals in the model. Projected expenditure in the pharmaceutical sector is reduced by 10% from 2008 to 2020, therefore reducing projected expenditure in 2020 by £1271 million (Table 7)

Year	Baseline (£m)	Scenario (£m)
2008	9375	9375
2009	9732	9547
2010	10098	9719
2011	10473	9891
2012	10855	10063
2013	11245	10235
2014	11488	10407
2015	11728	10579
2016	11967	10752
2017	12203	10924
2018	12436	11096
2019	12578	11268
2020	12711	11440

**Table 7 Reduction in projected procurement of pharmaceuticals**

#### 1.2. Reduce medical equipment wastage

Medical equipment is another significant sector in terms of NHS emissions and therefore the savings from a reduction in wastage of medical equipment is estimated. This affects the procurement of medical equipment in the model. Projected expenditure in the medical equipment sector is reduced by 10% from 2008 to 2020, therefore reducing projected expenditure in 2020 by £704 million (Table 8).

Year	Baseline (£m)	Scenario (£m)
2008	4774	4774
2009	4991	4905
2010	5215	5035
2011	5447	5165
2012	5685	5295
2013	5931	5425
2014	6101	5555
2015	6273	5685
2016	6445	5815
2017	6619	5946
2018	6792	6076
2019	6918	6206
2020	7040	6336

**Table 8 Reduction in projected procurement of medical equipment**

### 1.3. Reduce wastage of all other goods procured

The NHS procures many other goods which end up as waste and which presents the potential to reduce the carbon footprint. Projected expenditure on all goods (i.e. doesn't include services, personal travel or energy) procured by the NHS England is reduced by 10% from 2008 to 2020, therefore reducing projected expenditure in 2020 by £563 million. Pharmaceuticals and medical equipment are excluded as these have been calculated separately (see above scenarios).

Year	Total consumption-baseline (£m)	Total consumption-scenario (£m)
2008	36315	36315
2009	37949	37923
2010	39657	39596
2011	41441	41338
2012	43306	43149
2013	45255	45034
2014	46658	46424
2015	48104	47846
2016	49596	49300
2017	51133	50785
2018	52718	52298
2019	53984	53505
2020	55279	54716

**Table 9 Reduction in projected procurement of all goods bought by the NHS**

### 1.4. Smart travel plans

Travel emissions represented almost 20% of the carbon footprint in 2004. Five percent of NHS trusts have successfully implemented Smart Travel Plans which can reduce carbon emissions through, for example car sharing schemes and improved public transport. It is estimated that full implementation of a travel plan reduces emissions by an average of 10%. If implementations of travel plans are increased from 5% to 50% in NHS locations, then 10% savings will be achieved on 45% of the projected travel emissions, saving 180,000 tCO<sub>2</sub> (Table 10).

Year	Baseline travel emissions (kt CO2)	Scenario travel emissions (kt CO2)
2008	3531	3531
2009	3564	3555
2010	3597	3579
2011	3631	3603
2012	3665	3627
2013	3700	3650
2014	3728	3674
2015	3760	3698
2016	3795	3722
2017	3836	3746
2018	3883	3769
2019	3935	3793
2020	3997	3817

**Table 10 Reduction in projected emissions from personal travel to NHS facilities**

### 1.5. Low emissions fleet

The procurement of a lower emissions fleet for NHS business travel would cause a reduction in the carbon intensity of NHS business travel. This affects the efficiency of the 'other land transport' sector in procurement. Due to the aggregation of 178 sectors into 123, NHS business car travel is included in this more general sector. The model measures the carbon intensity of NHS business travel using monetary intensity factors, such that in 2008 860 tCO<sub>2</sub> is emitted per £million spent on land transport (the majority of which is assumed to be car travel as this sector does not include rail travel).

A carbon efficient fleet (120g/ km) is 25% more efficient than the average fleet (160g/ km) therefore we assume the monetary intensity factor to reduce by 25% from 2008 to 2020. In 2008 0.86 ktCO<sub>2</sub> is emitted per £m spent, therefore in 2020 this would be reduced to 0.65 kt CO<sub>2</sub>/ £m spent. However, based on previous trends, the baseline projects that the intensity of this sector will actually reduce beyond this saving to 0.56 ktCO<sub>2</sub>/ £m spent (Table 11).

This scenario is therefore redundant, yet we should be aware that in the future the best car on the market is likely to exceed 120 g/km and whilst we can't quantify these carbon savings now, it is still a desirable policy which can only lead to carbon savings.

Year	Baseline land transport efficiency (kt/ £m)	Scenario land transport efficiency (kt/ £m)
2008	0.86	0.86
2020	0.56	0.64

**Table 11 Reduction in projected procurement of a low emissions fleet**

### 1.6. Increase on-site renewables to produce electricity

As electricity accounts for 12% (2.3 MtCO<sub>2</sub> in 2004) of the NHS footprint, renewable sources of electricity can reduce this impact. On-site renewables are projected to produce 0 – 20% electricity from 2008 – 2020, leading to a reduction in projected 2020 electricity use by 1,296 GWh (Table 12).



Year	Electricity baseline (GWh)	Scenario (GWh)
2008	4258	4258
2009	4449	4375
2010	4650	4495
2011	4859	4616
2012	5078	4739
2013	5306	4864
2014	5471	4923
2015	5640	4982
2016	5815	5040
2017	5995	5096
2018	6181	5151
2019	6329	5169
2020	6481	5185

**Table 12 Reduction in projected electricity use due to an increase in renewable electricity sources**

### 1.7. Reduce electricity consumption

There are other options to reduce electricity consumption, such as more efficient computers, stand by controls and better lighting. In this policy wedge projected electricity use is reduced by 20% from 2008 and 2020, saving 648 GWh by 2020.

Year	Baseline (GWh)	Scenario (GWh)
2008	4258	4258
2009	4449	4389
2010	4650	4520
2011	4859	4652
2012	5078	4783
2013	5306	4914
2014	5471	5046
2015	5640	5177
2016	5815	5308
2017	5995	5439
2018	6181	5571
2019	6329	5702
2020	6481	5833

**Table 13 Reduction in projected electricity use due to various electricity saving measures**

### 1.8. Increase use of CHP

CHP provides an extra source of 'free' electricity as a by product of heat production, thereby producing carbon savings through utilising this electricity and reducing the demand for grid electricity. If the NHS increases their CHP coverage, then this affects the electricity mix (more 'free' electricity from CHP and less from fossil fuel sources) leading to a decrease in the carbon intensity of electricity production. The share of electricity from CHP is projected to increase from 6.7% - 20% between 2008 and 2020 (Table 14).

Year	Baseline (% CHP)	Scenario (%CHP)
2008	7%	7%
2009	7%	8%
2010	7%	9%
2011	7%	10%
2012	7%	11%
2013	7%	12%
2014	7%	13%
2015	7%	14%
2016	7%	16%
2017	7%	17%
2018	7%	18%
2019	7%	19%
2020	7%	20%

**Table 14 Increase in projected share of CHP in the electricity mix**

### 1.9. Renewable electricity in UK

The UK has set a target to have 40% renewable electricity in use by 2020. This will affect the projected electricity mix, raising it from a 10% to a 40% share in 2020. Table 15 shows the baseline projected electricity mix. Table 16 increases the share of renewables to 40%, and reduces the share of other sources proportionally. Consequently, the electricity conversion factor improved from 0.41 to 0.28 kt CO<sub>2</sub>/ GWh i.e. by 32%.

	Gas	Oil	Coal	Nuclear	Renewables	CHP
2008	39%	1%	33%	17%	4%	7%
2009	42%	0%	27%	17%	7%	7%
2010	44%	0%	21%	17%	11%	7%
2011	46%	0%	20%	16%	10%	7%
2012	49%	0%	19%	15%	10%	7%
2013	51%	0%	19%	14%	10%	7%
2014	53%	0%	18%	13%	10%	7%
2015	55%	0%	17%	12%	10%	7%
2016	57%	0%	16%	11%	10%	7%
2017	59%	0%	15%	10%	10%	7%
2018	61%	0%	14%	9%	10%	7%
2019	63%	0%	13%	8%	10%	7%
2020	65%	0%	12%	7%	10%	7%

**Table 15 Baseline projected change in the electricity mix**

	Gas	Oil	Coal	Nuclear	Renewables	CHP
2008	39%	1%	33%	17%	4%	7%
2009	42%	0%	27%	17%	7%	7%
2010	45%	0%	21%	17%	10%	7%
2011	45%	0%	20%	15%	13%	7%
2012	45%	0%	18%	14%	16%	6%
2013	46%	0%	17%	13%	19%	6%
2014	46%	0%	15%	11%	22%	6%
2015	46%	0%	14%	10%	25%	6%
2016	45%	0%	13%	9%	28%	5%
2017	45%	0%	11%	7%	31%	5%
2018	44%	0%	10%	6%	34%	5%
2019	44%	0%	9%	5%	37%	5%
2020	43%	0%	8%	4%	40%	4%

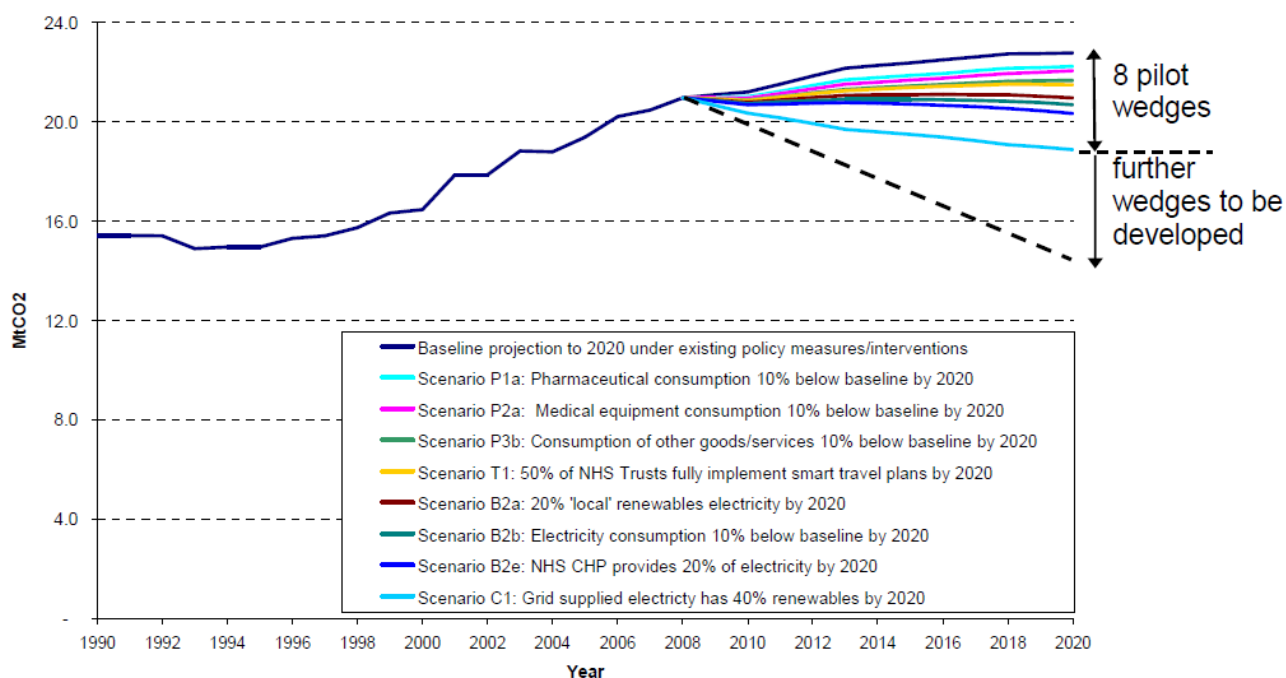
**Table 16 Projected increase in the share of renewable electricity**

By providing more carbon efficient electricity, sectors consuming electricity indirectly improve their carbon efficiency of production. The model incorporates this through a number of steps:

- The percentage input of electricity for each sector is obtained from the intermediate demand section in the UK supply and use tables. The electricity purchased is divided by total purchases. The data is available for 1992 – 2004 and is then projected to 2020 using the average change per year.
- The expenditure on electricity for each sector related to supplying goods and services to the NHS is then calculated by multiplying the input of electricity for each sector by NHS consumption expenditure for each sector.
- Emissions from electricity in the 2020 baseline equals the expenditure on electricity by sectors purely for providing NHS goods and services multiplied by the monetary production efficiency factor for electricity (6.25 kt/ £m).
- Emissions from electricity with 40% renewables is projected by multiplying the baseline emissions by 68%, which takes account that electricity supplies in the UK are 32% more efficient. However, as the renewable target only applies to the EU, we assume that the saving in emissions is only 50% as the other 50% would come from sectors out with the EU.

## B2. POTENTIAL CARBON REDUCTIONS

The model has quantified the potential CO<sub>2</sub> savings from the policy options considered to 2020. These are summarised in Figure 1 and presented in Table 17 for each of the main sectors.



**Figure 1 Cumulative CO<sub>2</sub> reductions from policy measures**

Policy wedge	Travel	Building energy	Procurement	Total
Reduce pharmaceutical wastage	0	0	532	532
Reduce medical equipment wastage	0	0	188	188
Reduce wastage of all other goods procured	51	0	331	382
Smart travel plans	180	0	0	180
Low emissions fleet	-	-	-	-
Increase on-site renewables to produce electricity	0	532	0	532
Reduce electricity consumption	0	266	0	266
Increase use of CHP	0	355	0	355
Renewable electricity in UK	11	899	555	1,464

**Table 17 Modelled CO<sub>2</sub> savings (kt) for each policy wedge by main sector in 2020**

## Appendix C – Input data to model

This section describes the baseline data that is input to the model. The table below summarises the data into 8 key variables, whose data 2008-2020 are then modified to suit the requirements of various policy interventions.

### VARIABLES AFFECTED BY EACH SCENARIO

Appendix Section	Name	Description	Units
<b>C1</b>	Direct energy use	Direct energy use by NHS England	GWh
<b>C2</b>	Electricity use	Electricity use by NHS England	GWh
<b>C3</b>	Procurement	Expenditure by sector of the NHS England	£ million
<b>C4</b>	Patient and visitor travel	Distance travelled by patients and visitors to NHS England facilities	km
<b>C5</b>	Commuter travel	Commuter distance travelled by NHS England staff	km
<b>C6</b>	Electricity generation	Percentage share of electricity generation	%
<b>C7</b>	Carbon intensity	Carbon intensity of production in the UK	kt CO <sub>2</sub> / £ million
<b>C8</b>	Travel intensity	Carbon intensity of UK travel for health purposes	kt CO <sub>2</sub> / 1000 km

**C1. DIRECT ENERGY CONSUMPTION, GWH**

<b>Fuel Source</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
<b>Gas</b>	6,425	6,550	6,686	6,809	6,932	7,055	7,177	7,300	7,423	7,546	7,144	7,770	8,291	8,642	8,180	7,902
<b>Oil</b>	1,950	1,850	1,740	1,654	1,568	1,482	1,396	1,310	1,225	1,139	1,109	948	829	748	712	655
<b>Coal</b>	1,240	1,190	1,142	1,094	1,046	997	949	901	853	805	743	652	695	677	572	477
<b>Renewables</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	9,615	9,590	9,568	9,557	9,545	9,534	9,523	9,512	9,501	9,490	8,997	9,370	9,815	10,067	9,464	9,034

<b>Fuel Source</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
<b>Gas</b>	8,617	8,246	8,380	8,506	8,635	8,766	8,898	9,033	9,169	9,308	9,449	9,592	9,737	9,884	10,033
<b>Oil</b>	625	389	735	684	636	592	550	512	476	443	412	383	356	331	308
<b>Coal</b>	526	364	315	293	271	252	233	217	201	186	173	160	149	138	128
<b>Renewables</b>	11	11	35	35	35	35	35	35	35	35	35	35	35	35	35
<b>Total</b>	9,780	9,010	9,465	9,518	9,577	9,644	9,717	9,796	9,881	9,972	10,068	10,170	10,276	10,388	10,504

**Table 1 – on-site energy generation 1990-2020**

## C2. ELECTRICITY CONSUMPTION, GWH

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>Electricity</b>	1,800	1,850	1,896	1,890	1,900	1,905	2,035	2,090	2,189	2,481	2,705	2,643	3,134	3,288	3,448	3,584

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Electricity</b>	3,748	3,995	4,258	4,449	4,650	4,859	5,078	5,306	5,471	5,640	5,815	5,995	6,181	6,329	6,481

**Table 2 – Electricity consumption 1990-2020**

**C3. PROCUREMENT DATA, £MILLION EXPENDITURE (AT 2004 PRICES)**

Sector Code	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	Agriculture			21	19	20	19	19	18	14	16	14	13	12	13	15	15
2	Forestry			-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Fishing			-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Coal extraction			16	15	15	12	9	8	6	6	5	4	3	3	2	1
5	Oil & gas extraction			-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Metal ores extraction			-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Other mining & quarrying			-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	Meat processing			154	137	145	136	136	126	108	105	99	95	89	89	90	87
9	Fish & fruit processing			79	71	76	71	70	65	56	61	58	56	52	50	51	50
10	Oils & fats			11	11	11	10	10	9	8	6	5	5	4	3	4	4
11	Dairy products			91	82	86	80	80	73	64	62	59	56	52	50	51	49
12	Grain milling & starch			23	20	21	20	17	16	14	16	15	13	12	13	13	13
13	Animal feed			6	5	5	4	4	3	2	2	2	2	3	2	2	2
14	Bread, biscuits etc.			74	66	70	65	61	57	53	60	56	53	48	48	51	49
15	Sugar			6	5	6	5	5	4	4	4	3	3	3	3	4	4
16	Confectionery			68	60	65	60	56	52	47	52	54	53	49	49	51	50
17	Other food products			40	36	37	36	33	30	27	27	30	28	28	26	29	28
18	Alcoholic beverages			-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	Soft drinks & mineral waters			-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Tobacco products			-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Textile fibres			-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	Textile weaving			-	-	-	-	-	-	-	-	-	-	-	-	-	-



Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Agriculture	14	14	14	13	13	12	12	11	11	10	9	9	8	8	7
2	Forestry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Fishing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Coal extraction	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
5	Oil & gas extraction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Metal ores extraction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Other mining & quarrying	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	Meat processing	83	80	76	72	68	64	60	57	52	49	45	42	39	36	33
9	Fish & fruit processing	48	46	45	43	41	39	37	35	33	31	29	27	25	23	21
10	Oils & fats	4	3	3	3	3	2	2	2	2	2	1	1	1	1	1
11	Dairy products	47	45	43	40	38	35	33	31	29	27	25	23	21	19	18
12	Grain milling & starch	12	12	11	11	10	9	9	8	8	7	7	6	6	5	5
13	Animal feed	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1
14	Bread, biscuits etc.	48	46	45	43	41	39	37	36	34	32	30	28	26	24	23
15	Sugar	4	4	4	4	3	3	3	3	3	3	3	2	2	2	2
16	Confectionery	49	48	47	46	44	42	41	39	37	35	33	32	30	28	26
17	Other food products	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
18	Alcoholic beverages	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	Soft drinks & mineral waters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Tobacco products	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Textile fibres	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	Textile weaving	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sector Code	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
23	Textile finishing			-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Made-up textiles			61	55	57	54	54	49	49	53	49	48	41	43	44	43
25	Carpets & rugs			-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Other textiles			43	39	40	38	37	36	37	39	45	45	48	50	52	53
27	Knitted goods			-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Wearing apparel & fur products			159	143	151	142	142	142	149	166	175	178	180	189	209	214
29	Leather goods			-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Footwear			2	2	2	3	3	3	3	4	3	3	3	4	6	6
31	Wood & wood products			-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Pulp, paper & paperboard			72	76	80	84	90	92	114	107	101	96	102	112	137	145
33	Paper & paperboard products			187	176	186	181	186	186	218	232	251	255	264	282	319	334
34	Printing & publishing			255	234	248	239	244	238	257	282	298	313	293	344	397	413
35	Coke ovens, refined petroleum & nuclear fuel			130	118	124	119	120	107	96	104	113	125	125	143	162	165
36	Industrial gases & dyes			40	37	39	36	36	36	37	43	48	55	62	69	79	84
37	Inorganic chemicals			-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	Organic chemicals			-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	Fertilisers			-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	Plastics & synthetic resins etc.			-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	Pesticides			-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	Paints, varnishes, printing ink etc.			-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	Pharmaceuticals			4,063	4,025	4,276	4,300	4,355	4,321	4,378	5,193	5,444	5,950	6,595	6,924	7,576	7,990
44	Soap & toilet preparations			75	67	72	67	65	66	69	70	84	95	99	111	132	139

Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
23	Textile finishing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Made-up textiles	42	41	40	38	37	35	34	32	31	29	27	26	24	23	21
25	Carpets & rugs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Other textiles	54	55	56	57	57	57	57	57	56	55	55	54	53	52	51
27	Knitted goods	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Wearing apparel & fur products	220	225	231	233	235	236	238	240	238	236	234	232	229	226	221
29	Leather goods	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Footwear	7	8	9	9	10	11	12	13	14	15	16	17	18	19	21
31	Wood & wood products	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Pulp, paper & paperboard	154	163	172	179	187	195	203	211	216	222	227	233	238	242	245
33	Paper & paperboard products	349	366	383	395	407	419	431	443	449	455	461	467	472	474	476
34	Printing & publishing	430	448	466	477	488	500	511	522	526	530	534	537	540	538	537
35	Coke ovens, refined petroleum & nuclear fuel	169	173	177	178	179	180	181	182	180	178	176	174	172	169	165
36	Industrial gases & dyes	89	94	100	104	109	113	118	123	126	130	133	137	140	142	145
37	Inorganic chemicals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	Organic chemicals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	Fertilisers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	Plastics & synthetic resins etc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	Pesticides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	Paints, varnishes, printing ink etc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	Pharmaceuticals	8,427	8,888	9,375	9,732	10,098	10,473	10,855	11,245	11,488	11,728	11,967	12,203	12,436	12,578	12,711
44	Soap & toilet preparations	146	154	162	167	173	179	185	191	195	199	202	206	209	211	213

Sector Code	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
45	Other chemical products			181	162	170	161	160	163	166	178	199	216	223	242	271	281
46	Man-made fibres			14	13	13	12	12	12	12	12	15	12	13	12	12	12
47	Rubber products			14	13	13	12	12	12	13	12	14	13	10	13	17	18
48	Plastic products			62	61	65	66	69	72	99	99	107	117	121	141	181	199
49	Glass & glass products			10	9	10	9	9	10	11	11	14	11	11	12	12	13
50	Ceramic goods			20	19	20	19	18	18	20	22	24	22	18	18	20	20
51	Structural clay products			10	10	10	9	10	10	9	11	10	10	9	10	12	13
52	Cement, lime & plaster			10	10	10	9	10	10	10	11	11	11	10	12	12	13
53	Articles of concrete, stone etc.			19	18	19	19	19	19	20	23	23	22	18	18	18	18
54	Iron & steel			-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	Non-ferrous metals			-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	Metal castings			-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	Structural metal products			10	10	10	9	10	10	10	11	14	11	10	12	14	15
58	Metal boilers & radiators			-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	Metal forging, pressing etc.			-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	Cutlery, tools etc.			32	30	31	30	30	30	29	29	32	28	30	30	32	32
61	Other metal products			19	18	19	19	20	23	29	28	24	22	20	23	24	25
62	Mechanical power equipment			-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	General purpose machinery			-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	Agricultural machinery			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
45	Other chemical products	291	302	313	319	325	332	338	344	345	346	347	348	348	346	343
46	Man-made fibres	12	12	12	12	12	11	11	11	10	10	10	9	9	8	8
47	Rubber products	18	19	19	20	20	20	20	21	21	20	20	20	20	20	20
48	Plastic products	219	240	264	286	309	334	361	389	415	441	469	499	530	558	588
49	Glass & glass products	13	13	14	14	14	14	14	14	14	14	14	13	13	13	13
50	Ceramic goods	20	20	20	20	20	19	19	19	18	18	17	17	16	16	15
51	Structural clay products	13	13	14	14	14	14	14	14	14	14	13	13	13	13	13
52	Cement, lime & plaster	13	13	13	14	14	14	14	14	13	13	13	13	13	12	12
53	Articles of concrete, stone etc.	18	18	18	18	18	17	17	17	16	16	15	14	14	13	13
54	Iron & steel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	Non-ferrous metals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	Metal castings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	Structural metal products	15	16	16	17	17	17	17	18	18	18	18	18	18	18	18
58	Metal boilers & radiators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	Metal forging, pressing etc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	Cutlery, tools etc.	32	33	33	32	32	31	31	30	29	28	28	27	26	25	24
61	Other metal products	25	26	27	27	27	27	28	28	28	28	27	27	27	26	26
62	Mechanical power equipment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	General purpose machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	Agricultural machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sector Code	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
65	Machine tools			-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	Special purpose machinery			-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	Weapons & ammunition			-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Domestic appliances nec			-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	Office machinery & computers			58	53	56	54	55	70	86	99	134	140	143	164	202	225
70	Electric motors & generators etc.			-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	Insulated wire & cable			-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	Electrical equipment nec			-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	Electronic components			-	-	-	-	-	-	-	-	-	-	-	-	-	-
74	Transmitters for TV, radio & phone			-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	Receivers for TV & radio			-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	Medical & precision instruments			1,844	1,833	1,857	2,023	2,244	2,325	2,596	2,999	3,040	3,317	3,365	3,454	3,752	3,985
77	Motor vehicles			1	2	2	3	2	1	2	1	2	1	3	3	5	7
78	Shipbuilding & repair			-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	Other transport equipment			89	80	84	79	80	80	82	92	101	106	105	116	130	135
80	Aircraft & spacecraft			-	-	-	-	-	-	-	-	-	-	-	-	-	-
81	Furniture			47	42	46	42	43	53	57	62	79	83	79	86	98	105
82	Jewellery & related products			-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	Sports goods & toys			-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	Miscellaneous manufacturing nec & recycling			32	30	31	29	30	31	32	33	23	24	32	42	58	62

Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
65	Machine tools	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	Special purpose machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	Weapons & ammunition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Domestic appliances nec			-	-	-	-	-	-	-	-	-	-	-	-	-
69	Office machinery & computers	251	281	314	345	379	416	457	501	542	586	633	684	738	790	846
70	Electric motors & generators etc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	Insulated wire & cable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	Electrical equipment nec	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	Electronic components	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
74	Transmitters for TV, radio & phone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	Receivers for TV & radio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	Medical & precision instruments	4,232	4,495	4,774	4,991	5,215	5,447	5,685	5,931	6,101	6,273	6,445	6,619	6,792	6,918	7,040
77	Motor vehicles	9	12	17	22	30	39	52	69	91	119	156	204	267	346	449
78	Shipbuilding & repair	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	Other transport equipment	139	144	149	152	155	157	160	162	163	163	163	163	163	162	160
80	Aircraft & spacecraft	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
81	Furniture	112	119	128	134	141	148	156	164	169	175	181	187	193	198	203
82	Jewellery & related products	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	Sports goods & toys	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	Miscellaneous manufacturing nec & recycling	66	71	75	79	83	87	91	96	99	102	105	109	112	115	117

Sector Code	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
85	Electricity production & distribution			297	268	285	267	267	232	232	252	237	225	197	219	248	245
86	Gas distribution			141	127	134	126	125	114	111	118	132	171	164	174	187	193
87	Water supply			72	65	70	67	68	62	64	68	62	63	62	63	66	65
88	Construction			217	201	211	203	268	237	273	226	250	278	314	327	344	360
89	Motor vehicle distribution & repair, automotive fuel retail			51	46	48	45	46	46	51	55	55	54	54	56	58	59
90	Wholesale distribution			-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	Retail distribution			-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	Hotels, catering, pubs etc.			154	138	146	139	138	156	203	243	262	274	285	335	395	429
93	Railway transport			68	61	65	54	50	51	53	59	62	66	80	83	86	88
94	Other land transport			546	501	529	506	515	504	528	581	614	663	666	698	744	765
95	Water transport			14	11	9	6	6	5	4	5	7	7	7	8	8	8
96	Air transport			13	13	14	12	13	14	16	21	21	22	19	19	20	21
97	Ancillary transport services			18	17	17	17	18	18	20	22	24	23	23	25	29	30
98	Postal & courier services			83	77	81	78	80	87	99	106	112	123	114	127	138	144
99	Telecommunications			328	298	315	300	303	286	288	324	332	349	348	369	406	414
100	Banking & finance			7	7	8	7	7	8	9	8	10	10	9	11	12	13
101	Insurance & pension funds			232	209	219	207	206	202	220	231	255	261	259	303	349	362
102	Auxiliary financial services			-	-	-	-	-	-	-	-	-	-	-	-	-	-



Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
85	Electricity production & distribution	243	240	237	231	225	219	213	207	198	189	181	173	166	157	149
86	Gas distribution	199	204	210	213	216	218	221	223	222	222	221	220	218	215	212
87	Water supply	65	64	64	63	61	60	58	57	55	53	51	49	47	45	42
88	Construction	377	395	414	427	439	452	466	479	486	492	499	505	511	513	515
89	Motor vehicle distribution & repair, automotive fuel retail	60	60	61	61	61	60	60	60	59	58	56	55	54	52	51
90	Wholesale distribution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	Retail distribution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	Hotels, catering, pubs etc.	467	507	552	590	631	675	721	770	811	853	898	944	991	1,033	1,076
93	Railway transport	91	93	95	96	97	98	98	99	98	98	97	96	95	93	92
94	Other land transport	786	807	829	839	848	857	865	873	869	864	859	853	847	835	822
95	Water transport	8	8	8	7	7	7	6	6	6	6	5	5	5	4	4
96	Air transport	22	22	23	24	24	25	26	26	26	27	27	27	27	27	27
97	Ancillary transport services	32	33	34	35	36	37	38	39	39	39	40	40	40	40	40
98	Postal & courier services	150	157	164	169	174	179	184	188	191	193	195	197	199	200	200
99	Telecommunications	422	430	439	440	442	443	444	444	439	433	427	421	415	406	396
100	Banking & finance	14	15	15	16	17	17	18	19	19	20	20	20	21	21	21
101	Insurance & pension funds	376	390	405	413	422	431	439	447	450	452	453	455	456	454	451
102	Auxiliary financial services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sector Code	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
103	Owning & dealing in real estate			371	343	364	350	361	329	316	347	360	366	374	410	478	489
104	Letting of dwellings			-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	Estate agent activities			-	-	-	-	-	-	-	-	-	-	-	-	-	-
106	Renting of machinery etc.			280	260	280	272	278	283	334	342	346	327	332	361	412	427
107	Computer services			230	210	247	235	234	256	318	341	369	410	422	445	499	534
108	Research & development			174	190	209	223	258	305	394	394	363	393	436	489	577	640
109	Legal activities			350	378	420	406	406	436	507	506	495	530	644	695	766	820
110	Accountancy services			73	69	77	76	81	87	91	91	90	107	113	120	140	148
111	Market research, management consultancy			-	-	-	-	7	7	8	9	7	10	13	18	27	-
112	Architectural activities & technical consultancy			353	386	429	452	516	539	662	655	625	658	710	777	846	912
113	Advertising			100	93	101	96	95	98	108	123	169	186	195	221	275	301
114	Other business services			348	383	418	438	514	500	585	608	461	541	640	691	791	853
115	Public administration & defence			-	-	-	-	-	-	-	-	-	-	-	-	-	-
116	Educarion			9	13	16	19	24	22	21	18	16	15	14	16	23	26
117	Health & veterinary services			2,433	1,981	2,161	2,216	2,683	2,346	2,744	3,532	3,598	3,853	4,419	4,866	5,436	5,856
118	Social work activities			157	169	169	174	208	225	307	312	335	335	342	370	457	502
119	Sewage & sanitary services			280	253	248	251	252	253	289	307	308	299	297	316	348	354
120	Membership organisations			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
103	Owning & dealing in real estate	501	513	525	529	533	536	540	543	538	533	528	523	517	508	498
104	Letting of dwellings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	Estate agent activities	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
106	Renting of machinery etc.	442	457	473	482	491	500	508	517	518	519	520	520	520	516	512
107	Computer services	572	612	655	690	727	765	805	846	877	909	941	974	1,007	1,034	1,060
108	Research & development	710	787	872	952	1,038	1,132	1,234	1,343	1,443	1,548	1,661	1,780	1,907	2,028	2,154
109	Legal activities	877	939	1,004	1,057	1,113	1,171	1,231	1,293	1,340	1,388	1,437	1,486	1,536	1,576	1,615
110	Accountancy services	157	166	176	183	191	198	206	215	220	225	231	236	241	245	248
111	Market research, management consultancy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
112	Architectural activities & technical consultancy	982	1,059	1,141	1,210	1,283	1,359	1,439	1,523	1,590	1,658	1,729	1,801	1,875	1,938	2,001
113	Advertising	330	361	395	425	457	492	529	569	602	638	675	714	755	792	831
114	Other business services	919	991	1,068	1,133	1,202	1,274	1,349	1,429	1,491	1,556	1,623	1,691	1,761	1,821	1,880
115	Public administration & defence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
116	Educarion	28	31	34	37	40	43	47	50	54	57	61	65	69	73	77
117	Health & veterinary services	6,309	6,796	7,321	7,763	8,227	8,714	9,226	9,762	10,185	10,621	11,069	11,528	11,999	12,395	12,795
118	Social work activities	551	605	665	718	776	838	904	975	1,037	1,103	1,171	1,243	1,319	1,389	1,462
119	Sewage & sanitary services	362	369	376	377	379	380	381	381	377	372	367	362	357	349	341
120	Membership organisations	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sector Code	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
121	Recreational services			17	18	21	22	25	23	36	40	38	48	61	66	76	87
122	Other service activities			75	68	72	67	67	70	80	86	86	98	114	130	167	179
123	Private households with employed persons			-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<b>Total</b>			15,642	14,764	15,677	15,718	16,791	16,485	18,063	20,471	20,975	22,475	24,117	25,834	28,760	30,441

Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
121	Recreational services	100	114	131	147	166	186	210	235	261	289	320	354	391	429	470
122	Other service activities	192	206	222	234	248	261	276	291	302	314	327	339	352	362	373
123	Private households with employed persons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<b>Total (£Million)</b>	32,268	34,223	36,315	37,949	39,657	41,441	43,306	45,255	46,658	48,104	49,596	51,133	52,718	53,984	55,279

**Table 3 – NHS England Procurement expenditure according to SIC codes 1990-2020**

#### C4. PATIENT AND VISITOR TRAVEL, KMS

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Walk</b>	213.0	218.4	223.7	235.9	232.7	248.7	249.9	236.6	237.5	238.6
<b>Car driver</b>	2,388.4	2,464.2	2,540.0	2,398.3	2,645.9	2,857.2	3,138.2	3,078.6	3,091.2	3,104.8
<b>Car passenger</b>	1,746.8	1,840.1	1,933.4	1,985.8	1,946.9	2,199.6	2,495.6	2,618.0	2,628.7	2,640.3
<b>Other private</b>	128.0	137.4	146.7	177.6	153.7	135.7	162.1	208.8	209.7	210.6
<b>Local bus</b>	321.6	341.6	361.6	391.1	378.2	441.7	456.7	480.5	482.5	484.6
<b>Rail</b>	228.7	241.6	254.5	194.9	234.3	232.3	371.7	430.7	432.4	434.3
<b>Taxi/mincab</b>	117.3	122.2	127.0	135.3	128.6	130.6	150.1	153.3	153.9	154.6
<b>Other public</b>	94.2	89.4	84.5	35.0	78.1	70.4	97.2	70.6	70.9	71.2
<b>All modes</b>	5,238.1	5,454.8	5,671.5	5,553.9	5,798.4	6,316.1	7,121.5	7,277.1	7,306.9	7,339.0

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
<b>Walk</b>	290.7	272.3	307.0	261.8	288.6	293.0	298.3	303.7	309.0	314.3
<b>Car driver</b>	2,858.2	3,025.6	2,995.9	3,535.0	3,663.4	3,525.4	3,601.2	3,677.0	3,752.8	3,828.6
<b>Car passenger</b>	2,388.0	2,751.4	2,573.7	2,973.2	3,280.3	3,146.8	3,240.1	3,333.5	3,426.8	3,520.2
<b>Other private</b>	293.5	249.3	221.3	220.3	249.7	268.6	278.0	287.4	296.8	306.1
<b>Local bus</b>	437.9	603.4	529.4	565.7	646.3	621.4	641.4	661.4	681.4	701.4
<b>Rail</b>	323.7	317.6	333.9	232.3	520.4	421.9	434.8	447.7	460.6	473.5
<b>Taxi/mincab</b>	186.5	201.9	144.1	218.7	146.8	190.3	195.2	200.1	204.9	209.8
<b>Other public</b>	12.1	79.4	18.0	19.3	14.4	25.2	25.0	24.8	24.6	24.3
<b>All modes</b>	6,790.4	7,500.9	7,123.3	8,026.3	8,809.9	8,492.8	8,714.1	8,935.5	9,156.8	9,378.2

	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Walk</b>	319.7	325.0	330.3	335.7	341.0	346.3	351.7	357.0	362.3
<b>Car driver</b>	3,904.4	3,980.2	4,056.0	4,131.8	4,207.6	4,283.4	4,359.2	4,435.0	4,510.8
<b>Car passenger</b>	3,613.5	3,706.8	3,800.2	3,893.5	3,986.8	4,080.2	4,173.5	4,266.8	4,360.2
<b>Other private</b>	315.5	324.9	334.3	343.6	353.0	362.4	371.8	381.2	390.5
<b>Local bus</b>	721.3	741.3	761.3	781.3	801.3	821.3	841.3	861.2	881.2
<b>Rail</b>	486.4	499.2	512.1	525.0	537.9	550.8	563.6	576.5	589.4
<b>Taxi/mincab</b>	214.7	219.5	224.4	229.3	234.1	239.0	243.9	248.7	253.6
<b>Other public</b>	24.1	23.9	23.7	23.4	23.2	23.0	22.8	22.6	22.3
<b>All modes</b>	9,599.5	9,820.9	10,042.2	10,263.6	10,485.0	10,706.3	10,927.7	11,149.0	11,370.4

**Table 4 – Patient / visitor travel 1992-2020**

## C5. COMMUTER TRAVEL, MILLION KMS

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>All modes</b>	2,040	2,005	1,981	2,396	2,404	2,390	2,446	2,466	2,521	2,398	2,639	2,808	2,970	2,902	2,971

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>All modes</b>	3,040	3,109	3,178	3,247	3,316	3,385	3,454	3,523	3,591	3,660	3,729	3,798	3,867	3,936

**Table 5 – Commuter travel 1992-2020**

## C6. ELECTRICITY SHARE (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>Gas</b>	0.01	0.02	0.02	0.09	0.13	0.16	0.21	0.27	0.27	0.33	0.33	0.31	0.33	0.32	0.34	0.32
<b>Oil</b>	0.13	0.12	0.11	0.08	0.05	0.05	0.05	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02
<b>Coal</b>	0.63	0.62	0.61	0.52	0.49	0.45	0.41	0.36	0.36	0.31	0.34	0.36	0.35	0.37	0.36	0.37
<b>Nuclear</b>	0.22	0.23	0.24	0.28	0.27	0.26	0.27	0.28	0.28	0.27	0.23	0.24	0.23	0.23	0.21	0.21
<b>Renewables</b>	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.01
<b>CHP</b>	0.00	0.01	0.02	0.03	0.04	0.07	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
<b>Total</b>	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Gas</b>	0.30	0.36	0.39	0.42	0.44	0.46	0.49	0.51	0.53	0.55	0.57	0.59	0.61	0.63	0.65
<b>Oil</b>	0.02	0.01	0.01	0.00	-	-	-	-	-	-	-	-	-	-	-
<b>Coal</b>	0.41	0.39	0.33	0.27	0.21	0.20	0.19	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12
<b>Nuclear</b>	0.19	0.16	0.17	0.17	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.07
<b>Renewables</b>	0.01	0.01	0.04	0.07	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
<b>CHP</b>	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
<b>Total</b>	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

**Table 6 – Electricity share 1990-2020**

## C7. CARBON INTENSITY OF PRODUCTION, KT CO2/ £ MILLION (KG CO2/£)

Example intensities of the two main NHS England procurement sectors

Sector Code	Sector	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
43	Pharmaceuticals	0.67	0.70	0.70	0.72	0.66	0.74	0.66	0.63	0.58	0.67	0.63	0.61	0.54	0.53
76	Medical & precision instruments	0.65	0.65	0.59	0.59	0.61	0.60	0.56	0.51	0.51	0.52	0.50	0.48	0.44	0.43

Sector Code	Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
43	Pharmaceuticals	0.52	0.51	0.50	0.50	0.49	0.48	0.47	0.47	0.46	0.45	0.44	0.44	0.43	0.42	0.42
76	Medical & precision instruments	0.42	0.40	0.39	0.38	0.37	0.36	0.34	0.33	0.32	0.31	0.30	0.29	0.28	0.28	0.27

**Table 7 – Carbon intensity of production 1992-2020**

## C8. CARBON INTENSITY OF UK TRAVEL FOR HEALTH PURPOSES, KT CO2/ 1000 KM (TES C02/KM)

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
0.00029	0.00029	0.00028	0.00028	0.00028	0.00027	0.00027	0.00027	0.00026	0.00026	0.00025	0.00026	0.00025	0.00025

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
0.00025	0.00024	0.00024	0.00024	0.00024	0.00023	0.00023	0.00023	0.00023	0.00023	0.00022	0.00022	0.00022	0.00022	0.00021

**Table 8 – Carbon intensity of UK travel for health purposes 1992-2020**