Natural Resources Footprinting

Technical Annex

A technical annex to support the main natural resources footprint report published by the SDU in June 2018

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Sustainable Development Unit

Document content

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Introduction

This technical annex fulfils two functions in support of the main natural resources report: to provide more detail where helpful and to provide clarity to the method and scope for each impact.

The main report measures the environmental footprint of the health and social care (HSC) system across four key impacts: water, waste, air pollution and carbon emissions. It helps to build a broader understanding of the sector's impacts beyond a focus on carbon emissions.

These are the four key impacts covered in this report:

 Carbon emissions

 Air pollution from travel and transport

 Water footprint

 Waste

This information helps the health and care system and the SDU in targeting activities to reduce these impacts and develop a more sustainable health and care system.

Accounting for different resources and impacts provides a more comprehensive picture of where action can be taken to benefit health and reduce environmental risks locally and globally. For example, food and catering have a fairly low carbon footprint but a much higher water footprint, whilst transport contributes a significant percentage of the HSC carbon footprint the impact of air pollution on health is more significant. Measuring impacts in a holistic way means that solutions can be developed that will more effectively address these impacts and deliver maximum co-benefits.

The direction of government strategies and legislation is the providing the system with a further mandate to act across these impacts:

- 25 Year Environment Plan
- Clean Growth Strategy
- Clean Air Strategy (consultation launch in 2018)
- Waste and Resources Strategy (to be announced in 2018)
- And more …

Please refer to the main report to see the action the SDU will be taking to support the system and see the excellent work going on across the system to continue to reduce the impact of the HSC system.

Impacts and influence:

Areas of Influence

Following consultation with the system it was decided that a restructuring of the resource footprint would benefit both how we understand our impact as a system and better communicate with stakeholders the varying degrees of influence and control we have over the impact we create.

Impacts are split where feasible into three Areas of Influence (AoI) as described below:

- **Core:** Impacts within the direct control of the HSC organisations such as utilities, direct water use, business travel etc.
- **Supply chain:** Impacts outside of the direct control of the HSC organisations, as a result of the supply of goods, services and capital projects to the sector.
- **Community:** Impacts outside of the direct control of the HSC system, such as patient travel, staff commuting and emissions from the use of propellant inhalers.

These AoIs reflect the source of impacts and the different levels of influence the system has on these impacts and hence the different mechanisms that are needed to manage reductions. For instance:

- **Core:** through direct investment
- **Supply chain**: through supplier engagement or clearer specification and contract management
- **Community**: through patient staff and partner engagement, information and guidance.

The table below summarises the area of influence, the system's level of influence and what scope each area covers – within the section for each impacts more granularity and specificity of the scope is detailed in a table.

Table 1. Areas of Influence (AoI) description

Area	*System level of influence*	*Scope of impact*	*Area*		*Scope of impact*
Core	High	Elements in direct control of the HSC such as our building's energy usage and NHS travel- i.e. Utilities, waste, business and fleet travel and anaesthetic gases	**Commissioned healthcare**	Medium level of influence	Healthcare commissioned outside of the NHS which is made up of core, supply chain and community, however the data and/or method cannot determine the exact segmentation across the three areas
Supply chain	Medium	Supply chain activities to supply goods, services and capital projects to the HSC system			
Community	Lowest	Covering the impacts generated outside of the health and social care estate but generated by patients, staff outside of work and the community based on the needs of the HSC.			

The split also helps highlight where emission changes in one area might correlate to changes in another area i.e. an increase in district nursing travel represented in the business mileage area (core) might have a corresponding reducing effect on patient travel (community).

Please note commissioned healthcare is the impact of non-NHS organisations only. However, some of the non-NHS impact is also included in the NHS core, supply chain and community. The data does not disaggregate the entirety of non-NHS provider healthcare due to the integrated working of the NHS with local authorities, the third and private sector.

In general, core impacts can be quantified with a higher level of certainty and are easier to influence directly. Community and supply chain impacts can be very high, but are typically subject to a greater degree of uncertainty and require more collaborative approaches to address. Both offer potential savings, health gains and other non-monetary benefits, such as improved staff engagement and retention. Positive change in all areas should underline the value that health and social care organisations have as ‘anchor organisations’. Organisations can lead by example, as well as supporting suppliers, staff and communities to make choices that protect health locally and globally.

Carbon footprint

Intro

Carbon reporting helps monitor our contribution to meeting the UK's Climate Change Act targets (CCA, 2008) and the UK's commitments on climate under the UN Sustainable Development Goals. HSC carbon emissions have fallen by 18.5% to 27.1 Mega tonnes (Mt) CO_2e since 2007. The progress made is testament to commitment and effort throughout the sector. Significant work is now required to accelerate emissions reduction to ensure the sector is playing its part in meeting the CCA targets.

This technical annex provides more detail to the scope / method including how changes in the method have affected the overall size of the HSC carbon footprint.

Scope

The footprint includes all scope 1,2,3 and well to tank (WTT) emissions aligned where possible to the Greenhouse Gas Protocol, this hybrid process uses where possible DEFRA/BEIS conversion factors and utilises an Economic Input Output process, specifically a Multi Region Input Output calculation method (MRIO). The MRIO looks at the whole supply chain and the embedded carbon of different processes and industries across four regional UK, Europe, China and the rest of the world to develop carbon intensities aligned to the spend by cost codes used in the Office of National Statistics Supply and Use Tables.

Areas of Influence

Table 2. Detailed carbon AoI description

Area	Scope	Method
Core	The direct impact from the entire health and social care system where we have significant control, such as the use of utilities, fugitive emissions and business/fleet mileage	Appling to BEIS conversion factors to usage data from across the system. For core impacts from Public Health and Social care uses the MRIO process. Non-provider anaesthetic gases are based on NAEI data.
Commissioned	Commissioned healthcare covers the health and care procured by individuals outside of the NHS system	For all organisations in scope, the MRIO process is used
Supply chain	The impact of the goods, services and infrastructure procured by the health and social care sector	Using a Multi Region Input Output calculation method (MRIO), carbon intensities have been calculated using expenditure and carbon emissions from different economic sectors.
Community	The support and influence the health and social care system can have to help the community, patients and staff make healthier choices e.g. commuting and patient travel as well as the fugitive emissions from the use of Pressurised Meter Dose Inhalers (pMDI).	A mixture of Department for Transport, SDU and organisation level data is used for travel distances and applied to BEIS conversion factors. NAEI data is used for inhaler usage.

Methodology - MRIO

The Carbon footprinting process is typically a volume/unit multiplied by a carbon intensity factor. Depending on the Area of Influence and organisations being assessed a different method may be used.

Core

In the core for the NHS we have tried to prioritise actual usage data e.g. kWh of energy and tonnes of waste multiplied by Department for Business, Energy & Industrial Strategy (BEIS) conversion factors[1] for the appropriate year. Data pre the coverage of BEIS conversion factors we have used the last years factors. The use of anaesthetic gases is included in the core and carbon emissions data is taken from the National Atmospheric Emissions Inventory (NAEI) for anaesthetics gases and applied to England per capita from the UK data. Other areas of the core use the Multi Region Input Output (MRIO) method detailed below.

Supply Chain

Where 'raw' data isn't accessible (either in the core for non-NHS elements or supply chain) the SDU have used what is known as an Economic Input Output Model, specifically a Multi-Region Input Output model (MRIO). This approach uses financial values rather than mass, size, or volume and applied to conversion factors specifically designed for use with financial values. The MRIO is unique as it also breaks down both the spend and generates a specific conversion factor for four regions of the world: UK, EU, China and rest of the world (RoW).

Using Office of National Statistics Supply and Use tables (SUT)[2] which detail the financial spend of 100+ industries (or Standard Industrial Classification (SIC) codes) as a matrix of spend between each industry – for the NHS we use 'Human Health Services' and a category also called 'Residential Care and Social Work Activities' represents Social Care. Both of these sets of values cover the UK so this is proportioned per capita to represent spending in England. The SUT don't have 100% coverage of all NHS spends, therefore the SUT data is used to calculate proportions which are then applied to the whole NHS and Social Care budgets for each year. Using a mixture of actual Public Health spend and back cast pre the existence of Public Health England is applied to the proportionate spends for 'Human Health Services' to represent public health spend.

So taking these two parts we have the extrapolated expenditure of the each of the three industries: NHS, Social Care and Public Health. Working with Stockholm Environment Institute (SEI) at the University of York they provide the analysis to split this spend across the four regions and develop the specific SIC code carbon intensity factor which is typically different for each SIC code and for each region:

E.g. In 2014 the total spend on Human Health was £128.5 billion, the proportion of this spend on 'Paper and paper products' (a SIC code) across the four regions in 2014 is multiplied by the specific conversion factor for the SIC code and region.

[1] BEIS conversion factors https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting
[2] ONS Supply and Use Tables
https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/inputoutputsupplyandusetables

Table 3. Example MRIO calculation

Region	2014 England proportion	Expenditure (millions)	Carbon intensity per £	Carbon emissions (tonnes)
UK	0.0019	£245.0	0.76	152,000
EU	0.0031	£400.6	0.48	158,000
China	0.0002	£30.0	2.03	50,000
Rest of World (RoW)	0.0009	£112.9	1.28	118,000
Total	0.0061	£788.5	0.61	478,000

This is calculated for each of the 100+ SIC codes across all 4 regions. The SDU then apply a concordance matrix, which removes certain SIC codes that have been replaced by actual data e.g. in the SUT data are SIC codes for Gas and Electricity these are removed for the NHS as ERIC and other raw energy data is used (as per above). The concordance matrix also merges the 100+ SIC codes in to the codes/names that the SDU use in this report, which makes the data presentation manageable, e.g. supply chain emissions are broken to 10 categories and commissioned healthcare made up of 89 different SIC codes:

- Business services
- Construction
- Food and catering
- Freight transport
- Information and communication technologies
- Manufactured fuels, chemicals and gases
- Medical Instruments /equipment
- Other manufactured products
- Paper products
- Pharmaceuticals

The publication of SUT data is typically 2-3 years in arrears, therefore the SDU use various economic and financial projections from inflation, GDP, and budget forecasting to extrapolate the latest MRIO outputs to the recent year.

When dealing with a large system such as HSC MRIO is an acceptable method to estimate emissions, the SDU aim is to continue to work to improve the accuracy and granularity of emissions and are exploring various ways to build bottom up emissions data for procurement, however the scale of NHS and care buying is so vast there is no simple solution.

Community

Staff commuting and patient & visitor travel is calculated through using the Department for Transport (DfT) data within the National Travel Survey[3] (NTS), where data for Health and social care professionals commute (which provides both the average distance and the modal share from this representative sample) this data is applied to BEIS factors for each mode of transport. Within the NTS there are also data for 'Personal Medical Business' and a proportion of social / visiting trips which have been used to provide both distances and modal share for visitor travel which is also applied to the BEIS conversion factors.

[3] All DfT NTS data available here and specific data can be request from DfT https://www.gov.uk/government/collections/national-travel-survey-statistics

Methodology Changes in 2017

In 2014 the ONS redesigned much of the SUT SIC codes methodology, which has re-calculated much of the data pre 2008, which has forced the SDU and SEI to use a new MRIO data base called EXIOBASE (previously EORA). And some of the data in the new SUT time showed significant gaps and unrealistic trends therefore work has been untaken to harmonise the two databases, a similar change happened in the SUT data in 2007 and 2012, in which the same process had to be applied. This isn't uncommon when faced with large methodological changes like this.

The SUT data for 2014 saw a distinct increase in spend on property and real estate services, this is assumed to reflect the cost of the transition from disbanding of PCTs, whilst setting up CCGs and more use of leased property e.g. via NHS Property services. In the previous modelling the gap in ERIC data regarding leased properties had been estimated as a small percentage but the rise in 2014 expenditure reflects the impact of cost of leased properties where service charges for energy, water and sometime waste are included therefore the estimate on leased properties has been taken out of the model using the MRIO process for leased properties as to reduce the likelihood of double counting for these emissions. This combined with the change in MRIO approach for non-NHS energy emissions has had a net effect; there is a small reduction in electricity emissions and an increase in heating emissions.

In this report the SDU took the decision to replace the waste MRIO output with waste volume data taken from ERIC, Greening Government Commitments and some extrapolation to cover the entire NHS. The SDU applied the BEIS factors for waste disposal which are known to under estimate the impact with the majority of BEIS waste factors covering only the transportation impact rather than the actual emissions created through alternative, incineration or energy recovery treatment processes. Overall this has significantly reduced the carbon emissions of waste; this has been back cast for all years. The MRIO data was likely over exaggerating the impact of waste disposal, handling and treatment whereas the BEIS process is not providing full coverage, however these are the factors set by government specifically for carbon reporting.

Major impacts to hotspots

In summary these are the changes the above changes have had on specific elements of the footprint:

Table 4. Impact of MRIO methodology changes

Categories	Updated 2014	Previous 2014	% Change	Rationale
Water	475	210	55%	MRIO change and change in SUT SIC calculation
Manufactured fuels, chemicals and gases	1,415	664	53%	MRIO change and change in SUT SIC calculation
Medical Instruments /equipment	4,181	2,731	34%	MRIO change and change in SUT SIC calculation
Business travel / fleet	1,504	1,013	32%	MRIO change and change in SUT SIC calculation
Other manufactured products	746	503	32%	MRIO change and change in SUT SIC calculation
Food and catering	1,987	1,342	32%	MRIO change and change in SUT SIC calculation
Paper products	910	617	32%	MRIO change and change in SUT SIC calculation
Construction	966	691	28%	MRIO change and change in SUT SIC calculation
Pharmaceuticals	3,827	2,975	22%	MRIO change and change in SUT SIC calculation
Freight transport	1,018	912	10%	MRIO change and change in SUT SIC calculation
Heating / fuels	2,269	2,053	9.5%	Changes in how NHSPS properties are accounted for and application of the MRIO for non-NHS energy emissions
Business services	3,003	2,920	2.8%	MRIO change and change in SUT SIC calculation
MDI usage	813	793	2.5%	Updated based on more accurate population data
Patient and Visitor travel	1,896	1,893	0.2%	Better aggregation of petrol and diesel vehicle usage
Anaesthetic gases	516	516	0.0%	No change to method
Electricity	3,113	3,149	-1.2%	Changes in how NHSPS properties are accounted for and application of the MRIO for non-NHS energy emissions
Information and communication technologies	426	451	-5.9%	MRIO change and change in SUT SIC calculation
Staff Commuting	548	621	-13%	Significant changes in how NHS staff numbers are calculated back cast throughout the model and better aggregation of petrol and diesel vehicle usage
Commissioned Healthcare	1,504	3,165	-110%	MRIO change and change in SUT SIC calculation
Waste	37	539	-1359%	Replacement of MRIO data with waste volume data applied to BEIS factors

Core carbon indicator

An approved indicator, with a full detailed method, has been created covering NHS provider's core footprint. The metric was approved by NHS Digital's Indicator Governance Board[4] in Jan 2018 and shows a more detailed method for providers. The indicator will can be used by providers (and the method can be used by other HSC organisations) to track progress from 2013/14 against the 28% reduction target by 2020. It is expected that further indicators will be created to cover all Areas of Influence and all the organisations/parts of the system in scope overtime.

Progress

Since 2007, the HSC system has made strong progress, exceeding the 10% target set in the Carbon Reduction Strategy[5]. The HSC system reduced carbon emissions by 14% by 2015. Emissions have continued to reduce, falling by 18.5% up to 2017. While the rate of reduction has accelerated over the last two years, this is still behind the trajectory needed to achieve the Climate Change Act 2020 target of 34%, highlighting the need to redouble and accelerate efforts going forward.

The table below summarises the carbon emissions by AoI between 2007 and 2017 and the corresponding percentage reduction.

Table 5. Carbon emissions reduction progress since 2007 by AoI

AoI	*2007 baseline (kt CO_2e)*	*2017 (kt CO_2e)*	*% reduction*
Core	8,051	6,564	-18.5%
Commissioned	1,810	1,201	-33.6%
Supply chain	19,587	15,548	-20.6%
Community	3,811	3,806	-0.2%
Total	33,259	27,119	-18.5%

The table shows the significant progress that has been made across the sector, particularly the 20% reduction in supply chain emissions representing close to 4MtCO_2e. This is due to reductions in the impact intensity of many supply chains that support the HSC system. This momentum can be harnessed to create further improvements. Headway has been less in community emissions, although, overall this is a relatively small area it can be managed via staff and patient engagement, such as supporting a shift to lower global warming impact inhalers, which on their own represent around 3.2% of HSC carbon emissions.

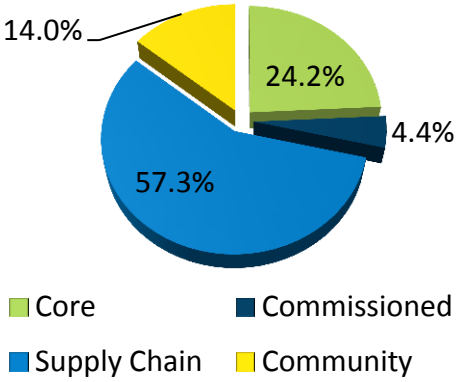
2017 Breakdown and hotspots

The breakdown across the three AoI shows that supply chain emissions remain the largest element at nearly two thirds of carbon emissions. The core, over which the sector has considerable direct influence, is nearly a quarter of the total. The impact of community emissions, where the HSC system can nudge staff and patients to act in more sustainable ways, is just over an eighth.

[4] National Library of Quality Assured indicators, NHS Digital, http://content.digital.nhs.uk/article/1674/Indicator-Assurance-Service
[5] Carbon Reduction Strategy: https://www.sduhealth.org.uk/crs

The diagram below summarises the breakdown across the areas of influence and their contribution of the overall footprint.

Figure 1. 2017 breakdown of HSC carbon emissions



Category	*2017 $ktCO_2e$*	*%*
Core	6,564	24%
Commissioned	1,201	4%
Supply chain	15,548	57%
Community	3,806	14%
Total	27,119	

The table below shows the breakdown across the AOI by each part of the HSC system:

Table 6. 2017 HSC emissions breakdown

(N.B: the darker the purple, the higher the value)

Area of influence	*Organisations*	*2017 $MtCO_2e$*	*%*
Core	NHS	5,366	19.8%
	Social care	1,085	4.0%
	Public Health	113	0.4%
	Subtotal	**6,564**	**24.2%**
Commissioned	NHS	533	2.0%
	Social care	653	2.4%
	Public Health	15	0.1%
	Subtotal	**1,201**	4.4%
Supply Chain	NHS	12,789	**47.2%**
	Social care	2,394	8.8%
	Public Health	365	1.3%
	Subtotal	**15,548**	**57.3%**
Community	NHS	2,908	10.7%
	Social care	880	3.2%
	Public Health	17	0.1%
	Subtotal	**3,806**	**14.0%**
Total		27,119	

The NHS typically has the largest impacts across each AoI; however the commissioned healthcare from social care is larger than that of the NHS. Even though social care has a similar number of staff the impact of the NHS is typically 5-6 times larger in each AoI, this is due to the size of the NHS estate and the more intense / complex need for resources required to treats patient in the NHS compared to social care sector.

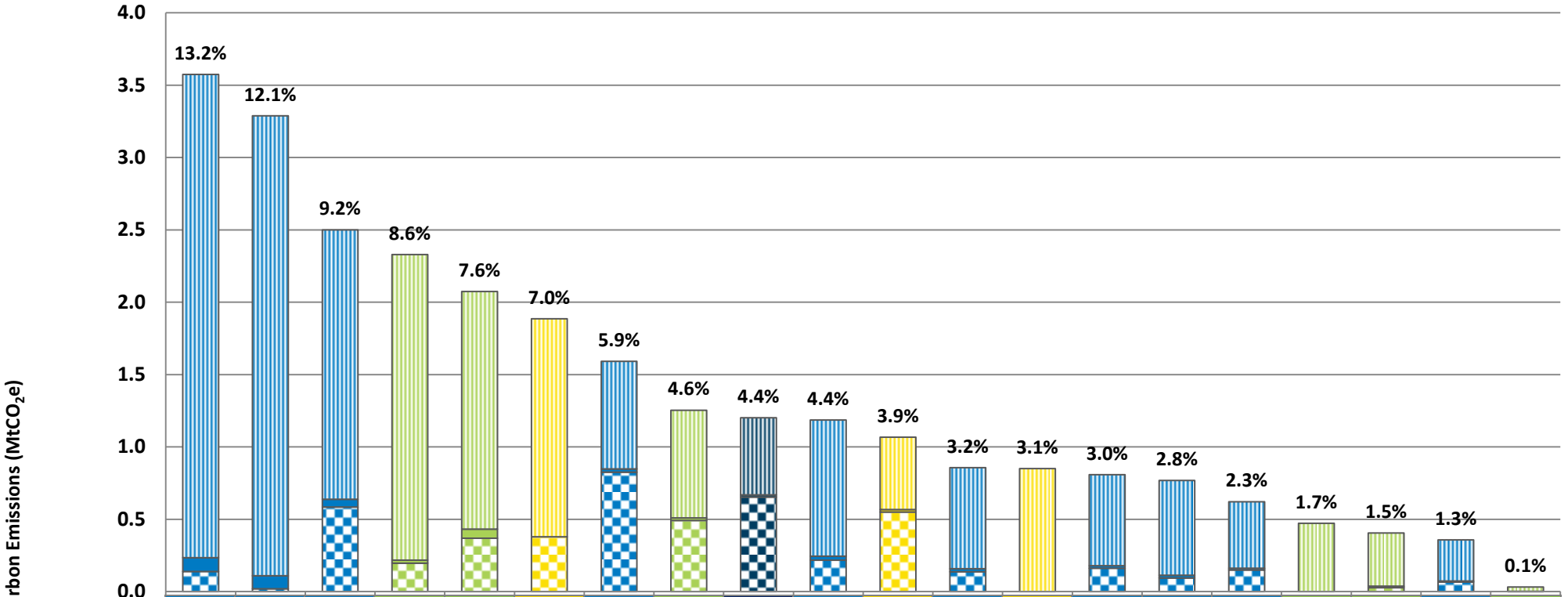
The HSC system's two largest hotspots are medical equipment and pharmaceuticals. The third largest, also within the HSC supply chain, relates to business services.

The following hotspots relate to core emissions - heating /fuel (gas, oil, coal, biomass etc.) and electricity. Patient and visitor travel and meter dose inhalers (MDI) are also significant impacts. The most common use of MDIs is in the treatment of asthma and chronic obstructive pulmonary disease (COPD). MDIs represent over 3.2% of the entire HSC carbon footprint. The impact is not in their manufacture but in the high global warming potential (GWP) of the propellants used as the delivery mechanism. Lower emission and safe alternatives are available.

Action to reduce carbon emissions can also reduce embodied water impacts and air pollution, and vice versa. Some examples of these types of action are provided in the main report's *Examples of good practice* section. The SDU and NHS Improvement will continue to work to support reductions in carbon emissions related to buildings. The SDU will also focus some attention on hotspot areas, such as potential options to consider lower emission inhalers, subject to the clinical and financial case being made. More detail is provided on this in the SDU actions section on the main report.

The following diagram highlights the relative contributions from key factors and gives an indication of the range of opportunities available to reduce the HSC carbon footprint.

Figure 2. Health and Social care detailed breakdown 2017



	Medical Instruments /equipment	Pharmaceuticals	Business services	Fuels	Electricity	Patient and visitor travel	Food and catering	Business travel / fleet	Commissioned Healthcare	Manufactured fuels, chemicals and gases	Staff Commuting	Freight transport	MDI usage	Construction	Paper products	Other manufactured products	Anaesthetic gases	Water	ICT	Waste
Total	3.57	3.29	2.50	2.33	2.07	1.89	1.59	1.25	1.20	1.19	1.07	0.86	0.85	0.81	0.77	0.62	0.47	0.40	0.36	0.03
%	13.2%	12.1%	9.2%	8.6%	7.6%	7.0%	5.9%	4.6%	4.4%	4.4%	3.9%	3.2%	3.1%	3.0%	2.8%	2.3%	1.7%	1.5%	1.3%	0.1%
NHS	3.34	3.18	1.86	2.11	1.64	1.51	0.74	0.74	0.53	0.94	0.50	0.70	0.85	0.63	0.66	0.46	0.47	0.37	0.28	0.03
Public Health	0.10	0.09	0.05	0.02	0.06		0.02	0.02	0.02	0.03	0.02	0.02		0.02	0.02	0.01		0.01	0.01	0.00
Social Care	0.14	0.02	0.58	0.20	0.37	0.38	0.83	0.49	0.65	0.22	0.55	0.14		0.16	0.09	0.15		0.03	0.07	0.00

Water footprint

This is the first time the amount of water used directly and indirectly by the HSC system has been estimated. Indeed this is the first time any health and care system globally has calculated an estimate of its water footprint. With the NHS constitution stating that it is 'committed to providing the most effective, fair and sustainable use of finite resources' and with the significant cost and risk associated with more constrained water resources in the future, it is important to measure the water that is used to support healthcare.

In 2017 the total HSC consumption of water (direct and indirect) was 2,319 million m^3, similar to that of a country such as Estonia[6]. Direct water use is only a small proportion of our overall footprint, less than 2%. In 2017 NHS providers alone used 35.8 million m^3 of potable water, a direct financial cost of over £80m a year. However, 'virtual' water, embedded in the manufacture and supply of food, products and services, makes up the vast majority of the water footprint.

Areas of Influence

Area	Scope	Method
Core	The direct impact from the entire health and social care system where we have significant control, such as the use of utilities and business/fleet mileage (fugitive emissions have no green or blue water impact)	The MRIO process is used for all organisations and across all Areas of Influence and as per the GHG process there are specific blue and green water conversion factors applied to each of the four regions for each specific SIC code
Commissioned	Commissioned healthcare covers the health and care procured by individuals outside of the NHS system	
Supply chain	The impact of the goods, services and infrastructure procured by the health and social care sector	
Community	The support and influence the health and social care system can have to help the community, patients and staff make healthier choices e.g. commuting and patient travel.	The community impact is estimated based on the ration between the MRIO impact for water footprint and carbon emissions from business travel and carbon emissions for staff and patient travel as we cannot calculate the expenditure for commuting and patient travel.

Scope

Using the MRIO process as per the carbon footprint, specific water intensities factors for water used directly or indirectly by the NHS system and defined as green and blue water have been used.

Green water covers water usage indirectly through soil moisture from precipitation used by plants via transpiration (as part of the hydrogen cycle). Blue water covers the usage of fresh water from surface or ground water, typically this is treated for use in processes such as manufacture, for cooling and heating systems as well as 'drinking' water. Other water impacts such as grey water

[6] National Water footprint explorer http://waterfootprint.org/en/resources/interactive-tools/national-water-footprint-explorer/

(which is the impact of any water that is polluted) and black water (the creation of sewage/effluent) is not included.

Method MRIO

The water footprint is calculated in the same way as the carbon emissions, however for the water footprint only the EXIOBASE model has been used and data outcomes from 2008 onwards only to remove the effects seen in the carbon footprint, due to inconsistencies in the Supply and Use Tables time series

In the water footprint there are two water conversion factors applied to the spend per each SIC code applied to each of the four specific regions. One factor is for blue water and one for green water. The total impact is the sum of the both and where appropriate the addition of direct water usage.

Progress

The HSC water impact has reduced since 2010 to 2,320 million m^3 in 2017 representing a 21% reduction. This shows that progress is being made by the HSC system.

Table 7. Water footprint reduction progress since 2010 by AoI

AoI	*2010 baseline (million m^3)*	*2017 (million m^3)*	*% reduction*
Core	194	165	-15.2%
Commissioned	144	150	4.7%
Supply chain	2,452	1,889	-23.0%
Community	138	115	-16.4%
Total	2,928	2,320	-20.8%

The largest reduction has been through the supply chain, by inherent cost savings and associated improvement in water resiliency within many industries that supply HSC. The impact of the core water footprint has also decreased. A move from coal or gas produced energy production to renewables is likely to have contributed to this reduction too.

2017 Breakdown and hotspots

The water footprint consists of three parts blue water, green water and direct water usage. The table below details the breakdown across the parts of the system and the breakdown by type of water.

Table 8. Blue and green water breakdown 2017 in million m^3

(N.B: the darker the colour (i.e. purple or orange), the higher the value)

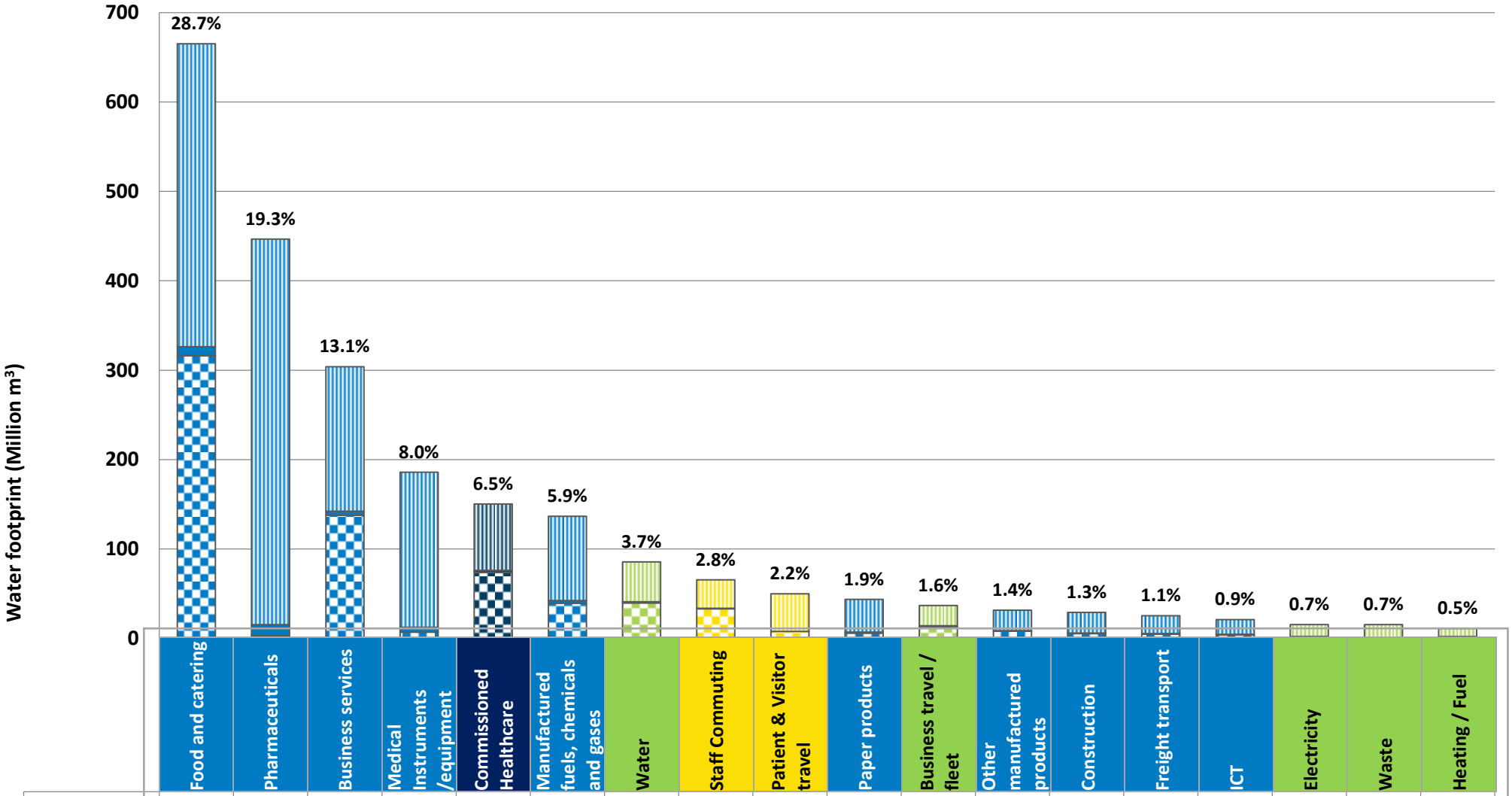
		Blue	Green	Direct water supply	Total
Core	NHS	11.6	50.0	42.1	103.7
	Social Care	3.3	15.1	39.3	57.7
	Public Health	0.5	1.5	1.2	3.2
	Subtotal	**15.4**	**66.6**	**82.6**	**164.6**
Commissioned	NHS	10.7	63.6		74.2
	Social Care	10.6	63.2		73.9
	Public Health	0.3	1.9		2.3
	Subtotal	**21.6**	**128.7**		**150.4**
Supply Chain	NHS	221.7	1,097.0		1,318.7
	Social Care	64.3	467.3		531.5
	Public Health	5.4	33.7		39.1
	Subtotal	**291.4**	**1,597.9**		**1,889.3**
Community	NHS	12.3	61.5		73.9
	Social Care	6.4	34.6		41.0
	Public Health	0.1	0.4		0.6
	Subtotal	**18.9**	**96.6**		**115.5**
Total		**347.3**	**1,889.8**	**82.6**	**2,319.7**

Overall the largest area of water footprint is from the supply chain, which is dominated by green water impacts. Direct water usage is the water direct from the mains used on HSC sites such as water consumed on site to the use of water for cleaning.

The chart below shows that over 60% of the HSC water impact is made up of three areas - food and catering (28.7%), pharmaceuticals (19.3%) and business services (13.1%), with medical instruments and commissioned healthcare being the 4th and 5th largest areas. The top six areas are all supply chain or commissioned healthcare impacts.

The usage of water itself in the HSC system is a large area of impact (both in terms of the water used and the impact of treating water to create clean potable water for the system) and is the single largest area in the core AoI. Travel and transport by patients and staff business mileage, equates to a total of nearly 7% of the entire water footprint.

Figure 3. HSC water footprint hotspots in 2017



	Food and catering	Pharmaceuticals	Business services	Medical Instruments /equipment	Commissioned Healthcare	Manufactured fuels, chemicals and gases	Water	Staff Commuting	Patient & Visitor travel	Paper products	Business travel / fleet	Other manufactured products	Construction	Freight transport	ICT	Electricity	Waste	Heating / Fuel
Total	665.25	446.70	303.97	185.80	150.36	136.74	85.61	65.55	49.93	43.68	36.82	31.54	29.20	25.26	21.18	15.49	15.48	11.18
%	28.7%	19.3%	13.1%	8.0%	6.5%	5.9%	3.7%	2.8%	2.2%	1.9%	1.6%	1.4%	1.3%	1.1%	0.9%	0.7%	0.7%	0.5%
NHS	339.04	431.40	161.60	173.39	74.22	94.52	44.58	31.84	42.04	36.52	22.63	22.76	23.16	19.71	16.60	13.26	14.21	9.00
Public Health	9.93	12.40	4.78	5.47	2.28	2.83	1.31	0.56	-	1.16	0.82	0.69	0.71	0.61	0.51	0.40	0.43	0.28
Social Care	316.28	2.91	137.60	6.94	73.86	39.39	39.72	33.15	7.89	6.00	13.37	8.09	5.33	4.93	4.07	1.83	0.84	1.90

Air pollution – travel and transport

Intro

Air pollution has a significant impact on human health, annually contributing to over 3 million deaths across the globe[7]. Each year there are estimated to be around 40,000 air pollution related deaths[8] in the UK alone. According to the World Health Organisation (WHO), 92% of the world's population live in areas where air pollution levels exceed WHO guideline limits[9]. The Government is targeting air pollution as a priority by publishing a Clean Air Strategy. This is supported by local action and the development of clean air zones in major cities such as London and Nottingham.

There are over 9.5bn NHS related road miles per year, which is around 3.5% of all road travel in England: this means that the NHS unintentionally impacts on air quality, particularly because of the need for staff and patients to travel to and from NHS sites. Health impacts from the resulting nitrogen oxides (NO_x) and particulate matter ($PM_{2.5}$) emissions are estimated to cost the economy around £345m per year. This is from mortality impacts alone.

"We need to understand that there is a price to pay for this scale of transport and travel, not just in terms of time or money but in terms of air pollution (NO_x, PM_{10} and $PM_{2.5}$) and greenhouse gas generation. Because no-one pays today for the true, full social cost of fossil fuel use and pollution (much of the cost is deferred to the future)."[10]

Annual Report of the Chief Medical Officer 2017

The SDU's Health Outcomes of Travel Tool (HOTT) is designed to support health care organisations understand, monitor and assess where and how to reduce air pollution and other travel and transport impacts on health.

[7] World Health Organisation, Air pollution, http://www.who.int/airpollution/en/
[8] Every Breath We Take, Royal College of Physicians, https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution
[9] World Health Organisation, Ambient air pollution http://www.who.int/airpollution/ambient/en/
[10] Chief Medical Officer Professor Dame Sally Davis, Annual Report of the Chief Medical Officer 2017 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/690846/CMO_Annual_Report_2017_Health_Impacts_of_All_Pollution_what_do_we_know.pdf

Areas of Influence

This report only covers NHS travel, due to the inability to secure robust and national level data sets for social care business mileage, supply chain and owned vehicles.

Area of Influence	Scope
Core	NHS (inclusive of primary, secondary and tertiary care, as well as mileage undertaken by NHS governance organisations such as DHSC, NHSE, PHE and some arm length bodies) business mileage inclusive of all ambulance vehicles. This currently doesn't include non-ambulance fleet – e.g. estates and facilities vehicles or internal courier/logistics movements – due to no robust national reporting[11].
Supply Chain	Covering the impact arising from spend by the NHS – this currently covers only some major suppliers who have provided data and is estimated to be 2.7% based on spend – this has been extrapolated to estimate the total NHS supply chain impact.
Community	Covering the commuting of NHS staff and the movement of patients and visitors to access healthcare when not using an ambulance or other vehicles provided by the NHS for them, e.g. using their own vehicles or public transport.

Scope

The data provided in this report only relates to NHS travel in England as the data for other areas of the HSC and movement outside of England is not available (i.e. air / rail travel out of England and the movement of goods before they enter England). Indoor air pollution also cannot be quantified due to lack of data and the complexities of the attributing impact to indoor activities.

Commissioned healthcare is not included in the air pollution impact – the movement of patients and visitors outside of the NHS are captured in the community AoI, however the impact of commissioned core and supply chain are not included as there are no central robust data streams of mileage or vehicle type.

The NHS also contributes to outdoor air pollution where fuels are burnt to produce electricity and heat. These, alongside air travel will also have an impact on health. These are not included because of lack of data.

Method

The air pollution impacts are focused on NO_x and $PM_{2.5}$ and do not include any other pollutants. The $PM_{2.5}$ includes generation from combustion as well as brake and tyre wear. The outcomes are from HOTT (please see a full explanation of method in the supporting guidance[12]). HOTT also covers other impacts such as road traffic incidents, noise and carbon emissions – but here the focus is on air pollution. The air pollution impacts are also limited to mobile sources as detailed above. Due to limitations of the available evidence, health and economic impacts are restricted to mortality and life years lost only. Illness caused through exposure to air pollution is not covered.

[11] Work is being undertaken to close this information gap with the aim of having this data from 2017/18.
[12] HOTT full guide https://www.sduhealth.org.uk/delivery/measure/health-outcomes-travel-tool.aspx

2017 breakdown and hotspots

Each year NHS related travel equates to 9.5 billion miles by all modes of land transport - nearly 3.5% of all road miles in England. Health and social care road transport is estimated to be responsible for up to 5% of all road travel. The table below shows the purpose of travel by organisation type:

Table 9. Breakdown of total mileage by purpose of travel in miles

(N.B: the darker the purple, the higher the value)

	Providers (non-ambulance)	***Ambulance providers***	***Primary care and CCGs***	***Governance bodies***	***Subtotal***
Business Mileage	**432,891,565**	**15,434,358**	**155,109,096**	**57,670,313**	661,105,332
Fleet		**229,486,293**		**33,890**	229,520,183
Supply Chain	**219,356,350**				219,356,350
Staff Commute	**1,423,643,939**	**54,586,579**	**200,159,820**	**24,509,997**	1,702,900,335
Patient and Visitor	**5,075,848,259**	Captured as fleet	**1,621,253,027**	N/A	6,697,101,286
Subtotal (exclusive of supply chain)	6,932,383,763	299,507,230	1,976,521,942	82,214,199	9,509,983,485

The road miles detailed above result in over 7,285 tonnes of NO_x and 333 tonnes of $PM_{2.5}$ which contributes to the loss of 10,358 quality adjusted life years (QALYs[13]) each year. The economic impact on society of these lost life years is nearly £345million.

In contrast to this, there is an added health benefit from regular active travel from staff commuting. The value of regular active travel in increasing the health and wellbeing of NHS staff has also been quantified at nearly £18m per year, in the reduction of treatment costs alone.

[13] 'A measure of the state of health of a person or group in which the benefits, in terms of length of life, are adjusted to reflect the quality of life. One QALY is equal to 1 year of life in perfect health' NICE.

Waste

Intro

In 2016/17 NHS providers alone generated nearly 590,000 tonnes of direct waste[14]. Waste in this context means items put into recycling receptacles, skips and bins in NHS trusts. This represents around 2% of all commercial and industrial waste in England[15].

There are two key waste management challenges for the HSC sector. Firstly, avoid as much waste as possible, as far up the supply chain as possible. This may include buying fewer products in the first place, through lean processes, or avoiding unnecessary treatment. Secondly, ensure HSC organisations treat waste in the most efficient and productive way possible. Indeed all waste should be seen as having potential material value.

Data

The majority of waste data we have from the HSC system is from NHS providers through the Estates Return Information Collection (ERIC). The waste categories have changed significantly year on year since 2013/14 and are suggested to change again in 2018/19 reporting cycle. This makes any time series or analysis over multiple years impossible.

[14] ERIC, 2016/17 data http://hefs.hscic.gov.uk/ReportFilter.asp
[15] DEFRA 2016 stated Commercial and Industrial waste in England was 32.2Mt

Integrating the results

This report highlights significant progress made across the HSC system to reduce the impact of natural resources and in particular that:

- The carbon emissions from health and social care are down by 18.5% on 2007, at 27.12MtCO_2e with further progress required to meet the 2020 Climate Change Act targets.
- The system wide water footprint is 2.2bn m^3, representing a reduction of 21% since 2010.
- A first assessment of the NHS impact on air pollution has been estimated to support action towards cleaner air.
- 85% of NHS provider waste is now directed away from landfill, with further action required to reduce waste and the use of plastics.

Integrating these results also helps to identify the connections and co–benefits of managing natural resources in a coordinated and holistic way. It helps to broaden the measurement and interpretation of the system's impact on the environment and to plan where to focus action. The table below highlights the potential co-benefits of managing hotspots across the different impacts and the following two sections describe how these can be used to identify areas of action across the system

Table 10. Summary of integrated results

		Carbon	***Water***	***Air pollution from transport (NHS only)***	
		$MtCO_2e$	***million m^3***	***tNO_x***	***$tPM_{2.5}$***
Core	Electricity	2.07	15.49	Static sources of air pollution currently unquantified.	
	Heating / Fuel	2.33	11.18		
	Water	0.40	85.61	-	-
	Business travel / fleet	1.25	36.82	639.8	44.9
	Anaesthetic gases	0.47	-	891.2	27.0
	Waste	0.03	15.48		
Commissioned	Commissioned Healthcare	1.20	150.36		
Supply Chain	Pharmaceuticals	3.29	446.70		
	Medical Instruments /equipment	3.57	185.80		
	Freight transport	0.86	25.26		
	Business services	2.50	303.97		
	Paper products	0.77	43.68		
	Other manufactured products	0.62	31.54		
	Manufactured fuels, chemicals and gases	1.19	136.74		
	Food and catering	1.59	665.25		
	Construction	0.81	29.20		
	ICT	0.36	21.18		
Community	Staff Commuting	1.07	49.93	1780.0	72.5
	Patient and Visitor travel	1.89	65.55	3974.8	188.6
	MDI usage	0.85	-	-	-

Glossary

25 Year Environment Plan - a strategy written by DEFRA to "set out what we will do to improve the environment, within a generation" https://www.gov.uk/government/publications/25-year-environment-plan

Active Travel – relates to walking and cycling primarily but also includes any other modes of travel powered by human energy. Regular active travel has a health benefit because it is a form of exercise.

AoI or Area of influence – is a new way of segmenting the impact in relation to the methodology, level of control and size of the impact to better support managing the impact (see page 7)

Carbon emissions / GHG / CO_2e – in the report carbon emissions has been used interchangeably with CO_2e, all measurement of carbon is inclusive of the main greenhouse gases based on their global warming potential as per standard UK government reporting.

Circular economy / approaches - A circular economy is a regenerative process or system in which resource input and waste, emission, and energy loses are minimised by closing material and energy loops.

Clean Air Strategy – currently in consultation (until 14th August 2018): https://consult.defra.gov.uk/environmental-quality/clean-air-strategy-consultation/

Clean Growth Strategy – "An ambitious blueprint for Britain's low carbon future." https://www.gov.uk/government/publications/clean-growth-strategy

DPIs or Dry Powder Inhalers –are inhalers that can be used to treat both chronic obstructive pulmonary disease and Asthma that don't require any high global warming potential propellants.

Fugitive gases – are emissions of gases usually without any combustion (in health typically from MDIs and anaesthetic gases, as well as leaks from air conditioning and refrigeration) that have a negative effect on both climate change and air pollution.

Greenhouse Gas Protocol – is an internally recognised approach to carbon accounting: https://ghgprotocol.org/corporate-standard

GWP or Global Warming Potential – each different greenhouse gas has a GWP with shows how many times more potent it is compared to carbon dioxide over 100 years, which means all the effects of the different GHGs can be calculated as carbon dioxide equivalents or CO_2e. For example methane is around 38 times more potent than CO_2.

HSC – Health and Social Care referring to the NHS, social & residential care and public health as one system.

ICS or Integrated care systems – is the evolution of STPs to a new type of even closer collaboration. Integrated care system can be formed from several NHS organisations, in partnership with local councils and others, to take collective responsibility for managing resources, delivering NHS

standards, and improving the health of the population they serve.
https://www.england.nhs.uk/integratedcare/integrated-care-systems/

MDIs or Pressurised Meter Dose Inhalers – are inhalers used to treat both chronic obstructive pulmonary disease and Asthma and use propellants to get the active pharmaceutical ingredient into the patient's lung. The propellants are bad for the environment and increase the effects of climate change.

Mega tonnes – 1 mega tonne = 1,000 kilo tonnes or 1,000,000 tonnes

MRIO or Multi Region (Economic) Input Output – is a methodology to attribute impact (in this case carbon emissions and water footprint) to per unit of expenditure in four different regions: UK, EU, China and Rest of World budget codes (or SIC – Standard Industry Codes) which represent over 100 different industries. The Office of National Statistics provides health and social care spend data against these SIC codes which are applied to the intensity factors (see technical annex here).

NO_x – is a generic term for nitrogen oxides which are a pollutant, they have no global warming potential but are hazardous to health when breathed in.

$PM_{2.5}$ or Particulate matter 2.5 - refers to atmospheric particulate matter (PM) with a diameter of less than 2.5 micrometres, which is about 3% the diameter of a human hair, and are hazardous to health when breathed in.

Quality-adjusted life year (QALYS): A measure of the state of health of a person. One QALY is equal to one year of life in perfect health. It is often measured in terms of the person's ability to carry out the activities of daily life, and freedom from pain and mental disturbance.

STP or Sustainability Transformation Partnerships - NHS organisations and local councils are developing shared proposals to improve health and care, working in 44 areas covering all of England. Providing a coordinated place based approach to local care.
https://www.england.nhs.uk/integratedcare/stps/

UN SDGs or United Nations Sustainable Development Goals – "The Sustainable Development Goals (SDGs) are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity." There are 17 interconnected goals.
http://www.undp.org/content/undp/en/home/sustainable-development-goals.html

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