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Carbon footprinting project evaluated

Now being entered is a "carbon constrained" world. Current scientific evidence indicates an emergency pathway of greenhouse gas (GHG[1]) emission reductions is required to stabilise temperature increases at below a 2°C threshold in an effort to avoid catastrophic climate change.

How we work, live, eat and travel will be subject to significant changes.

The UK's Climate Change Bill 2008 set a legislative target of an 80% reduction in the GHG emissions from 1990 levels to 2050. The UK Climate Change Committee recently set interim carbon budgets to provide the roadmap of how to meet the 2050 target. Public sector organisations are expected to take a lead role.

The NHS in England faces a particular challenge. The demand for its services continues to increase: healthcare expenditure in the UK has risen from 4% of GDP in 1960 to a projected 10% of GDP by 2010. Against this trend, the NHS in England will need to deliver significant reductions in emissions, of the scale and speed illustrated in Figure 1.

The NHS Sustainable Development Unit (SDU) was established in 2008 to help develop a coordinated approach within the NHS in England not only for carbon reduction, but also to achieve sustainable development in general. Faced with the emissions reduction challenge described above, the SDU set out to develop a carbon reduction strategy which was subsequently published in 2009.[2] To inform the strategy, the SDU commissioned a carbon footprint study to calculate the carbon footprint of the NHS in England. This report summarises the carbon footprinting research that was undertaken.

The NHS SDU funded the research project, which was undertaken by the Stockholm Environment Institute (SEI) and Arup. The Department of Health (DH) and the Sustainable Development Commission (SDC) were also key stakeholders, providing an important peer review process for the results and the development of the overall carbon reduction strategy.

Objectives

The key project aim was to estimate the full "consumption-based" footprint of services and activities of the NHS in England. This means estimating the emissions from direct energy use and travel, but importantly also the embedded emissions within goods purchased and used by the organisation. This is discussed in more detail in the sections below.

In addition to the overall project aim, the following project objectives were identified:

- Development of a credible, transparent and robust methodology for the carbon footprint calculation.
- Calculation of historical emissions back to 1990, to serve as a baseline for future emissions monitoring and forecasting.
- Identification of carbon "hotspots".
- Projection of future emissions to 2020, using current known estimates of consumption by NHS England.
- Identification of a pilot set of carbon policy "wedges" that would help to reduce emissions. These follow the Socolow Stabilisation Wedges approach,[3] as shown in Figure 2.

The three project outputs were a 1990-2004 carbon footprint report,[4] a 1990-2004 carbon modelling report,[5] and the production of a strategic carbon modelling tool for the SDU's future use.

GHG Protocol

The globally recognised approach for documenting the carbon footprint of an organisation or organisations is the Greenhouse Gas Protocol (GHG Protocol),[6] which categorises carbon emissions as Scope 1, 2 or 3 emissions, as shown in Figure 3 and as defined below:

- **Scope 1 Emissions** are direct emissions occurring from sources that are owned or controlled by the organisation (for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc); and emissions from chemical production in owned or controlled process equipment.
- **Scope 2 Emissions** are emissions resulting from the generation of purchased electricity consumed by an organisation.
- **Scope 3 Emissions** cover all other emissions which occur from sources not owned or controlled by the organisation, but which are emitted as a consequence

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Paul Brockway currently works in Arup's Sustainability Group in Newcastle. Previous to this he worked in Arup's Building Engineering (Newcastle) and Industrial Projects (London).

In 2004 he returned from a two-year Voluntary Service Overseas (VSO) placement as a civil engineering lecturer and Vice Head of Department at Jimma University, Ethiopia.

Originally a structural engineer by training, Paul Brockway has developed a particular focus on climate change and sustainability. In 2008 he completed a six-month secondment in the energy, buildings and transport team of the Sustainable Development Commission (SDC), London.

Paul Brockway was the project manager responsible for the carbon footprinting research project of the NHS in England. He developed the project specification, assisted data collection, reviewed results from Bottomline software and was lead author of the research report. He is now the project manager for the second phase of the carbon footprinting project – this will develop an analytical tool to model carbon in the NHS region to 2020, and quantify the effects of policy interventions in terms of carbon savings.

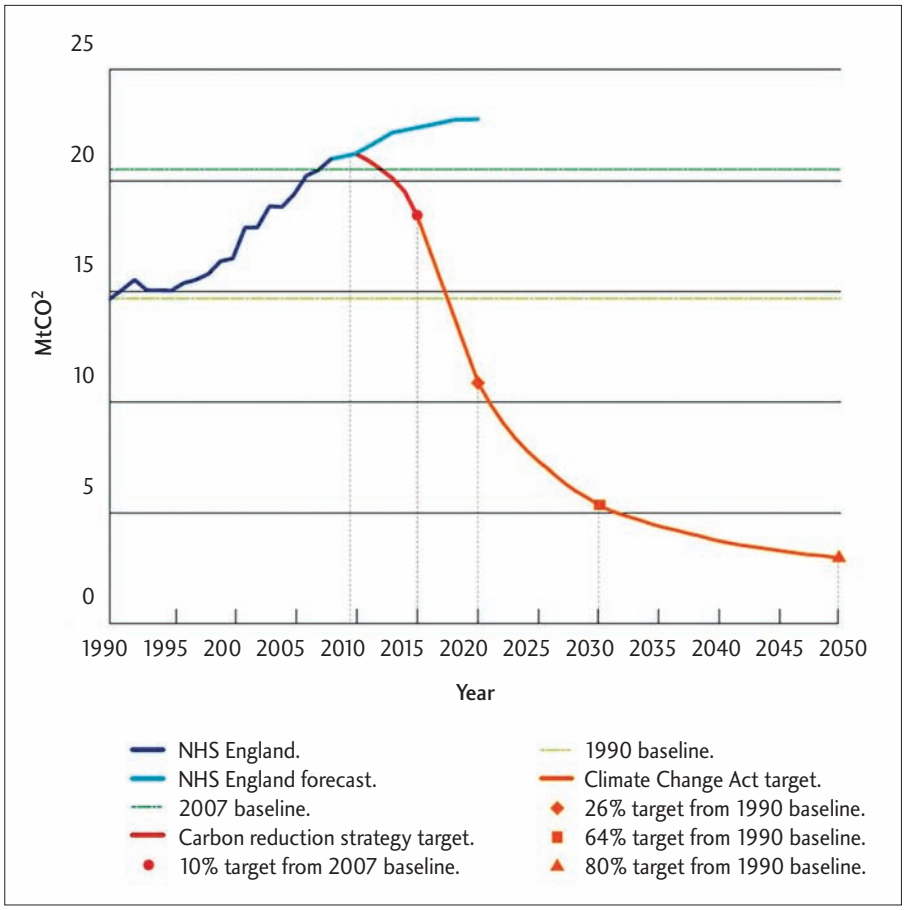

Figure 1: NHS in England emissions baseline and Climate Change Act targets.

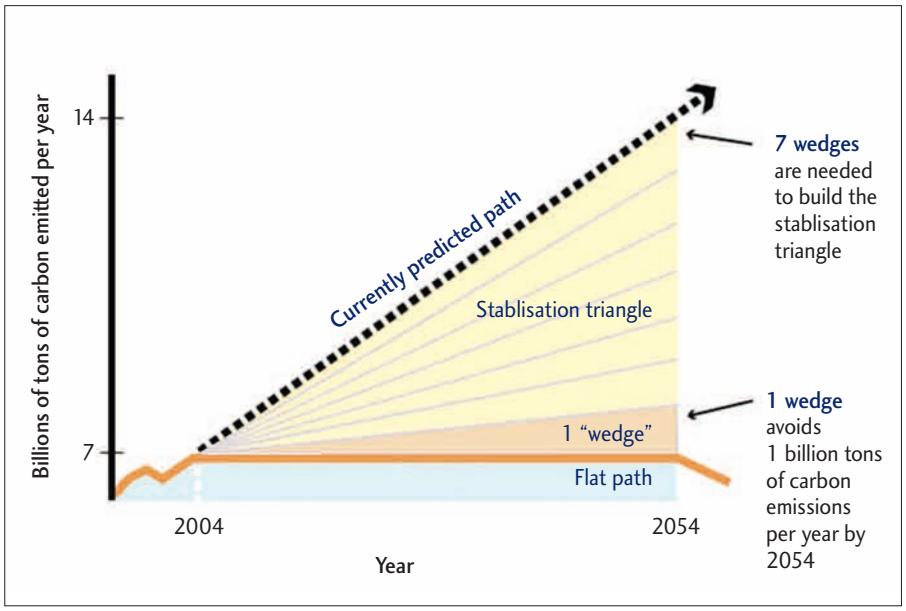

Figure 2: Socolow Stabilisation Wedges.

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of the activities of the organisation. Examples of these indirect emissions include the extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services.

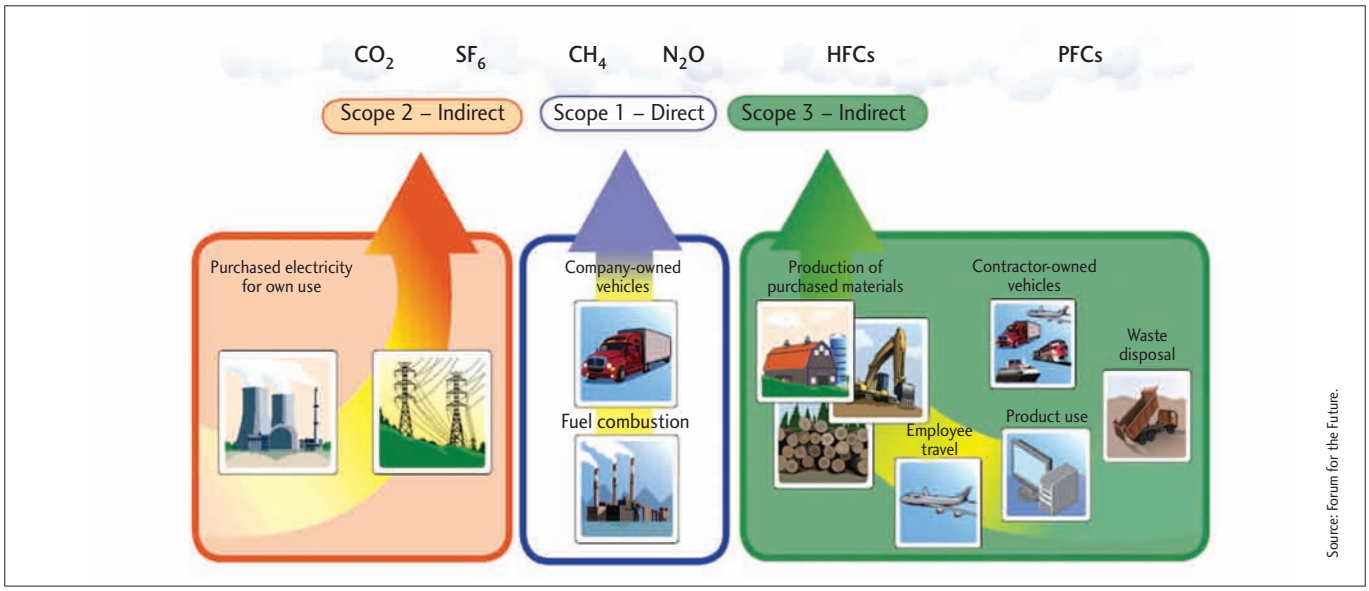
Carbon footprinting methodology

Traditional organisational carbon footprinting methodologies typically capture only Scope 1 and 2 emissions, as they generally calculate emissions from the consumption of energy by the organisation – including electricity, on-site gas use and transport fuel. The Carbon Trust's Carbon Management Programme[7] is a common example of this approach. However, in many cases (including this NHS in England analysis) the majority of an organisation's emissions are attributable to Scope 3 emissions, and it follows that these traditional techniques can significantly underestimate the total consumption-based carbon footprint of an organisation.

Therefore, in order to capture the full consumption-based footprint, a methodology was developed which included Scope 3 emissions, in addition to Scope 1 and 2 emissions. The consumption-based methodology incorporates both direct (i.e. on-site) and indirect (i.e. off-site) carbon emissions, and considers the full supply chain impacts of activities of the NHS in England and has been sub-divided into its principal contributory components, as defined below. The methodology for the three primary emissions sectors is summarised. For a more detailed description refer to the 2008 carbon footprint report.[4]

- **Procurement** (emissions embedded in goods and services): this uses nationally available economic and environmental accounts to combine an expenditure breakdown of the NHS in England with carbon intensities to determine overall procurement emissions of the organisation.
- **Travel** (emissions associated with

Figure 3: GHG Protocol classification of emissions.



movement of staff, patients and visitors): mainly uses National Travel Survey (NTS) data in conjunction with known/estimated numbers of staff, patients and visitors.

- **Building energy** (e.g. emissions resulting from consumption of heating and electricity): emissions were calculated based on energy consumption data from the Estates Return Information Collection (ERIC) annual returns by Trusts, provided by DH.[8]

Projected emissions to 2020 are based on future estimates of consumption and carbon intensities in these sectors.

Two notes of clarification are worthwhile at this point. Firstly, emissions of the NHS in England are calculated and reported in terms of CO_2. This is a valid assumption as CO_2 emissions account for over 85% of the UK's GHG emissions.[9] Secondly, the term "carbon" footprint is a slight misnomer, as CO_2 emissions are reported.[10]

Size of footprint

The 2004 carbon footprint of the NHS in England is broken down in the three primary sectors as shown in Figure 4. At an estimated 18.6 $MtCO_2$, the carbon footprint of the NHS in England represents over a quarter of England's public sector emissions, and around 3% of the UK's total consumption-based CO_2 emissions.

The emissions produced in the production and distribution of goods and services are seen to account for 60% of the carbon footprint of the NHS in England. This is typical of a service sector industry, where consumption of building energy is much lower than would be the case in a manufacturing organisation, which uses heavily energy intensive processes. This observation is further evidenced by the breakdown of Scope 1-3 emissions (Fig. 5). Scope 3 emissions include all procurement emissions, and in addition include travel emissions from staff commuting, patient and visitor journeys. This supports the rationale to determine and baseline emissions of the NHS in England using Scope 1, 2 and 3 emissions.

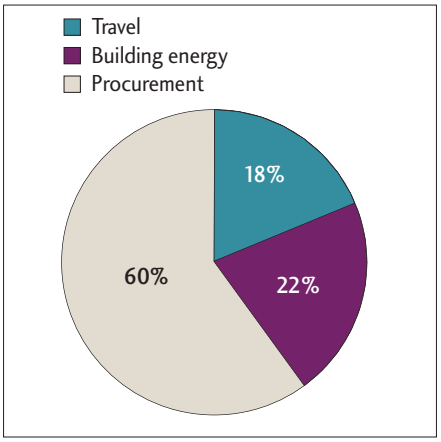


Figure 4: 2004 NHS in England carbon footprint primary sector breakdown.

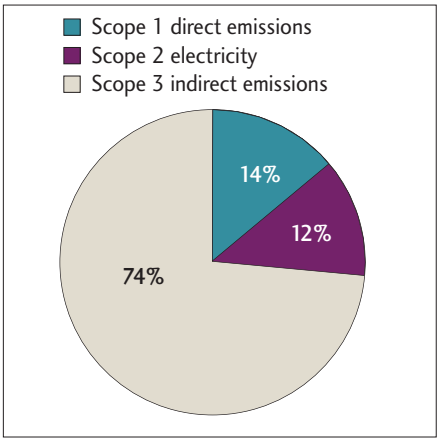


Figure 5: 2004 NHS in England carbon footprint Scope 1-3 emissions breakdown.

Within the procurement sector, the emissions occurring in the manufacture and distribution of pharmaceuticals consumed by the NHS in England are responsible for a fifth of the overall carbon footprint, as shown in Figure 6. This is equivalent in magnitude to either the building energy or travel sectors, and reflects the fact that around a quarter of the NHS England procurement budget is used on pharmaceuticals.

Results over time

The analysis estimated the NHS in England emissions for the period 1992-2004. The results are illustrated in Figure 7. At 12%, the growth in total NHS consumption CO_2 emissions over 1992-2004 is slightly lower than the 17% rise in the same period for overall UK consumption CO_2 emissions.[9] Despite a 13% fall in building energy emissions, this rise in emissions resulted from increases in travel emissions (+11%) and procurement emissions (+26%).

Modelling to 2020

Having established the historical NHS in England emissions, the second phase of the carbon research project examined projected emissions to 2020 (Fig. 8). The analysis was split into two parts. Firstly, emissions were projected to 2020 using a baseline scenario, which combines a continuing trend analysis with known estimates of future consumption – for example Wanless spend projections[11] are used to estimate the procurement expenditure to 2020. It is therefore similar but not the same as a business-as-usual scenario. Under the baseline scenario, emissions are projected to rise to 23 $MtCO_2$ by 2020, 55% higher than in 1990.

Secondly, the model that had been developed to project emissions to 2020 was then used to test "pilot" carbon "wedge" savings, based on a given policy interventions. The results are illustrated in

Figure 8. Examples of the pilot wedges include:

- **Procurement:** lowering consumption of pharmaceuticals to 10% below the 2020 baseline projection.
- **Travel:** smart travel plans adopted across all NHS estate.
- **Building energy:** increase use of combined heat and power (CHP).

Conclusions

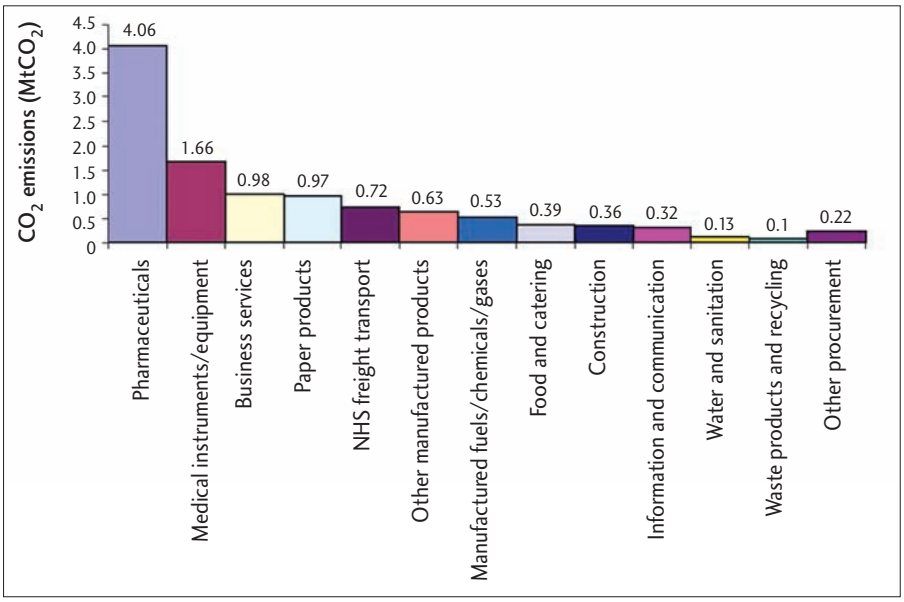
Firstly, this ground breaking carbon footprinting research forms an important foundation block for the development of the carbon reduction strategy of the NHS in England, by allowing a far more comprehensive plan to be developed across a range of policy areas.

Secondly, it has also highlighted the importance of considering the full consumption footprint of the NHS in England, since only a quarter of the organisation's emissions are Scope 1 and 2 emissions, which are captured by "traditional" carbon footprinting techniques. Thirdly, the analysis results confirm the scale of the challenge to the NHS in England: emissions are projected to rise by over 50% between 1990-2020, at a time when significant reductions are required.

In addition, the results have important strategic impacts for the NHS. As well as providing a baseline for monitoring of future emissions against targets, by developing a carbon scenario modelling tool, future carbon "wedges" can be tested to determine the most effective mitigation actions. Carbon reduction actions may focus on "quick wins" such as reducing wastage of pharmaceuticals, or developing longer-term initiatives, such as creating alternative, less carbon intensive models of patient care. Finally, it is important to note the wider benefits of carbon reductions to the NHS in England, which include:

- Contributing to the wider sustainable development agenda, including direct health benefits, reducing consumption, and investment in the local economy.

Figure 6: 2004 NHS in England carbon footprint procurement emissions breakdown.



- Ability to reinvest financial savings back into patient care.
- Achieving greater business resilience and continuity.
- Acting as an exemplar to other public sectors.

References

1 Greenhouse gases (GHG) include carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. They trap heat in the earth's atmosphere, and increases in GHG levels lead to higher temperatures – the so-called greenhouse effect. *The Need for Sound Carbon Accounting in Scotland*. Available at www.sei.se/scotland

2 *Saving Carbon, Improving Health* – NHS Carbon Reduction Strategy for England. NHS England (2009) www.sdu.nhs.uk

3 Socolow R. *et al*. (2004) Solving the Climate Problem: Technologies Available to Curb CO2 Emissions. *Environment*, Vol.46, No.10, pp.8-19.

4 *NHS England carbon emissions: carbon footprinting report – September 2008*. Available at www.sdu.nhs.uk

5 *NHS England Carbon Emissions; Carbon modelling to 2020*. 2009. Available at www.sdu.nhs.uk

6 Refer to www.ghgprotocol.org

7 Refer to www.carbontrust.co.uk/carbon/publicsector/nhs

8 Refer to www.hefs.ic.nhs.uk

9 Wiedmann T., Wood R., Lenzen M., Minx J., Guan D., Barrett J. *Development of an Embedded Carbon Emissions Indicator – Producing a Time Series of Input-Output Tables and Embedded Carbon Dioxide Emissions for the UK by Using a MRIO Data Optimisation System*, Report to the UK Department for Environment, Food and Rural Affairs by Stockholm Environment Institute at the University of York and Centre for Integrated Sustainability Analysis at the University of Sydney, June 2008. Defra, London, UK.

10 As one mole of CO_2 (which weighs 44g) contains 12g of carbon, the masses of carbon and CO_2 are directly related by the fraction 12/44.

11 *Our Future Health Secured?* Available at www.kingsfund.org.uk/research/publications/our_future.html

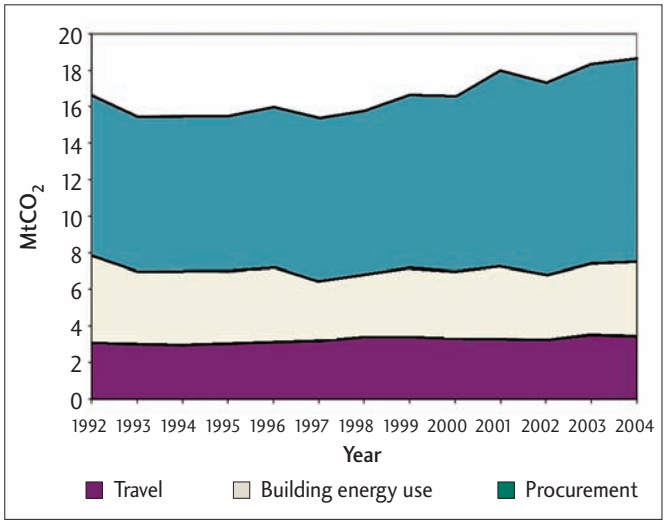


Figure 7: 1992-2004 NHS in England carbon footprint emissions breakdown.

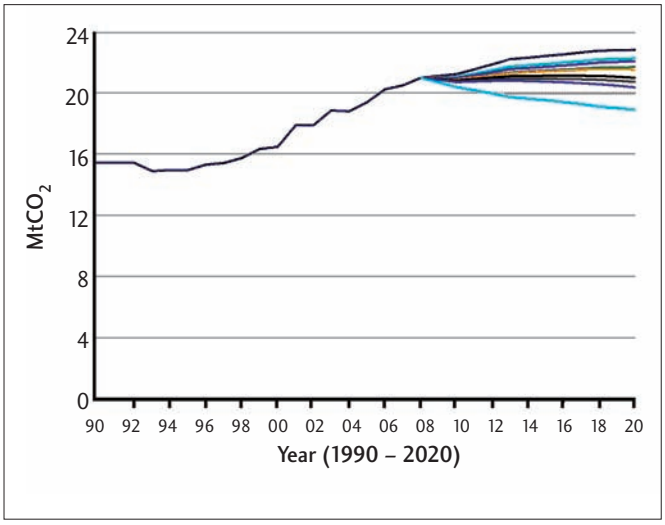


Figure 8: 1990-2020 NHS in England carbon footprint/carbon wedges.