



The Annual Carbon Footprint of NHS Sight Tests at Five Optometry Practices

This report has been produced by The Centre for Sustainable Healthcare in partnership with NHS England and NHS Improvement (Cheshire & Merseyside) and Cheshire Local Optical Committee.

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Executive Summary

Recognising the climate emergency as one of the greatest public health threats in this century, the NHS recently declared an ambitious goal of reducing its GHG emissions from 24.9 million tonnes of carbon dioxide equivalent (CO₂e) to net zero by 2045. If the NHS is to truly ease its burden on climate change, each service, including services commissioned from the private sector must play its part.

NHS England commissions optometry practices to deliver sight tests in primary care to eligible patients. Until now the carbon footprint and subsequent environmental impact of NHS sight tests has been unknown.

The aim of this study is to calculate the annual carbon footprint of NHS sight tests at five fixed site optometry practices in the North West, provide an estimate of the average carbon footprint of an individual NHS sight test and identify variation between practices. The study estimates that the total annual carbon footprint of the 25,745 sight tests performed by the five practices in 2020 was 135,573 kgCO₂e. 69% (93,726 kgCO₂e) of annual GHG emissions come from travel, the second largest contributor is energy, adding 19,667 kgCO₂e (14%). Procurement contributes 14,437 kgCO₂e (11%), waste adds 6,576 kgCO₂e (5%), and water contributes 1,167 kgCO₂e (1%) (Figure 1). The carbon footprint of an individual sight test is estimated to range from 4.02 kgCO₂e to 9.28 kgCO₂e, with the average carbon footprint per sight test estimated at 5.27 kgCO₂e.

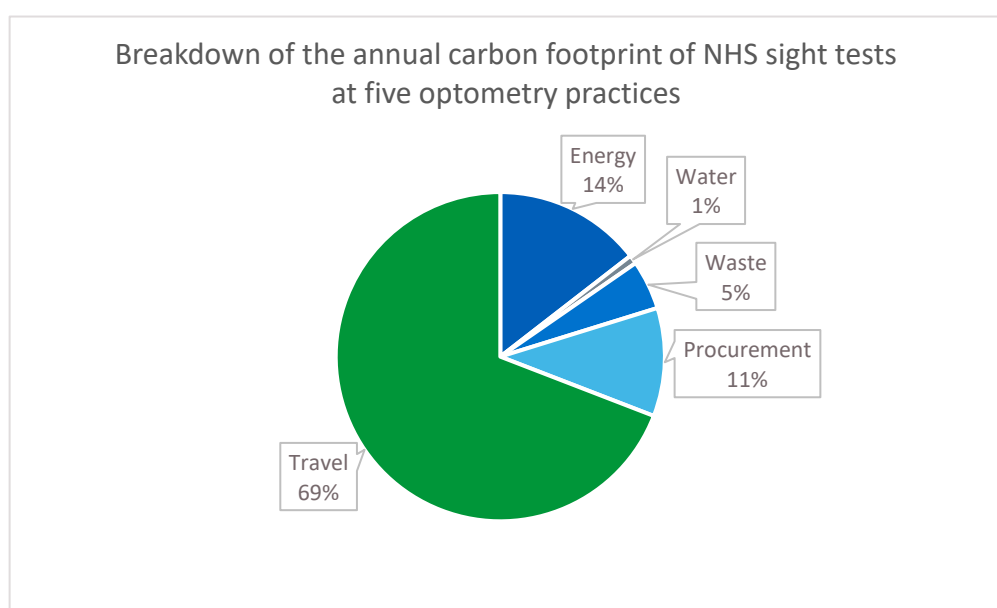


Figure 1: Breakdown of the annual carbon footprint of NHS sight tests at five optometry practices

Recommendations for NHS England and Improvement: Commissioners of Sight Tests

If the NHS is to truly ease its burden on climate change, its services commissioned from the private sector must not be ignored. NHS England and Improvement have the opportunity to work towards their commissioned services becoming net zero in line with the rest of the NHS.

With an increased focus on moving additional eyecare services into the community to help ease pressure on secondary care, it is particularly important that current and future commissioned optometry services are performed in a sustainable way, both for patients and planet.

The study highlights both NHS England and Improvement and the optometry sector have the opportunity to reduce the environmental impact of NHS sight tests through collaboration and taking action on reducing GHG emissions from travel, energy, procurement, water and waste.

This study is the first of its kind in the UK and highlights the need for further carbon footprinting work within the optometry sector.

General

1. Encourage collaboration between NHS England, optometry professional bodies and optometrists to work together to reduce GHG emissions of sight tests and other commissioned services provided by optometry practices.
2. Ensure commissioned optometry services are involved in the future Greener NHS plans and discussions.
3. Work together with sector bodies to raise awareness of sustainability in the optometry sector and where possible provide general training on sustainability issues within the sector. Potentially support the development of an e-learning module on sustainable optometry.

Travel

Consider travel and accessibility when commissioning new optometry contracts, trying to ensure services are commissioned which are accessible by active and/or public transport. NHS England should work with local authorities where possible to support sustainable/active travel to services.

Energy, water, and waste

Encourage collaboration of central spectacles and contact lenses recycling points within the local area.

Procurement

In collaboration with optometrists, encourage the optometry industry to work on measuring and reducing the carbon emissions of their products and packaging.

Aim

To analyse the annual carbon footprint of NHS sight test services provided by five Optometry practices in the North West of England.

Background

The connection between environmental factors and eye health is already well known; poor air quality is linked to eye disorders whilst seasonal changes can irritate eyes and cause allergies. Climate change, caused by rising Greenhouse Gas (GHG) emissions, can exacerbate these health conditions. Increasing UV radiation exposure, rising air pollution and warmer drier conditions pose a greater risk to human eye health.ⁱ Equally, eye health services are often resource intensive, with consumables, energy consumption and travel requirements subsequently contributing to rising GHG emissions.

In support of the UK government's efforts to reduce its climate impact, the NHS is legally required under the amended Climate Change Act (2008) to reduce its GHG emissions to net zero by 2050 compared to its 1990 baseline.ⁱⁱ However, recognising the climate emergency as one of the greatest public health threats in this century, the NHS recently declared a more ambitious goal of achieving net zero by 2045.

In 2020 the NHS carbon footprint was calculated at 24.9 million tonnes carbon dioxide equivalent (CO₂e).ⁱⁱⁱ Between 2010 and 2011, ophthalmology accounted for £2.14 billion expenditure in healthcare which equated to a carbon footprint of 1.175 million tonnes CO₂e.^{iv} However, the carbon footprint of optometry, particularly at practice and sight test level is unknown.

Optometry and Sight Tests

Optometry practices provide an extensive range of high-quality primary care NHS services including, but not limited to eye examinations, contact lens assessment, urgent eyecare, post-surgical assessments and prevention advice and support.

NHS England commissions optometry practices to deliver sight tests in primary care to eligible patients. A sight test is defined as an examination of the eye which checks the quality of your sight and helps to detect eye problems which might require prescription glasses or contact lenses. It is recommended that you get your eyes tested at least every 2 years or as advised by your ophthalmic practitioner or optometrist. During 2019-2020, the number of NHS-funded sight tests carried out in England was 13,355,060 with 99.9% being conducted by optometrists.^v

Within this report the NHS sight test is referred to as the sight test only and excludes the addition of spectacles and contact lenses that might be prescribed and sold by the optometry practices as a result of the sight test.

This report aims to:

1. Provide an analysis of the annual carbon footprint of NHS sight tests at five fixed site optometry practices in the North West.
2. Provide an estimate of the average carbon footprint of an NHS sight test based on the five optometry practices.
3. Develop recommendations for reducing GHG emissions associated with NHS sight tests.

Data and Methods

Optometry practices

Table 1 details the five optometry practices in the North West of England involved in the study, along with the number of sight tests they performed in 2020. Practices 1, 2, 4 and 5 are independent optometry practices, whereas practice 3 is part of a high street chain. In total, 25,745 sight tests were performed by the five practices in 2020.

Table 1 Five optometry practices

Practice Name	Location	No. sight tests
Practice 1 – independent	Cheshire	1053
Practice 2 – independent	Cheshire	1400
Practice 3 - chain	Merseyside	20,172
Practice 4 – independent	Cheshire	1120
Practice 5 – independent	Merseyside	2000

Carbon footprint analysis

A carbon footprint is the sum of all direct and indirect GHG emissions which are produced throughout the supply chain of activities and products and is expressed in carbon dioxide equivalents (CO₂e).² It is based on the use of resources, such as energy, water, waste disposal and procured goods and services. The NHS also views the GHG emissions caused by patient and visitor travel and staff commuting as part of the NHS's carbon footprint.

To estimate the annual carbon footprint of sight tests at an optometry practice, the carbon footprint of the individual resources required to perform sight tests was estimated using a hybrid methodology. Most of the carbon footprint was based on a process-based carbon footprint analysis. However, due to the time constraints of the project, for some of the consumables Environmentally Extended Input-Output Analysis (EEIOA) was used.

The annual resource use to perform sight tests was measured across all five individual practices. Data was taken retrospectively from the year 2020. The following resources were included:

1. Energy use: gas and electricity use at the optometry practice

2. Water use at the optometry practice
3. Waste disposal: domestic waste, clinical waste, and recycling
4. Staff travel: commuting for work
5. Patient travel: travelling to appointment
6. Procurement (consumables required directly for or in connection with a sight test): minims, fluorets, paper towels, antiseptic wipes, hand gel, ink cartridges, paper, envelopes, postage and PPE. Additional consumables indirectly associated with an NHS sight test include contact lenses, contact lens solution, and spectacles (including cases and wipes). These indirect consumables have not been included within the calculation of the carbon footprint of NHS sight tests, however, are included separately within the results.

The retrospective data regarding the resource use was received from each optometry practice in the form of the metrics described in Table 2.

Table 2: 2020 resource use data received from each optometry practice

Resource	Metric
Electricity and gas	kWh or invoice cost
Water	m ³ or invoice cost
Staff travel	Miles travelled per week
Patient travel	Average miles travelled per week
Procurement	No. bought annually or amount spent (£) on item annually

The Greenhouse Gas Protocol

This report follows the reporting principles of the Greenhouse Gas Protocol (GHGP), a globalized standard framework covering 7 different GHG's expressed in CO₂e.^{vi} GHG emissions are categorised into scope 1, 2 and 3 emissions.

Scope 1: Direct emissions from owned or directly controlled sources on site.

Scope 2: Indirect emissions from the generation of purchased energy, mostly electricity.

Scope 3: All other indirect emissions that occur when producing and transporting goods and services, including the full supply chain.

Table 3 shows the parameters measured within this report and which GHGP scope they fall under.

Table 3: GHGP reporting scopes

	Scope 1	Scope 2	Scope 3
Energy	✓	✓	✓
Water			✓
Waste disposal			✓
Staff commuting			✓
Patient travel			✓
Procurement			✓

Parameters

Energy

Annual electricity and gas use in kWh was collected from each practice. The associated GHG emissions were calculated using the 2020 BEIS conversion factors.^{vii} Factors include Well-to-Tank (WTT) emissions and, in the case of electricity, also Transmission and Distribution (T&D) emissions. Where cost per month was provided instead of kWh, average UK energy costs were used to estimate monthly kWh consumption.

Water

Annual water use in cubic metres (m³) was collected from each practice. The GHG emissions associated with both water supply and treatment were calculated using the BEIS conversion factors.⁶ Where cost per month was provided instead of m³, average UK water costs were used to estimate monthly consumption in m³.

Waste Disposal

Three different types of waste streams were considered from each practice; domestic, clinical and recycling. A 2020 study by C Rizan, M Bhutta, M Reed and R Lillywhite estimated the carbon footprint of waste streams in a UK hospital. The study included transportation to the treatment facility, pre-treatment and final treatment in the estimation of the carbon footprint

of each waste stream. As it was assumed that the waste treatment of the optometry practices' waste would be similar to that of a hospital, the GHG emission factors for domestic waste, dry mixed recycling and clinical waste of the study were used.

Practice 3 was the only practice to provide waste data in the form of expenditure (£) per waste stream per month rather than weight. To estimate the GHG emissions from cost, figures for pounds per tonne of each waste stream were used.^{viii ix}

Staff travel (commuting)

Practices provided data on staff commuting which was mainly obtained through staff surveys. The detail of the data varied across practices; some provided miles and transport mode for each staff member whereas others only provided average miles per staff. Table 4 details the data provided by each practice, this determined the methodology used as described below.

Table 4: staff travel data provided by each practice

Practice	Miles known	Transport mode known	Data provided for each staff member or average across staff
Practice 1	Yes	Yes	Average
Practice 2	Yes	Yes	Average
Practice 3	Yes	Yes	Each staff
Practice 4	Yes	No	Average
Practice 5	Yes	No	Average

Where miles and transport mode were known, the GHG emissions associated with commuting were calculated using the BEIS conversion factors. For car travel, as the type of car used was not known the GHG emissions factor based on the national fuel mix was assumed. For bus travel, the emission factor for a local bus (not London) was applied, and for train travel it was assumed to be light rail. WTT emissions were also included for all transport types.⁶

Where transport mode was unknown, but miles were known the associated GHG emissions were calculated using The Centre for Sustainable Healthcare's travel carbon footprint calculator^x which takes into account the likelihood of transport mode for distance travelled based on the National Travel Survey.

It was assumed all staff commute 5 days a week with 234 working days a year unless otherwise stated.

Patient travel

The GHG emissions associated with patient travel were mainly estimated using The Centre for Sustainable Healthcare's travel carbon footprint calculator. Three practices provided average return distance in miles for their patients. The GHG emissions estimated by the calculator were then multiplied with the number of sight tests.

For the two practices which were unable to provide patient travel data, an average return distance was estimated based on the three practices and the carbon footprint calculator was used.

Procurement – consumables

For the carbon footprint of the minims, fluorets, antiseptic wipes, hand gel, ink cartridges, postage, contact lenses, and contact lens solution, EEIOA was used for the 'cradle-to-gate' emissions. In EEIOA, financial spend in a sector is directly converted into a carbon dioxide equivalent value. The annual spend of each item was multiplied with its associated sector specific emissions factor. EEIOA was used as either all materials of the item could not be identified or there are currently no carbon emissions factors available for the materials.

The carbon footprint of a paper towel was taken from Mike Berners-Lee *How Bad Are Bananas?* It is assumed the paper towels are of low-quality recycled paper per sheet.^{*xi*}

The GHG emissions associated with paper and envelopes have been calculated on the basis of number and weight of item using the ICE database conversion factors.^{*xii*}

In 2019, eyewear brand Ace & Tate conducted a carbon footprint calculation and Life Cycle Analysis (LCA) of two of their spectacle products; Neil stainless steel spectacles and Pierce regular acetate spectacles.^{*xiii*} The LCA looked at all phases from production including raw materials, manufacturing of frames, transport and edging, to the end of life phase consisting of use phases and disposal. The spectacles analysed are a similar material to that of the majority of the frames on the market today. As due to time constraints the spectacle materials from the five practices were not provided, it was assumed that all spectacles are manufactured in a similar way to that of Ace & Tate. The results from the LCA up to the end of life for both products have been used to provide an estimate of the carbon footprint of spectacles within this report, taking the average carbon footprint from the stainless steel and acetate frames into account at a 50:50 ratio. Cloths and case are also included with the carbon footprint figures for spectacles.

A 2021 study from C Rizan, M Reed and M Bhutta estimated the carbon footprint of PPE using a 'cradle-to-grave' life-cycle approach.^{*xiv*} The study included raw material extraction,

manufacturing, transport and disposal in the estimation of the carbon footprint of PPE used at Royal Sussex County Hospital, Brighton UK. The results of the study were used to provide the carbon footprint of non-sterile gloves, apron and a type IIR Surgical mask within this report. PPE 2020 consumption data was supplied by each practice.

GHG emission factors

The GHG emissions factors used are from a variety of sources:

- Department of Business, Energy and Industrial Strategy (BEIS) – full set of conversion factors 2020.^{vii}
- Circular Economy – The ICE Database.^{xii}
- Sustainable Development Unit carbon conversion factors 2018-2019.^{xv}
- C Rizan, M Bhutta, M Reed, R Lilywhite. The carbon footprint of waste streams in a UK hospital. 2021.^{xvi}
- C Rizan, M Reed, M Bhutta. Environmental impact of Personal Protective Equipment supplied to health and social care services in England in the first six months of the COVID-19 pandemic. 2020.^{xiv}
- Mike Berners-Lee. How bad are bananas? 2020.^{xi}
- Ace & Tate. CO2 and LCA summary. 2019.^{xiii}

Allocating emissions to NHS sight tests

After calculating the GHG emissions associated with staff travel, energy, water, and waste, emissions were allocated to sight tests based on the proportion that sight tests contribute towards all services provided by the practice. Table 5 details the proportion of all services that sight tests constitute at each optometry practice based on the data received.

Table 5: Sight test contribution to overall services

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
% Contribution of sight tests to all services	58%	74%	93%	84%	89%

GHG emissions associated with patient travel were allocated based on the number of sight tests performed by each practice assuming that it is one patient per sight test.

Non-medical procurement emissions were allocated based on the percentage contribution of sight tests towards all services performed by the practice. 15% of medical procurement items including minims and fluorets, were allocated to NHS sight tests at each practice. It was assumed these medical items are used less frequently in sight tests compared to other services.

Results

The first section discusses the total annual carbon footprint of NHS sight test services at all five optometry practices. The second section looks at the annual carbon footprint of NHS sight tests per practice, and the third section analyses the carbon footprint per NHS sight test at each of the five practices.

Annual carbon footprint of NHS sight test services at five optometry practices

The total annual carbon footprint of the 25,745 sight tests performed by the five optometry practices in 2020 is 135,573 kilogramme carbon dioxide equivalents (kgCO₂e) (Table 6). This is roughly the equivalent of flying return economy class from London to Hong Kong 39 times.

Table 6: Total annual carbon footprint of NHS sight tests performed by five optometry practices in 2020

No. sight test performed	25,745
Annual GHG emissions (kgCO ₂ e)	135,573

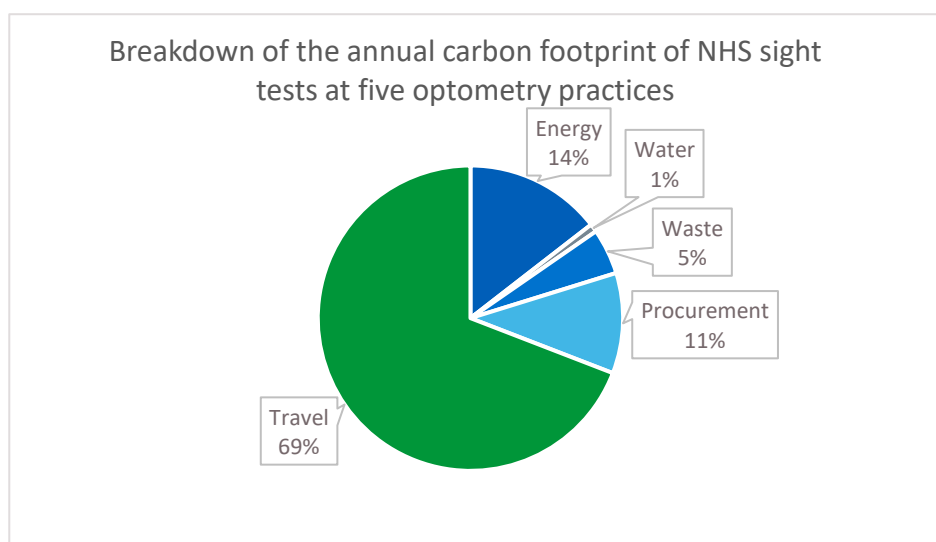


Figure 2: Breakdown of the annual carbon footprint of NHS sight tests at five optometry practices

According to Figure 1, 69% (93,726 kgCO₂e) of annual GHG emissions come from travel. The second largest contributor is energy, adding 19,667 kgCO₂e (14%). Procurement

contributes 14,437 kgCO₂e (11%), waste adds 6,576 kgCO₂e (5%), and water contributes 1,167 kgCO₂e (1%).

Annual carbon footprint of NHS sight tests per optometry practice

The annual carbon footprint of NHS sight tests across the five optometry practices ranges from 6,134 kgCO₂e to 102,213 kgCO₂e. Table 7 highlights the annual carbon footprint of NHS sight tests per practice. Practice 3 produced the largest annual carbon footprint but equally performed the greatest number of sight tests. However, Practice 2 produced the smallest annual carbon footprint but performed the 3rd greatest number of sight tests during 2020.

Table 7: Carbon footprint of NHS sights per optometry practice

Optometry practice	No. sight tests in 2020	Annual carbon footprint of sight tests (kgCO ₂ e)	Carbon footprint per sight test (kgCO ₂ e)
Practice 1	1053	9,774	9.28
Practice 2	1400	6,134	4.38
Practice 3	20,172	102,213	5.07
Practice 4	1120	9,405	8.40
Practice 5	2000	8,047	4.02

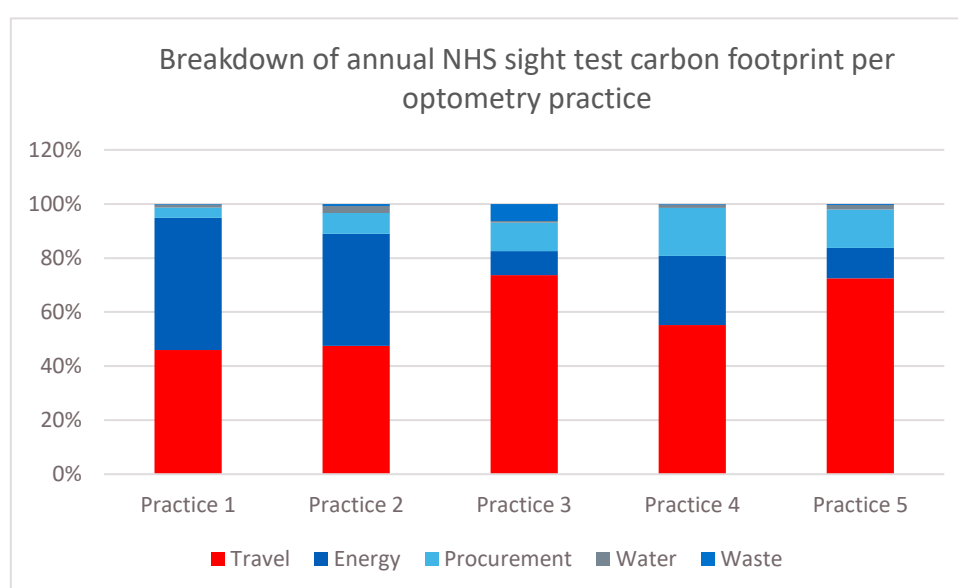


Figure 2: Breakdown of annual NHS sight test carbon footprint per optometry practice

As shown in Figure 2, the carbon footprint of an NHS sight test is made up of GHG emissions that come from travel (staff commuting and patient travel), energy, procurement, waste, and water. For four out of five optometry practices, travel makes up the largest contribution to the carbon footprint of an NHS sight test. However, for practice 1, the majority of emissions come from energy. Emissions associated with waste contribute the least in all practices apart from practice 3 in which it contributes more GHG emissions than water.

Travel

GHG emissions associated with travel are the highest contributor to the annual carbon footprint of NHS sight tests from the five optometry practices, making up 69% (93,726 kgCO₂e) of all GHG emissions (Figure 1). Staff commuting contributes 51% (48,063 kgCO₂e) of these emissions, whereas patient travel contributes 49% (45,662 kgCO₂e).

In terms of individual practices, Table 8 highlights the percentage contribution of travel GHG emissions towards the annual carbon footprint of NHS sight tests at each practice. Percentage contribution of travel does vary between 46% and 74% between practices. For four practices, travel emissions are the largest contributor towards the annual carbon footprint. However, for practice 1, travel is the second largest with energy emissions being the first largest (49%).

Table 8: Travel GHG emissions per optometry practice

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
Annual travel GHG emissions (kgCO ₂ e)	4,495	2,913	75,302	5,188	5,828
Travel GHG emissions per sight test (kgCO ₂ e)	4.27	2.08	3.73	4.63	2.91
% Contribution	46%	47%	74%	55%	72%

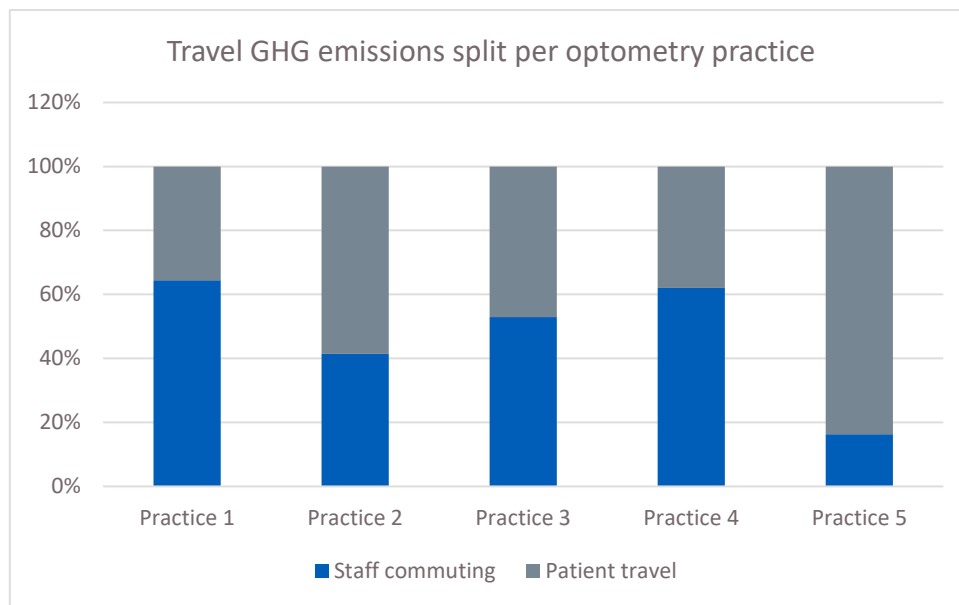


Figure 3: Travel GHG emissions split per optometry practice

According to figure 3, Staff commuting contributes a larger proportion of annual travel GHG emissions than patient travel across three out of five practices.

Energy

Energy is the second largest contributor of GHG emissions to the annual carbon footprint, making up 14% (19,667 kgCO₂e) (Figure 1). The two sources of energy across the five optometry sites analysed are gas and electricity. Annually, gas adds 3,710 kgCO₂e (19%) and electricity adds 15,957 kgCO₂e (81%).

However, in terms of the individual practices, energy GHG emissions contribution can vary from 9%-49% (Table 9). For practice 1, energy emissions are the largest contributor to the annual carbon footprint of sight tests (49%). For, practices 2 and 4 energy emissions are the second largest contributor after travel, and practices 3 and 5, energy emissions are the third largest contributor.

Table 9: Annual energy GHG emissions per optometry practice

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
Annual energy GHG emissions (kgCO ₂ e)	4,776	2,540	9,032	2,406	912
Energy GHG emissions per sight test (kgCO ₂ e)	4.54	1.81	0.45	2.15	0.46
% Contribution	49%	41%	9%	26%	11%

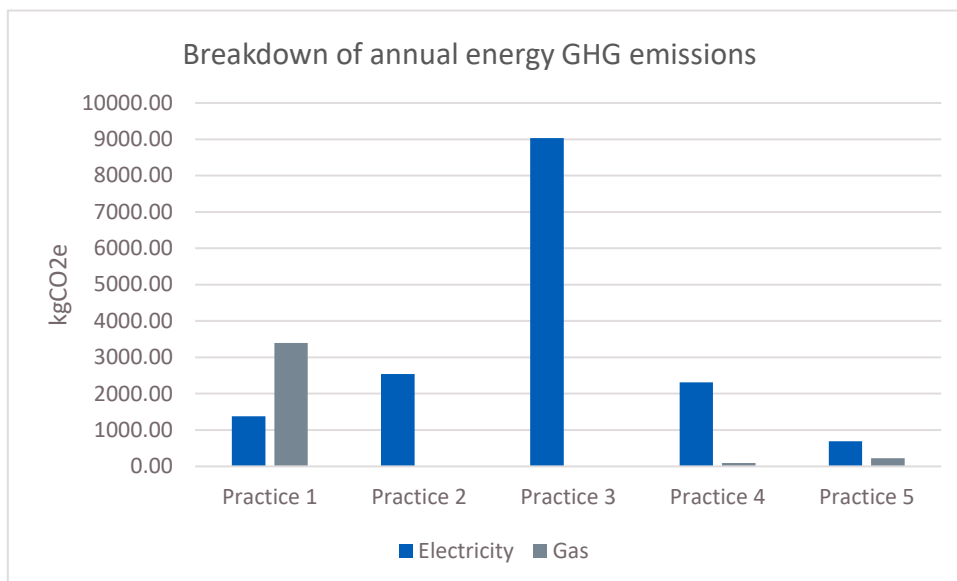


Figure 4: Breakdown of annual energy GHG emissions

Looking at all five practices together, electricity is responsible for more GHG emissions than gas. Looking at the practices individually, not all practices use gas as an energy source and practice 1 is the only practice to produce more GHG emissions from gas than electricity (Figure 4).

Procurement

Procurement makes up 11% of the annual GHG emissions of NHS sight tests from the five optometry practices (Figure 1).

In terms of individual practices, Table 10 highlights the percentage contribution of procurement GHG emissions towards the annual carbon footprint of NHS sight tests at each practice. Procurement emission contribution varies between practices ranging from 4% (practice 1), to 18% (practice 4). For practices 1,2 and 4, GHG emissions associated with procurement are the third largest contributor to their annual sight test carbon footprint. For practices 3 and 5, procurement GHG emissions are the second largest contributor to their annual sight test carbon footprint.

Table 10: Annual procurement GHG emissions per optometry practice

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
Annual procurement GHG emissions (kgCO ₂ e)	368	477	10,778	1,676	1,138
Procurement GHG emissions per sight test (kgCO ₂ e)	0.35	0.34	0.53	1.50	0.57
% Contribution	4%	8%	11%	18%	14%

Table 11 details the breakdown of GHG emissions associated with procurement for NHS sight tests at each practice. PPE, Postage, ink cartridges and antiseptic wipes contribute the majority of GHG emissions. However, there is also variation between optometry practices, for example, paper towels contribute 6.2% of practice 2's procurement emissions but only 0.6% of practice 3's procurement emissions.

Table 11: Breakdown of procurement GHG emissions per optometry practice

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
Minimis	1.1%	0.8%	4.4%	0.3%	1.4%
Fluorets	1.1%	0.5%	Included above	0.2%	0.3%
Antiseptic wipes	12.0%	18.0%	46.4%	7.8%	42.1%
Paper towels	4.7%	6.2%	0.6%	2.8%	1.0%
Hand gel	2.5%	2.5%	7.9%	1.6%	7.1%
Ink cartridges	24.8%	12.4%	1.1%	2.0%	4.6%
Paper	1.7%	1.2%	0.8%	1.1%	5.8%
Envelopes	1.1%	0.3%	0.5%	0.3%	19.6%
Postage	20.6%	6.9%	10.0%	55.6%	11.0%
PPE	30.5%	51.1%	28.3%	28.4%	7.1%

The Covid-19 pandemic has led to an increased use of PPE across all sectors, with healthcare in particular consuming large quantities. From Table 12, PPE's contribution to procurement emissions ranges from 7.1% to 51.1% across the practices. Annually, PPE adds 3,962 kgCO₂e to the total carbon footprint of sight tests performed by all five practices. 1,765 kgCO₂e comes from aprons, 1,811 kgCO₂e from gloves and 385 kgCO₂e from masks. The number of PPE used is partly dependent on the number of staff at each practice.

Table 12: Annual PPE GHG emissions

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
Annual PPE GHG emissions (kgCO ₂ e)	112	244	3,049	476	81
% Contribution	30.5%	51.1%	28.3%	28.4%	7.1%

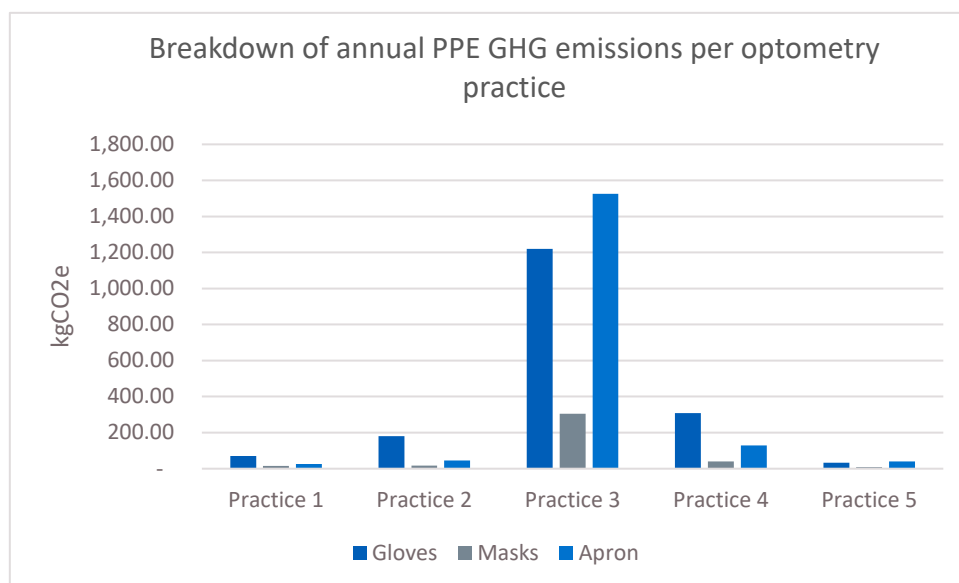


Figure 5: Breakdown of annual PPE GHG emissions per optometry practice

As shown in Figure 5, from the three types of PPE analysed, three out of five practices gloves contributed to highest proportion of GHG emissions. All practices had the least GHG emissions from masks.

Waste

5% (6,576 kgCO₂e) of annual NHS sight test GHG emissions from the five practices comes from waste (Figure 1), with 3,874 kgCO₂e coming from clinical waste and 2,702 kgCO₂e coming from domestic waste and recycling.

However, in terms of the individual practices, waste GHG emission contributions can vary from 0.3%-6.3%. According to Table 13, waste contributes 6.3% of annual emissions at practice 3, yet contributes 0.3% - 0.7% at practices 1,2,4 and 5.

Table 13: Annual waste GHG emissions per optometry practice

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
Annual waste GHG emissions (kgCO ₂ e)	25.08	43.0	6,449	24.48	34.40
Waste GHG emissions per sight test (kgCO ₂ e)	0.02	0.03	0.32	0.02	0.02
% Contribution	0.3%	0.7%	6.3%	0.3%	0.4%

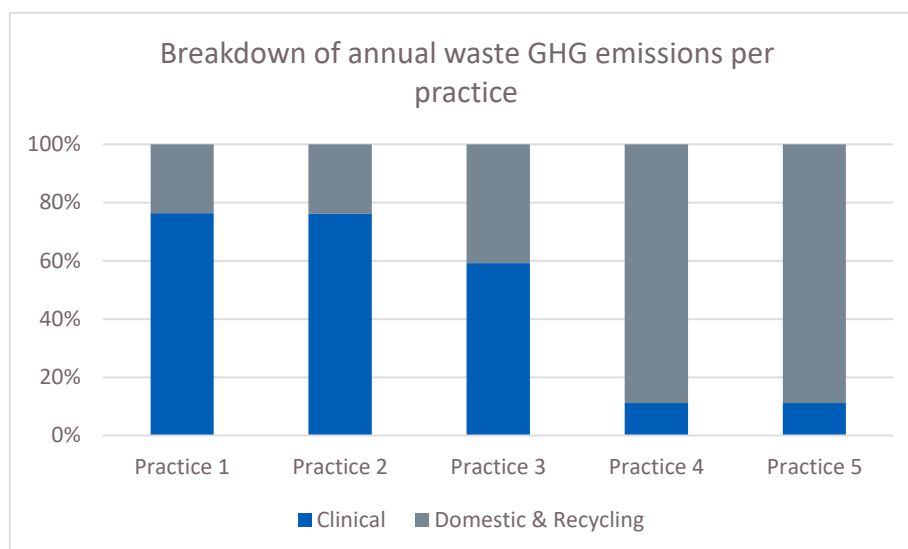


Figure 6: Breakdown of annual waste GHG emissions per practice

The three types of waste across the five optometry sites analysed are clinical, domestic, and recycling. However, four out of five practices were unable to split out domestic and recycling waste data. According to Figure 6, three out of five practices produce a higher amount of GHG emissions from clinical waste than domestic and recycling. This could be because clinical waste is disposed of via high temperature incineration which is more carbon intensive than domestic waste disposal and recycling.

Water

Water contributes the least GHG emissions to the annual carbon footprint of NHS sight tests from the five practices, making up 1% (1,167 kgCO₂e) (Figure 1).

From Table 14, the percentage contribution of water GHG emissions varies slightly between individual optometry practices. Water emissions contribute 1%-3% towards the annual NHS sight test carbon footprint at all five practices.

Table 14: Annual water GHG emissions per optometry practice

	Practice 1	Practice 2	Practice 3	Practice 4	Practice 5
Annual water GHG emissions (kgCO ₂ e)	110	161	652	111	134
Water GHG emissions per sight test (kgCO ₂ e)	0.10	0.11	0.03	0.10	0.07
% Contribution	1%	3%	1%	1%	2%

Carbon footprint per NHS sight test

The carbon footprint of an NHS sight test is estimated to range from 4.02 kgCO₂e to 9.28 kgCO₂e (Figure 7). Taking the annual number of sight tests performed and the annual carbon footprint across all five practices, the average carbon footprint per sight test is estimated to be 5.27 kgCO₂e.

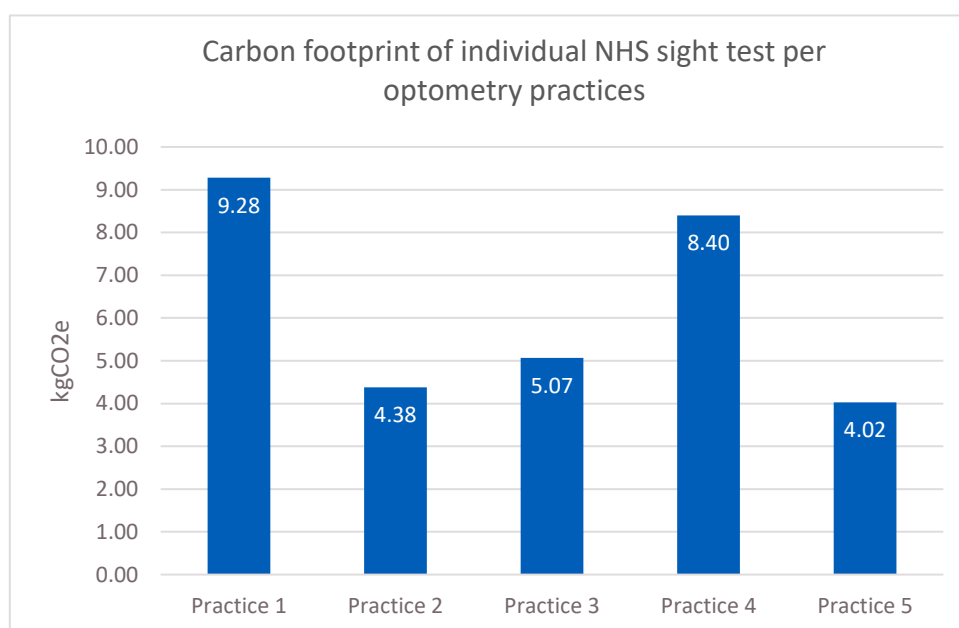


Figure 7: Carbon footprint of an NHS sight test per optometry practice

As shown in Figure 7, practice 1 has the highest sight test carbon footprint, with 9.28 kgCO₂e. Practice 4 has the second highest with 8.40 kgCO₂e per sight test followed by practice 3 (5.07 kgCO₂e) and practice 2 (4.38 kgCO₂e). Practice 5 has the lowest carbon footprint per sight test, with 4.02 kgCO₂e.

Comparing this to other commissioned NHS services, the carbon footprint of a dental examination is 5.50 kgCO₂e and a composite filling (without Nitrous Oxide) is 14.76 kgCO₂e^{xvii}.

Looking at the average carbon footprint of a sight test, 5.27 kgCO₂e (Figure 8), 3.64 kgCO₂e (69%) comes from travel. The second largest contributor is energy adding 0.76 kgCO₂e (14%). Procurement adds 0.56 kgCO₂e (11%), waste adds 0.26 kgCO₂e (5%), and water adds 0.05 kgCO₂e (1%).

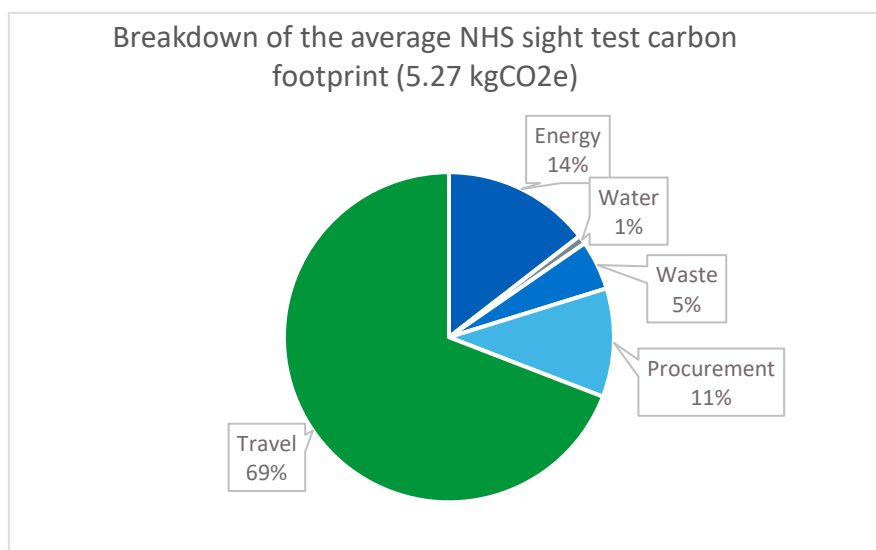


Figure 4: Breakdown of the average NHS sight test carbon footprint

Additional services

There are consumables indirectly associated with an NHS sight test, like contact lenses, contact lens solution and spectacles. These consumables have not been included within the carbon footprint of NHS sight tests as they are not directly part of a sight test and rather seen to provide an income stream for optometry practices. However, it is important for the optometry sector to consider the GHG emissions associated with these additional procurement items as they occur as a result of performing a sight test.

Table 15 details the GHG emissions associated with an NHS sight test including one pair of spectacles, and an NHS sight test including 6 months' worth of contact lenses.

Table 15: Carbon footprint of an NHS sight test including spectacles and contact lenses

Carbon footprint of an average NHS sight test excluding spectacles or contact lenses (kgCO ₂ e)	5.27
Carbon footprint of an average NHS sight test including one pair of spectacles (kgCO ₂ e)	8.64
Carbon footprint of an average NHS sight test including 6 months of monthly replacement contact lenses including solution (kgCO ₂ e)	40.24
Carbon footprint of an average NHS sight test including 6 months of daily disposable contact lenses (excludes solution as none is required) (kgCO ₂ e)	49.24

Recommendations

Recommendations for optometry practices and optometrists

Table 16 provides a summary of the recommendations suggested to reduce the carbon footprint of NHS sight tests across the five optometry practices.

Table 16: Summary of recommendations

		Quick wins	Medium wins	Longer term wins
General	Share results within your practice	✓		
	Collaboration		✓	
	Collect carbon footprint data	✓		
	Set up a green team		✓	
	Self-assessment tools	✓		
Travel	Travel survey	✓		
	Car free day	✓		
	Car share	✓		
	Encourage active travel		✓	
	Promote sustainable travel information to patients		✓	
	Combine appointments	✓		
	Consolidate deliveries		✓	
Energy & Water	Review energy contract		✓	
	Upgrade equipment			✓
	‘Switch off’ campaign	✓		
	Install a smart meter	✓		
	Check for leaks	✓		
Procurement	Paperless sight test	✓		
	Sustainable spectacles		✓	
	Recyclable packaging		✓	
Waste	Waste audit	✓		
	Contact lens recycling		✓	
	Recycle frames		✓	

General

1. Share these results within your practice. It is a good way to start a conversation around sustainability and get everyone involved.
2. Share ideas and sustainability best practice with other practices. If the NHS is to become net-zero by 2045, collaboration is key. Optometrists and optometry practices must work together to find solutions. Join the network 'Eyehealth Susnet', hosted by the Centre for Sustainable Healthcare, for blogs, discussions and resources around sustainability in eye health; available at; [EyeHealth Susnet | CSH Networks \(sustainablehealthcare.org.uk\)](https://www.sustainablehealthcare.org.uk).
3. Continue collecting carbon footprint data. You can't manage what you don't measure. It is important for practices to continue monitoring their GHG emissions for both awareness and to encourage change. Appendix 1 provides practices with a basic template for collecting and recording carbon emissions data for scope 1 and 2.
4. Set up a green team. Optometrists and staff in practices are best placed to make sustainability improvements. You know your processes and services best so are best placed to be highlighting areas of inefficiency and making sustainability changes. Encourage all staff within the practice to identify areas which could be improved and ask questions; how can we do this better? How can we do this differently? You could also start a sustainability ideas board.
5. Use a sustainability self-assessment tool. For example, The Association of British Dispensing Opticians (ABDO) have developed a free [sustainability self-assessment tool](#) ^{xviii} designed to encourage everyone in the optometry sector to look at their current practices and find key solutions to making their working life, practice and/or businesses more sustainable.

Travel

With travel contributing 69% of the annual GHG emissions of NHS sight tests by all five practices (Figure 1), it is important for all practices to focus on reducing their travel carbon footprint from both staff and patients.

It is worth highlighting that data collected from practices showed that the majority of staff across all practices commuted by car. Reducing car commuting and encouraging active travel not only helps to reduce GHG emissions but has other potential benefits, for example, improving health and air quality within your local community.

1. Undertake a travel survey with staff. A travel survey is a good way to engage staff in thinking about their travel habits.
2. Car free day. Where possible encourage staff to swap the car for walking or public transport one day a week. Walking instead of driving saves around 0.35 kgCO₂e per mile, this would mean driving one less day a week could save 67 kgCO₂e per year per staff (based on a 4 mile commute).
3. Car share. Where a car free day is not possible, try car sharing with another colleague. Not only will you be saving GHG emissions and petrol costs, but it is also a great way to get to know your colleagues better.
4. Encourage active travel. This could be via installing secure cycle parking at your practice, signing up to the governments 'cycle to work scheme' or promoting active travel options such as e-scooters and displaying cycle/walking routes to work.
5. Provide public transport information to your staff. Regularly promote local bus and train routes and times.
6. Switch to electric vehicles. This could be both for fleet and personal vehicles. Financial support is available for purchasing an electric vehicle. The UK government's [low-emission vehicles](#) grant takes up to £3,000 off the price of a new electric vehicle, and the [electric vehicle homecharge scheme](#) provides a grant of up to 75% towards the cost of installing a charge point at home.
7. Provide sustainable travel information to your patients. Provide patients with information on how to travel to your practice by active transport or public transport. Where possible, information on safe cycling and walking routes should be supplied.
8. Combine appointments. If patients require two appointments, combine them, if possible, to reduce patient travel to and from the practice.
9. Consolidate orders and deliveries. This will not only reduce travel GHG emissions but also waste from packaging.

Energy and water

Many energy savings can be achieved with little or no cost.

1. Review your practices current electricity contract. If you are on a standard tariff, see if you can switch to a renewables tariff or switch to a provider who produce renewable

electricity. The [Energy Saving Trust](#) provides free advice and tools on switching to green energy tariffs and how to spot greenwashing.^{xix}

2. Upgrade to more energy efficient equipment. Switching inefficient bulbs to LEDs helps lower electricity bills and GHG emissions. Every traditional halogen bulb replaced with an LED saves £2-3 and 5 kgCO₂e per year.^{xx}
3. Run a 'switch off' campaign. A simple but effective action to ensure everything that can be switched off at the end of the day, is. A lot of energy is wasted when unnecessary lights and equipment are left on out of hours. Carry out a walk around at designated times to identify what equipment should be turned off, perhaps at the end of the day. Draw up an action plan and ensure all staff are aware of what equipment should be turned off.
4. Install a smart meter. Smart meters help business have more control over their energy consumption by sending energy readings directly to their supplier meaning accurate bills. Many small businesses can get a smart meter at no extra cost, depending on your business's energy supplier and tariff. Energy suppliers might also offer an in-house display screen that shows exactly how much energy you are using in kWh and £ in real time.
5. Ensure there are no water leaks within your practice.

Procurement

When procuring items, as a general rule, consider the 5Rs of sustainable procurement. This framework was developed by the Greener NHS Team^{xxi} and follows the principles of, reduce, reuse, (buy) reprocessed, (buy) renewable, (buy) recyclable. We have provided some recommendations under each heading.

1. Reduce: Can you do without the product?

- a. Run a paper lite or paperless sight test. Review your current sight test processes to see if you can reduce paper consumption. Does your practice send out paper appointment reminders that could be switched to text or email reminders? Could your practice go paper less in some of your other services? From the analysis, ink cartridges contributed highly towards many practices' procurement emissions. Going paper-less or paper lite might also reduce printing requirements.

2. Reuse: Can you buy reusable products instead of single use?

- a. Switch from single use to reusable. Where safe to do so following the COVID-19 pandemic and in line with infection control guidelines identify reusable alternatives to single use items.

3. (Buy) Reprocessed: Can you buy reprocessed or refurbished?

- a. Recycled paper. If you cannot go paperless, can you purchase recycled paper products?

4. (Buy) Renewable: What is the product made of?

- a. Procure spectacles which are made from sustainable materials and/or made in the UK. Spectacles are always going to be required, so where items cannot be reduced we must look to source them from sustainable sources. Calculate the percentage of frames made from renewable or recyclable materials that your practice stocks and set a target to increase this annually. Many companies like Eco-wear and Ace & Tate are moving away from fossil fuel derived materials such as plastic and moving towards bio and plant-based materials. Other companies such as Coral eyewear and Sea2See are using rescued and recycled marine plastics in their spectacle frames. Spectacle cases should also be considered, for example, Millmead Optical Group manufacture spectacle cases in Liverpool made from recycled plastic bottles.

5. (Buy) Recyclable: Is the product recyclable?

- a. Purchase items in recyclable packaging. Push suppliers to ensure their packaging is kept to a minimum and recyclable. If you have noticed a certain product comes in excessive or non-recyclable packaging highlight this to the supplier and ask them to switch to recyclable packaging. Not only is non-recyclable packaging more carbon intensive but it also increases your practices domestic waste consumption and costs.

Waste

1. Carry out a waste audit to ensure correct waste disposal and see if your practice is recycling everything it can. Clinical and domestic waste streams are more costly and carbon intensive than recycling streams. Carrying out a waste audit helps to

identify if your practice is recycling everything possible. It also helps to identify items that are being thrown away frequently and highlights opportunities for reduction such as overuse or inadequate stock keeping.

2. Encourage contact lens recycling. Research conducted by Optical Express found that 97% of contact lens wearers are disposing of their lenses down the drain or into landfill and only 3% of people recycle their lenses. Flushing lenses down the drain leads to microplastic pollution in UK waterways.^{xxii} Encourage your patients to dispose of their lenses responsibly and take them to a contact lens recycling box. Contact lens packaging should also be recycled where possible.
3. Recycle frames. The Lions Clubs operate a recycling scheme in which used or unwanted glasses can be posted to them and then sent to be reused in developing countries. Alternatively, Recyc-Line are a UK based company that recycle end of life frames in which the materials are put back into industry as raw materials rather than going to landfill.

Recommendations for NHS England and Improvement: Commissioners of Sight Tests

If the NHS is to truly ease its burden on climate change, its services commissioned from the private sector must not be ignored. NHS England and Improvement have the opportunity to work towards their commissioned services becoming net zero in line with the rest of the NHS.

With an increased focus on moving additional eyecare services into the community to help ease pressure on secondary care, it is particularly important that current and future commissioned optometry services are performed in a sustainable way, both for patients and planet.

General

1. Encourage collaboration between NHS England, optometry professional bodies and optometrists to work together to reduce GHG emissions of sight tests and other commissioned services provided by optometry practices.
2. Ensure commissioned optometry services are involved in the future Greener NHS plans and discussions.
3. Work together with sector bodies to raise awareness of sustainability in the optometry sector and where possible provide general training on sustainability issues within the sector. Potentially support the development of an e-learning module on sustainable optometry.

Travel

Consider travel and accessibility when commissioning new optometry contracts, trying to ensure services are commissioned which are accessible by active and/or public transport. NHS England should work with local authorities where possible to support sustainable/active travel to services.

Energy, water, and waste

Encourage collaboration of central spectacles and contact lenses recycling points within the local area.

Procurement

In collaboration with optometrists, encourage the optometry industry to work on measuring and reducing the carbon emissions of their products and packaging.

Limitations and Further Research

This study has several limitations. Firstly, the sample size has been small and restricted to one region of England. The carbon footprint analysis of the five optometry practices and their sight tests may not be representative of the whole country. Increasing the sample size and expanding the scope of the analysis to include additional areas of England would provide a more accurate estimation of the carbon footprint of NHS sight tests.

Secondly, data collection was retrospective leading to some differences in the type and accuracy of data collected. For example, some practices were unable to provide energy and waste data in terms of kWh and weight, and instead provided cost. To analyse the expenditure data additional assumptions had to be made increasing the uncertainty around the results.

Thirdly, whilst this study focussed purely on the estimation of the carbon footprint of NHS sight tests, it should be noted that the NHS commissions additional eyecare services including domiciliary services. These services will also have an environmental impact which needs estimating and addressing.

This study is the first of its kind in the UK and highlights the need for further carbon footprinting work within the optometry sector. Acknowledging the limitations of this study, it is recommended that a larger study including optometry practices from a range of regions across the UK should be undertaken. Prospective rather than retrospective data collection over a 12-month period will ensure greater data accuracy. Including all optometry services in a larger study would provide an understanding of the full GHG emissions impact of the high street optometry sector and pave the way to tackle it.

Appendices

Appendix 1: Example GHG emissions database template

The below Figure suggests a monthly template for collecting GHG emissions data. Firstly, collect the data in the correct activity unit each month. Electricity and gas should be recorded in kWh, this can be found on your invoices. Water should be collected in m³, you should also be able to find this on your invoices. Secondly, multiply the activity unit by the appropriate GHG emissions factor. 2021 energy carbon emissions factors can be found on the [Government website](#) and are updated each year.

2021 Emission factors:

- Electricity: 0.29130 kgCO₂e/kWh
- Gas: 0.21451 kgCO₂e/kWh
- Water: 0.3666 kgCO₂e/m³

Thirdly, record your carbon emissions for each source each month. It might also be useful to record cost too.

Month	Electricity			Gas			Water		
	kWh	Carbon emissions (kgCO ₂ e)	£	kWh	Carbon emissions (kgCO ₂ e)	£	m ³	Carbon emissions (kgCO ₂ e)	£
Jan-20	500	145.65	600	200	42.902	300	40	14.664	80
Feb-20									
Mar-20									
Apr-20									
May-20									
Jun-20									
Jul-20									
Aug-20									
Sep-20									
Oct-20									
Nov-20									
Dec-20									
<i>Total</i>									

Appendix 2: Example of optometry practice one page summary

Practice 1 Carbon Footprint Summary

No. sight tests performed in 2020: 1053

Table 1: Practice 1 annual carbon footprint data 2020

	Annual carbon footprint (2020) (kgCO ₂ e)	Carbon footprint per NHS sight test (kgCO ₂ e)
Practice 1 sight test	9,774	9.28
Average sight test		5.27

The annual carbon footprint of all NHS sight tests performed at practice 1 is 9,774 kgCO₂e, the equivalent of flying return to Hong Kong 2.8 times. The practice has a carbon footprint of 9.28 kgCO₂e per sight test, 1.76 times above the average carbon footprint of the sight tests across all the five practices analysed and also the highest carbon footprint per sight test across all five practices.

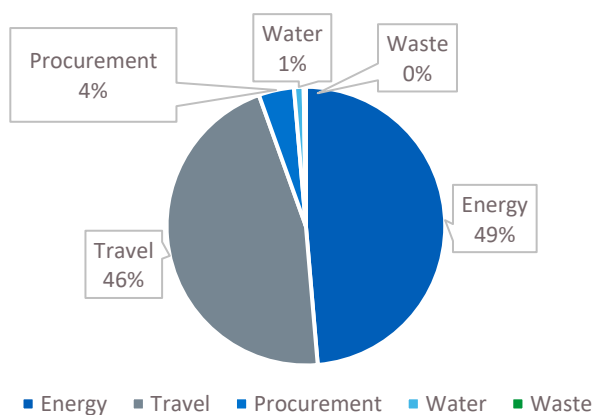


Figure 5: Breakdown of practice 1 annual sight test

Energy contributes the largest (49%) proportion of GHG emissions, adding 4,776 kgCO₂e with gas contributing 3,396 kgCO₂e and electricity contributing 1,381 kgCO₂e (see Figure 1). Travel is the second largest contributor (46%) adding 4,495 kgCO₂e, with staff commuting adding 2,894 kgCO₂e and patient travel adding 1,601 kgCO₂e. Procurement adds 368 kgCO₂e (4%) (Table 2), water adds 110 kgCO₂e (1%) and waste adds 25 kgCO₂e (0.3%).

Table 1 compares practice 1's carbon footprint per sight test to the average carbon footprint per sight test. Energy, travel and water GHG emissions per sight test are higher for practice 1 compared to the average sight test carbon footprint.

	Practice 1 (kgCO2e)	Average (kgCO2e)
Energy	4.54	0.76
Travel	4.27	3.64
Procurement	0.35	0.56
Waste	0.02	0.26
Water	0.10	0.05

Table 3: Breakdown of annual procurement GHG emissions

Item	GHG emissions (kgCO2e)	% Contribution	Item	GHG emissions (kgCO2e)	% Contribution
PPE	112.3	28%	Hand gel	9.2	2%
Ink	91.4	25%	Paper	6.4	2%
Postage	75.7	21%	Envelopes	4	1%
Antiseptic wipes	44.3	12%	Fluorets	3.9	1%
Paper towels	17.3	5%	Minims	3.9	1%

The NHS sight test carbon footprint does not include spectacles, contact lenses or contact lens solution as they are not directly part of a sight test. However, it is important for optometry practices to consider the emissions associated with these additional procurement items as they occur as a result of performing a sight test. Spectacles, contact lenses and contact lens solution contribute 1,647 kgCO2e if included in annual sight tests GHG emissions analysis. Contact lenses add 690 kgCO2e, contact lens solution adds 49 kgCO2e and spectacles add 907 kgCO2e.

This report focuses specifically on the carbon footprint of NHS sight tests, however it is also important to understand and report your organisational carbon footprint. From the practice data supplied for energy, water, waste, staff commuting and procurement, practice 1's organisational carbon footprint for 2020 was 17,116 kgCO2e. It should be noted that the procurement data included does not represent the full range of items procured at practice 1 in 2020, rather the procurement items specifically for sight tests.

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