

City of London Carbon Footprint



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1. EXECUTIVE SUMMARY

Climate change is the biggest environmental challenge facing the world today, particularly for the world's major cities, often cited as consuming more than 75% of the world's energy and being responsible for 80% of greenhouse gas emissions.

Whilst to date, most climate change legislation has focused on energy intensive sectors, it is increasing being recognised that other organisations can also have a key part in mitigating climate change including the public sector. The UK Government has announced a number of key initiatives that require local authorities to address their own impacts and seek to motivate and influence other sectors of the economy to do more.

The City of London has established a reputation as a leader in tackling climate change, earning a Beacon Award in 2008 for its pioneering efforts to address the effects of climate change in the Square Mile; becoming the first local authority to develop a comprehensive Climate Change Adaptation Strategy; and commissioning ongoing, cutting edge research into environmental markets and sustainable financial centres.

While the City has already taken steps to reduce its own operational carbon emissions (introducing energy management systems and developing a carbon footprint for its own operations), the next step is to look further – at the wider community, the Square Mile. This study has calculated a carbon footprint of the Square Mile and is essential in helping the City understand where to focus its attention. By presenting the footprint in a number of different ways (commercial floorspace, worker population and residential population) it allows a more relevant and accurate analysis of the situation in the City.

The overall carbon footprint for the City of London is 1,668,165 tonnes of carbon dioxide (tCO₂) per annum. The report presents this split in terms of residential and commercial footprints to aid comparison and assessment. The residential carbon footprint for the Square Mile is 2.67 tCO₂ per resident. This figure is comparable, although higher than a number of the major UK cities (for example, the local authority areas of Manchester, Leeds and Birmingham¹). Whilst the scope of this study has not enabled the reasons for these differences to be identified, it may in part be due to the City's relatively high electricity consumption, accounting for approximately 40% of residential energy use versus 20% in the above mentioned UK cities. Electricity is more carbon intensive than gas and thus contributes to a higher carbon footprint.

The commercial carbon footprint for the Square Mile is 0.32 tCO₂ per metre of floorspace (m²). This figure is higher than Manchester, Leeds and Birmingham; which again is anticipated to be at least partially attributed to the City of London's relatively high use of carbon-intensive electricity (accounting for 73% of all commercial/industrial energy use compared to an average of 36% in the other cities). This is not unexpected for a global financial centre such as London, with highly energy intensive office activities such as lighting, air conditioning and in particular data management centres.

As part of this study, a survey of a selection of the City's businesses was conducted to gather more information on energy use. The results indicate that responding businesses perceive their most energy intensive activities to be heating and lighting, and air conditioning.

¹ Figures for these other cities are presented in the main body of the report along with their reference.

The study provides a baseline carbon footprint for the Square Mile and a methodology for tracking this in the future. The findings will helping the City to target activities to continue to reduce carbon emissions within the Square Mile, consistent with positioning itself as the leading sustainable global financial centre within the global low carbon economy.

2. INTRODUCTION

2.1. Background

The Global Challenge and the UK Government's Response

Climate change is widely considered as the biggest environmental challenge facing the world today and is increasingly dominating international and UK political agendas. Pressure is mounting on Governments to take action to reduce carbon or greenhouse gas (GHG) emissions².

The UK Government has responded to this pressure with a myriad of climate change legislation and national targets for emissions reductions, such as:

- Setting a national target of 80% reduction in GHG emissions by 2050;
- Establishing the world's first national Climate Change Act to tackle the threat of climate change; and
- Introducing an emissions trading scheme for non-energy intensive organisations such as retailers, banks, government departments, and large local authorities, known as the Carbon Reduction Commitment (CRC).

Previously, climate change legislation has focused on the energy intensive organisations, such as energy generators, iron and steel makers, cement manufacturers. However, there has been a push more recently to widen the scope to include more sectors of the economy, including the public sector, such as the CRC.

Role of the Public Sector

The public sector as a whole has an important role to play in tackling climate change. Not only can it look to reduce its own impact on climate change and managing emissions, but public sector organisations can motivate and influence the wider community into action. This is particularly the case for Local Authorities (LAs) who understand local circumstances and priorities.

The Local Government White Paper³, published in 2006, reinforces the importance of LAs in tackling climate change by introducing a new performance framework (the Comprehensive Area Assessment). This assesses the performance of each LA against a set of National Indicators, including three that relate to climate change:

- NI 185 – measures CO2 emissions reductions from LA operations (mitigation);
- NI 186 – measures per capita reduction in CO2 emissions in the LA area (mitigation); and

² The linkage between carbon, carbon dioxide and greenhouse gas emissions is discussed in Section 3 of this report.

³ The Local Government White Paper was published in October 2006 and is available here:

<http://www.communities.gov.uk/publications/localgovernment/strongprosperous>

- NI 188 – measures the LA's progress in assessing and addressing the risks and opportunities of a changing climate (adaptation).

Role of the City of London

The City of London Corporation has recognised the challenge of climate change for a number of years and has taken steps to reduce the impact of its own operations on climate change, as well as influencing businesses within the Square Mile to do the same.

- In March 2008, the City was awarded the Beacon Status for its pioneering efforts to address the effects of climate change in the Square Mile. The award recognises the City's success in managing its energy use, reducing CO2 emissions by 35% over the last 10 years, and addressing climate change as a priority within its Community Strategy.
- The City was the first LA to develop a dedicated Climate Change Adaptation Strategy that identifies the priority risks associated with climate change and proposes adaptation measures to enable that the City's infrastructure and services cope in a changing climate.

The City has made sustainability a fundamental part of its approach to corporate planning. An important outcome of this is an extensive programme of sustainability activities across the organisation. This is evidenced by the periodic sustainability review conducted on the City's initiatives. The City has also been working to develop the environmental finance sector and to position the City as a leader in the new low carbon economy⁴.

2.2. Aims of the Study

The City of London Corporation has commissioned URS Corporation Ltd (URS) to calculate the carbon footprint of the Square Mile and present it in the following outputs. We have continued this breakdown of the results throughout the report for simplicity and transparency.

- Total carbon footprint based on residential plus working population;
- Domestic carbon footprint based on residential population; and
- Commercial carbon footprint based on working population, and commercial floor space.

This study represents the next step by the City to tackle carbon emissions, by helping to identify the most carbon intensive activities within the Square Mile and provide a baseline against which performance can be tracked. It will also allow the City to develop a more informed response to climate change including:

- Programmes under the Beacon Agenda; inform the City's decisions to set appropriate targets for NI 186;
- The development of a Climate Change Mitigation Strategy for the City to complement the Adaptation Strategy.

The key elements of this study were:

⁴ See the Sustainability Assessment of Global Financial Centres report released by the City in March 2008, and its work with leading City businesses on the London Accord.

- Reviewing key data sources and data collection methodologies, in particular, the UK Department for Business, Enterprise and Regulatory Reform's (BERR) Regional Energy Statistics which formed the basis for the carbon footprint information presented in Sections 3 and 4;
- Circulating and analysing responses to an online, project specific survey to members of the City's Clean City Awards network to gather more information on energy use as presented in Section 5;
- Obtaining data on potable water consumption from Thames Water based on domestic and non-domestic supplies;
- Developing and designing a City of London Carbon Footprint calculator; populating this tool with all data collected; and analysing the findings.

For more detail on the steps taken as part of this study, please see Appendix A.

2.3. Structure of this Report

This report is arranged as follows:

Section 1 – outlines the aims of this study and the approach taken;

Section 2 – describes the scope of the footprint;

Section 3 – presents the overall carbon footprint for the City of London;

Section 4 - presents the City of London carbon footprint for the residential portion;

Section 5 – presents the commercial carbon footprint of the City, using CO₂ emissions by commercial floorspace as a key indicator;

Section 6 – presents the findings of the online survey of City businesses; and

Section 7 – summarises the main findings of the study and sets out recommendations. The supporting Appendices comprise:

- The detailed methodology and data sources of all the calculations and assumptions (Appendix A);
- The survey questionnaire that was sent to the Clean City Awards Members (Appendix B);
- A list of the key references and data owners (Appendix C).

3. WHAT IS INCLUDED?

3.1. Introduction to Carbon Footprinting

The term 'carbon footprint' has become increasingly commonly. At an initial glance a definition might seem simple:

A measure of the impact that a person OR organisation OR product OR location has on the environment in terms of the amount of carbon dioxide or greenhouse gases produced.

But even in this definition a number of questions could be raised:

1. It is carbon, carbon dioxide or greenhouse gases that are measured and what is the difference?
2. What is the entity on which a carbon footprint is calculated?
3. What elements or activities are considered when working out the impact and surely this must be affected by the boundaries of the entity being assessed?

The answer to the first question is that all can potentially be used. This clearly has led to different numbers being generated in different studies, which are not comparable. The two most common measures are carbon dioxide and carbon dioxide equivalents (CO₂e). The greenhouse gases that are captured under carbon dioxide equivalents are typically the six Kyoto gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs and PFCs) although some standards and guidance require all greenhouse gases to be considered⁵. For this study we have considered only CO₂.

The answer to the second and third questions is that a carbon footprint can be calculated for a range of entities and there are an emerging number of standards or methods for different entities that identify different elements or activities that might need to be included. Until a single standard exists, different approaches can be taken and this can mean that for any type of footprint a range of elements or activities could be included. In the next section we explore what are the sources of carbon dioxide emissions in a city and then define those that we have included in the footprint for the City of London.

There are a wide range of guidelines and protocols on greenhouse gas (GHG) inventories published by various nationally and internationally recognised bodies to date, and guidance on this issue is evolving very quickly.

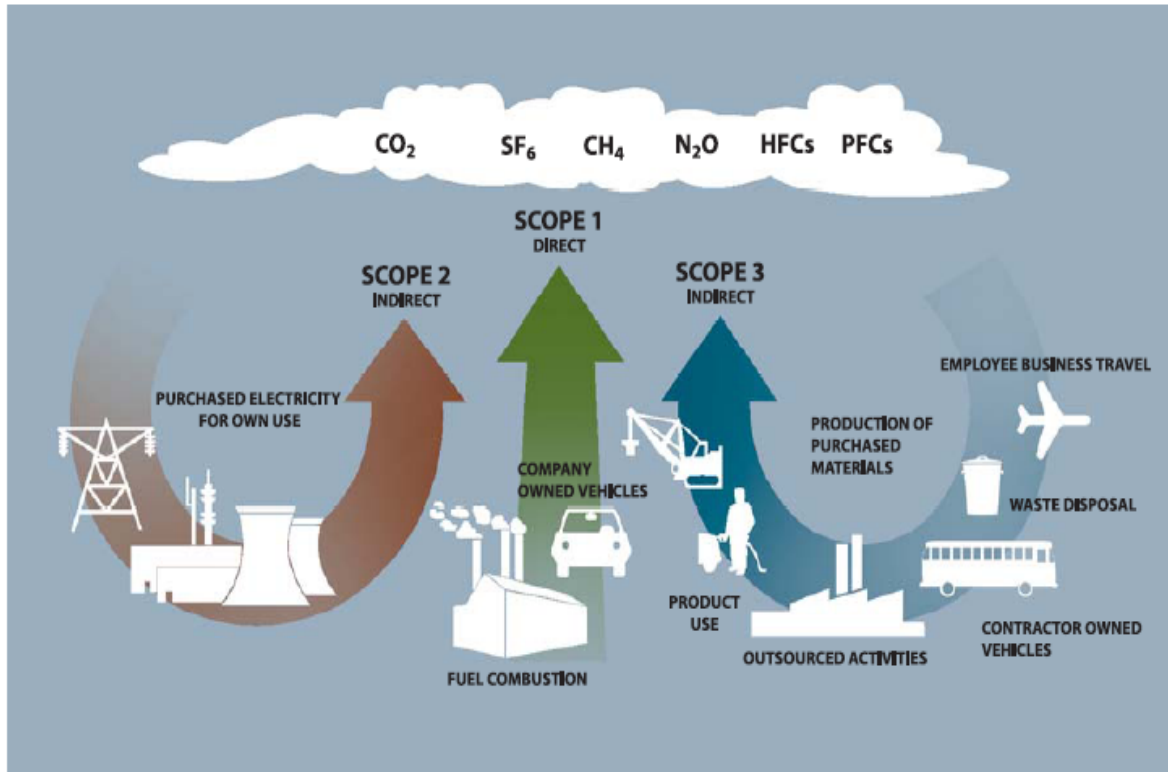
The most widely recognised to date is the World Resources Institute and World Business Council for Sustainable Development (WRI/WBCSD 2004) Corporate Accounting and Reporting Standards (often called the GHG Protocol)⁶. This protocol defines emission sources in a series of "Scopes" which are shown in Figure 1 below. Under the GHG Protocol, organisations are requested to report direct emissions resulting from the combustion of fossil fuels in their equipment or vehicles (Scope 1) and also indirect emissions from electricity consumption (Scope 2). The reporting of emissions from other indirect emissions associated with equipment not owned or controlled by the organisation e.g.

⁵ As defined in IPCC 4th Assessment Report 2007, available at: <http://www.ipcc.ch/ipccreports/assessments-reports.htm>

⁶ WRI/WBCSD's Corporate Accounting and Reporting Standards is available at: <http://www.ghgprotocol.org/>

commuting, business travel, waste production and the production of purchased materials (Scope 3 emissions) are optional.

Figure 1: The GHG Protocol - Definition of Scopes



In the absence of a single, standard methodology it is important that the scope and boundaries of a carbon footprint are clearly defined to aid transparency and comparability.

3.2. Typical Emission Sources in a City

A carbon footprint for a city could potentially include a sizeable number of sources. Cities place hefty resource demands on the earth, consuming around 75 per cent of the world's energy and producing up to 80 per cent of the world's GHG emissions⁷. The resource demands of a city include:

- energy (electricity, gas or other fuels) for buildings, such as commercial, industrial, housing, schools, hospitals;
- goods and consumables that are imported from outside the city like food, electronics, white goods;
- transport of items and people into, out of and around the city;
- raw materials used in the manufacture of other products and construction within the city;

⁷ C40 Group website, <http://www.c40cities.org/>. The C40 Group is a collective of the world's largest cities committed to tackling climate change.

- transport and treatment of waste; and
- clean water provision and wastewater treatment.

All these processes generate carbon emissions, either through the direct use (e.g. fuels for transport, gas for heating) or through their production and manufacture (e.g. building materials, goods and consumables), as illustrated in Table 1 below.

Table 1: Emission Activities in a City

Direct Emission Sources	Indirect Emission Sources
Energy use in buildings (gas, oil, etc.)	Energy use in buildings (purchased electricity)
Transport within the City of people and goods	Energy use to manufacture goods and consumables
	Transport to the City of people and goods
	Waste disposal – transport and treatment
	Clean water provision – transport and processing
	Wastewater – transport and treatment

3.3. Carbon Emission Sources in the City of London Footprint

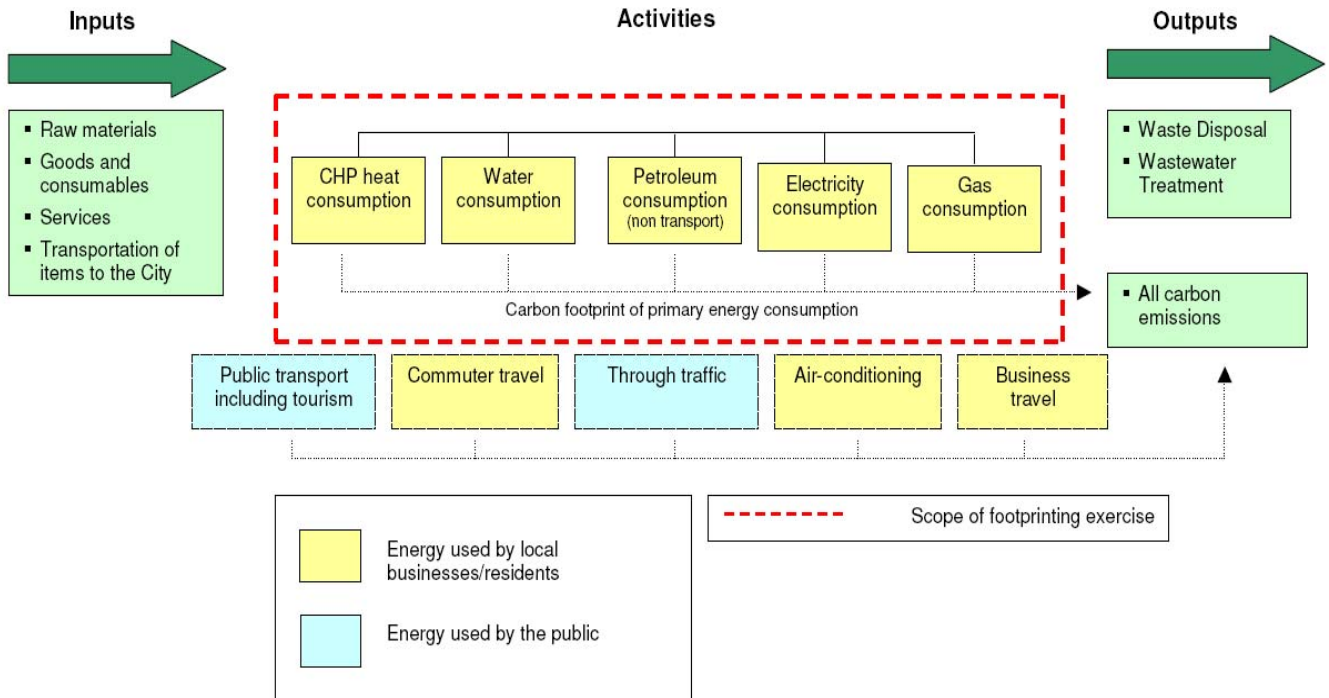
Clearly defining the boundaries of the footprint for the City of London was important to enable comparability and analysis of the findings. As the focus of the survey was to consider the Square Mile rather than just the Corporation’s own emissions guidance such as WRI/WBCSD’s GHG protocol could not be directly applied. In developing the scope of the footprint we have focused on energy use associated with buildings (including energy use associated with treatment of water used in the city.)

Transportation has been excluded from this exercise. The Corporation decided that transportation had been the focus of a number of recent studies by the Corporation, such as the July 2008 report on Aviation Services and the City⁸ and a focus on other uses of energy would provide balance in studies. In addition, it was recognised that there could be difficulties in obtaining robust data on the different transport sources (business travel, tourism, through traffic, etc.) for the City. Excluding these elements therefore removed some potential data uncertainties.

The boundary described in Figure 2 illustrates the activities and sources of carbon emissions within the Square Mile. The red box presents the emissions and activities that have been included in this study (i.e. energy-use emissions and emissions associated with the consumption of water).

Figure 2: City of London Carbon Footprint Approach

⁸ Aviation Services and the City, written by York Aviation and published by the City of London Corporation, July 2008 is available at: http://217.154.230.195/NR/rdonlyres/53D815CC-09A5-4912-AF21-152DD1F405DB/0/BC_RS_FullAviation_report_with_appendices_July2008.pdf



Clearly, there are a number of other sources that could be considered in the future including the manufacture and transportation of goods and consumables used in the City, emissions associated with waste disposal and treatment, and emissions from public transport and through traffic. Examples include the Regional Economic Environment Input Output (REEIO) model used by some English regions calculate regional GHG emissions and emissions forecasts, and the approach developed by the Stockholm Environment Institute which takes into account embodied GHG emissions of imported products and materials (from UK and overseas).

4. THE OVERALL FINDINGS

The City of London can be considered to be significantly different from most, if not all, other local authorities in the UK in terms of its relative proportion of commercial, industrial and residential land use. The Square Mile is home to just 7,800 residents, with an estimated 5,900 working age residents (i.e. males aged 16 to 64 and females aged 16 to 59). Yet there are approximately 340,000 people working in the Square Mile in buildings with a floor area of 5,162,000 meters squared (m²).

The carbon footprint as calculated in this study for the City is 1,668,165 tCO₂ per annum. Figure 3 and Table 2 gives a detailed breakdown of energy use and carbon emissions by source.

Figure 3: Breakdown and Percentages of City of London Emissions

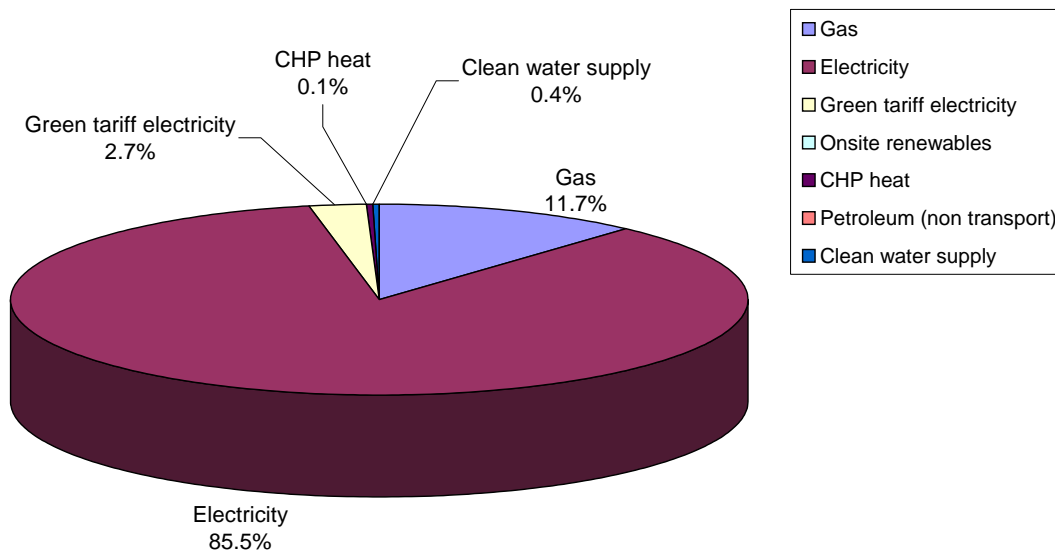


Table 2: City of London Carbon Footprint

Emission source	Consumption per annum [kWh, litres-water]			CO ₂ generated per annum	CO ₂ generated per annum / capita & commuter	CO ₂ generated per annum
	Domestic	Commercial	Total	tonnes of CO ₂	tonnes of CO ₂	%
Gas	36,330,689	907,956,684	944,287,373	194,523	0.56	11.7%
Electricity	24,591,119	2,632,511,028	2,657,102,147	1,426,917	4.13	85.5%
Green tariff electricity		85,309,144	85,309,144	45,813	0.13	2.7%
Onsite renewables				-	-	0.0%
CHP heat		4,829,850	4,829,850	909	0.00	0.1%
Petroleum (non transport)	174	11,436	11,610	3	0.00	0.0%
Clean water supply	482,566,500	21,417,433,500	21,900,000,000	6,373	0.02	0.4%
TOTAL				1,668,165	4.84	100%

Source: URS Analysis December 2008. Refer to Data Sources in Appendices.

Given the City's unusual situation, presenting the footprint in a number of different ways (by residential population, worker population and commercial floorspace) allows a more relevant and accurate analysis of the situation in the City. This analysis has been provided in Sections 5 and 6 below.

5. RESIDENTIAL CARBON FOOTPRINT

5.1. Findings

The residential carbon footprint for the City as presented below considers domestic energy consumption and domestic water consumption for 2006. It does not include transportation activities nor with the exception of water consumption, energy used in the manufacturing and delivery of goods and services used in the home.

The total carbon emissions for the residential proportion of the City is 20,831 tCO₂, which when presented per capita (per resident) is 2.67 tCO₂⁹. Figure 4 and Table 3 gives a detailed breakdown of energy use and carbon emissions by source.

Figure 4: Breakdown and Percentages of City of London Residential Emissions

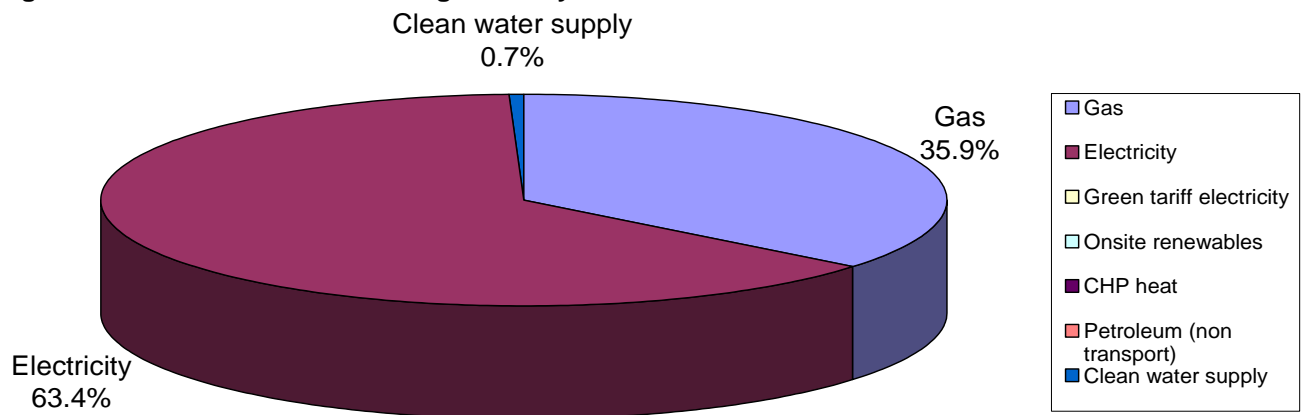


Table 3: City of London Residential Carbon Footprint

Emission source	Consumption per annum	CO ₂ generated per annum	CO ₂ generated per annum / residential population	CO ₂ generated per annum
	kWh	tonnes of CO ₂	tonnes of CO ₂	%
Gas	36,330,689	7,484	0.96	35.9%
Electricity	24,591,119	13,206	1.69	63.4%
Green tariff electricity	-	-	-	0.0%
Onsite renewables	-	-	-	0.0%
CHP heat	-	-	-	0.0%
Petroleum (non transport)	174	0	0.00	0.0%
Clean water supply	482,566,500	140	0.02	0.7%
TOTAL		20,831	2.67	100%

Source: URS Analysis December 2008. Refer to Data Sources in Appendices.

⁹ The City of London carbon footprint takes account of electricity and gas consumption, consumption of petroleum for non-transport purposes, consumption of CHP heat, and water consumption. Most of the energy use comes from 2006 BERR data on electricity and gas consumption. Water consumption figures are from Thames Water and CHP data was provided by the City of London.

5.2. Analysis

Based on the scope used in this study, the City of London's residential carbon footprint appears larger than the footprints of other major UK city centres, illustrated in Table 4.

The information on these cities and their emissions was sourced from Defra's experimental statistics on carbon dioxide emissions for local authorities¹⁰. It should be noted that unlike this study for the City of London, Defra does not take account of emissions associated with water consumption. Even excluding water the footprint for the City of London is still larger than the other cities referenced below.

A potential reason for this variation could be the high proportion of electricity used as an energy source (a relatively high carbon intensity energy source compared to say gas) used in the City compared to other UK cities. Electricity accounts for for approximately 40% of residential energy use versus 20% in Manchester City, Leeds City and Birmingham City local authority areas.

Table 4: Residential Carbon Footprints of Large UK City Centres

Local Authority Area	Domestic CO ₂ generated per annum / capita of residents
City of London	2.67 tonnes CO ₂
Leeds City	2.43 tonnes CO ₂
Birmingham City	2.27 tonnes CO ₂
Manchester City	2.25 tonnes CO ₂

Source: URS Analysis December 2008 based on BERR 2006 Total Final Energy Consumption at Local Authority Level¹¹. See Appendices.

¹⁰ Defra's experimental statistics for 2006 were published in September 2008 and are available here: <http://www.defra.gov.uk/environment/statistics/globalatmos/globalghg.htm>

¹¹ The City of London residential carbon footprint as calculated here takes into account emissions associated with water consumption whereas the other cities data do not. However, energy use for water consumption only accounts for 0.4% of the City's total. If we applied the same Defra data (and not include emissions associated with water usage), the City's residential footprint would be 2.62 tCO₂, still somewhat higher than the other major cities.

6. COMMERCIAL CARBON FOOTPRINT

6.1. Findings

The commercial carbon footprint¹² for the City as presented below considers commercial energy consumption and water consumption for 2006¹³. Based on this scope, the total carbon emissions for the commercial proportion of the City have been calculated to be approximately 1,653,708 tCO₂. Figure 5 and table 5 below illustrate this commercial footprint split by emission source.

Figure 5: Breakdown and percentages of City of London commercial emissions

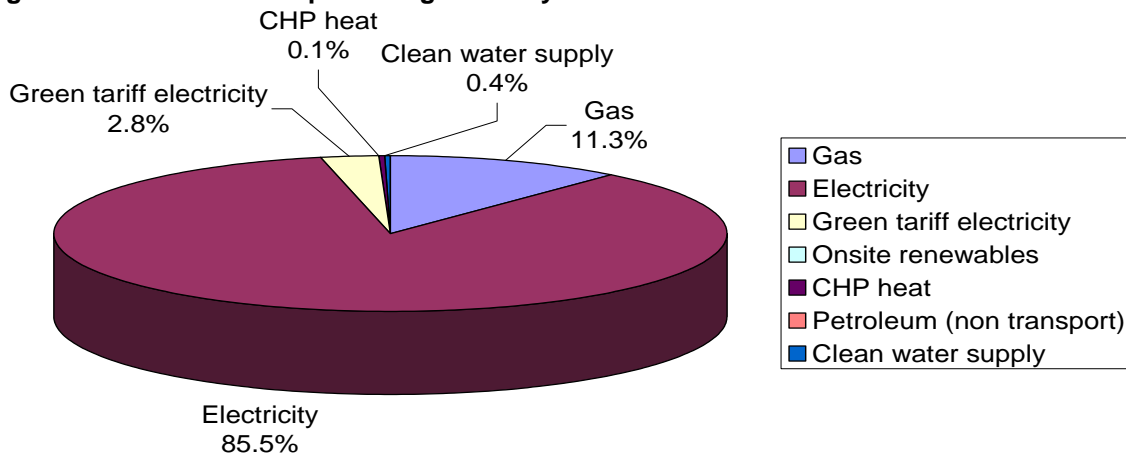


Table 5: City of London Commercial and Industrial Floorspace Carbon Footprint

Emission source	Consumption per annum	CO ₂ generated per annum	CO ₂ generated per annum / workers	CO ₂ generated per annum / commercial floorspace m ²	CO ₂ generated per annum
	kWh	tonnes of CO ₂	tonnes of CO ₂	tonnes of CO ₂ / commercial floorspace m ²	%
Gas	907,956,684	187,039	0.55	0.04	11.3%
Electricity	2,632,511,028	1,413,711	4.18	0.27	85.5%
Green tariff electricity	85,309,144	45,813	0.14	0.01	2.8%
Onsite renewables	-	-	-	-	0.0%
CHP heat	4,829,850	909	0.00	0.00	0.1%
Petroleum (non transport)	11,436	3	0.00	0.00	0.0%
Clean water supply	21,417,433,500	6,232	0.02	0.00	0.4%
TOTAL		1,653,708	4.89	0.32	100%

Source: URS Analysis December 2008. Refer to Data Sources in Appendices.

¹² For the purposes of this exercise the footprint has been split between domestic and non-domestic energy and water usage. Non-domestic including commercial, retail, industrial and private sector usage is referred to as 'commercial' footprint for this report. The commercial carbon footprint does not include transportation activities nor (with the exception of water consumption) energy used in the manufacturing and delivery of goods and services made outside the Square Mile, and procured by the City's businesses.

¹³ According to the Annual Business Inquiry, in 2007 there were 15,672 individual places of business in the City of London.

In the following sections to aid assessment and comparison we have presented this total figure in two ways by commercial floorspace within the City (in m²) and the worker population.

6.2. By Commercial Floorspace

Table 6 below presents the carbon footprint of the City in terms of commercial floorspace.

Table 6: Commercial Carbon Footprint by Commercial Floorspace (m²)

Emission source	CO2 generated per annum
	tonnes of CO2 / m2
Gas	0.04
Electricity	0.27
Green tariff electricity	0.01
Onsite renewables	-
CHP heat	0.00
Petroleum (non transport)	0.00
Clean water supply	0.00
TOTAL	0.32

If we compare this commercial footprint to the commercial footprints of a selection of other major UK cities (see Table 7), the carbon footprint when presented by commercial floorspace is larger than the other cities selected.

Table 7: Commercial Carbon Footprint of Large UK City Centres

Local Authority Area	Commercial CO ₂ generated per annum / commercial floorspace [m ²]
City of London	0.32 tonnes CO ₂
Manchester	0.26 tonnes CO ₂
Leeds City Council	0.22 tonnes CO ₂
Birmingham	0.22 tonnes CO ₂

Source: URS Analysis December 2008. Refer to Data Sources in Appendices.

To enable further comparison, we analysed the City's carbon emissions against floorspace using the defined methodology used for Display Energy Certificates (required under the Energy Performance of

Buildings Regulations) as a benchmark¹⁴. The carbon efficiency of commercial buildings in the City appears low with a 'G' rating, based on 0.35 tonnes of CO₂ /m². The benchmarks within the Display Energy Certificates are based on the "categorisation" of the building, using the "office" category for our benchmarks. It is possible that the large number of headquarters in the Square Mile with highly electricity-intensive office activities (such as air conditioning and data management centres) result in a higher CO₂ /m² figure than for typical offices.

6.3. By Worker

The commercial carbon footprint per worker in the Square Mile is 4.89 tCO₂ per annum. Comparing this figure to the residential (per capita) footprint for the Square Mile of 2.67 tCO₂ workers, it is clear that the working population plays a major role in the City's carbon dioxide emissions.

Table 8: Commercial Carbon Footprint presented by worker

Emission source	CO2 generated per annum / workers
	tonnes of CO2
Gas	0.55
Electricity	4.18
Green tariff electricity	0.14
Onsite renewables	-
CHP heat	0.00
Petroleum (non transport)	0.00
Clean water supply	0.02
TOTAL	4.89

Source: URS Analysis December 2008. Refer to Data Sources in Appendices.

¹⁴ Due to a lack of information on the use of renewables in the City, the calculation does include use of renewable energy.

If we compare this commercial footprint to the commercial footprints of the other major UK cities, the City of London has the second largest emissions per worker, after Birmingham¹⁵.

Table 9: Commercial Carbon Footprint per Employee in Large UK City Centres

Local Authority	Commercial CO ₂ generated per annum / capita of workers
Birmingham	5.08 tonnes CO ₂
City of London	4.89 tonnes CO ₂
Manchester	4.65 tonnes CO ₂
Leeds	4.56 tonnes CO ₂

Source: URS Analysis December 2008. Refer to Data Sources in Appendices.

¹⁵ The carbon footprints of each of the cities are based on the BERR 2006 data. The City of London carbon footprint also includes energy used for water consumption. Daytime commuters are assumed to be equal to the total number of jobs in each city as provided in the Official Labour Market Statistics. Official Labour Market Statistics are available for each UK local authority at: <https://www.nomisweb.co.uk/default.asp>

7. FINDINGS ON RESPONSES TO THE ONLINE SURVEY

7.1. Energy Use

A survey was conducted to obtain information on commercial floorspace, energy and water use, other fuel sources, types of activities that consume energy, and carbon saving policies/programmes in place. The survey questions are presented in Appendix B. The survey provides supplementary information to our hard data desk analysis.

The survey was sent to the 1,400 Members of the Clean City Awards. There were 106 responses received representing 8% of those contacted. Figure 6 shows the proportional breakdown of respondents. The responses reflect the type of businesses typically located in a financial centre, with the majority of responses coming from accounting (19%), other financial services (14%), legal (13%), banking (12%), and hotels and restaurants (8%). Figure 6 shows a profile of commercial activity of the businesses that responded to the survey.

Figure 6: Respondents by Sector

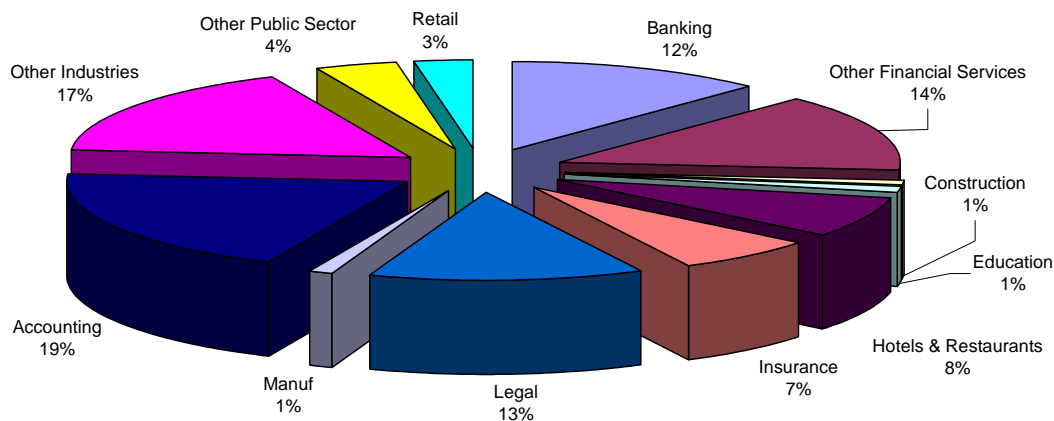
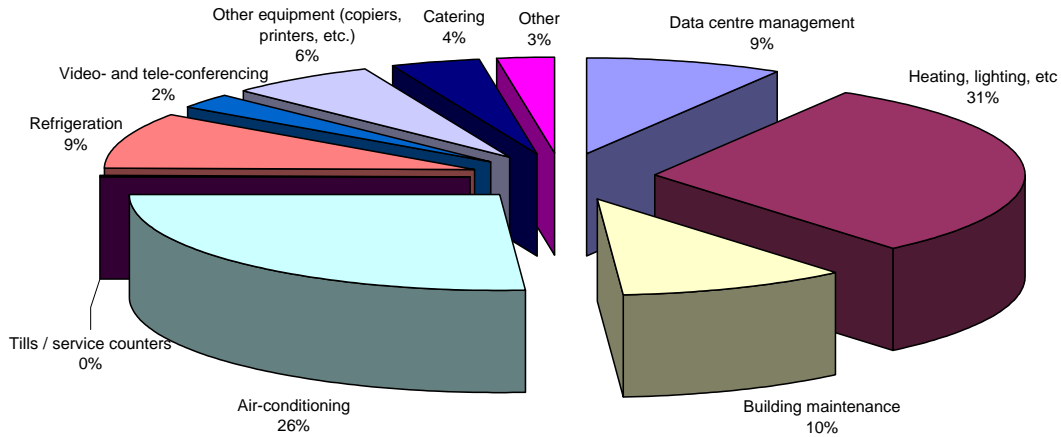


Figure 7 shows energy use by activity type. Based on the information provided by the respondents the key emission sources are heating and lighting etc (31%) air conditioning (26%), building maintenance (10%), data centre management and refrigeration (both 9%).

Figure 7: Proportion of Energy Use By Activity Type – All Survey Respondents



7.2. Alternative fuel sources

There was limited response to the question requesting information on alternative fuel sources although several respondents mentioned that they had contracts for green tariff energy.

7.3. Policies & Programmes

Only a third of the respondents to the survey (38) provided information on what policies, programmes and plans are in place to reduce carbon emissions. Of these 85% had some form of policy, programme or plan to reduce carbon emissions. Most of the positive responses came from businesses within the sectors of banking, accounting and other financial services. Many of the respondents regularly assess and monitor their office energy use and/or carbon emissions. For example, one respondent answered:

“The Bank sets annual targets for the Reduction in Carbon emissions caused by energy and we regularly compare energy use and carbon emissions against recognised industry benchmarks. We have also implemented various recommendations made by the Carbon Trust to reduce energy consumption within the Building. There is also an Energy & Sustainability Statement on our staff intranet etc.”

7.4. Summary of Survey

Overall, the survey provided some additional information regarding energy use within a selection of businesses in the City. Key uses of energy were identified to be heating and lighting, air conditioning, building maintenance, data centre management and refrigeration.

8. CONCLUSION AND RECOMMENDATIONS

This study has quantified the residential and commercial carbon emissions within the city, accounting for energy used for electricity and gas consumption, CHP heat and power, water treatment, and non-transport petroleum.

The main conclusions are as follows:

- The Square Mile has a unique demographic, housing only 7,800 residents yet hosting approximately 340,000 workers, with a large amount of commercial floor area (5,162,000 m²). The total carbon footprint is 1,668,165 tCO₂ per annum.
- The residential carbon footprint for the Square Mile is 2.67 tonnes of carbon dioxide (tCO₂) per resident. This is higher than Manchester, Leeds and Birmingham, which may at least in part be attributable to the high carbon content of its energy sources used (using much more electricity than gas).
- The commercial carbon footprint for the Square Mile is 0.32 tCO₂ per metre of floorspace (m²). Again this is higher than Manchester, Leeds and Birmingham; and may also in part be attributable to the high proportion of electricity use. For the commercial buildings, electricity use would be required to power aspects such as lighting, air conditioning and data centre management and the nature of the businesses located in London may contribute to the high observed electricity use.
- A survey was conducted to gather more detailed information on the energy use of selected City businesses. The respondents identified key energy uses to include heating and lighting, air conditioning, building maintenance, data centre management and refrigeration.

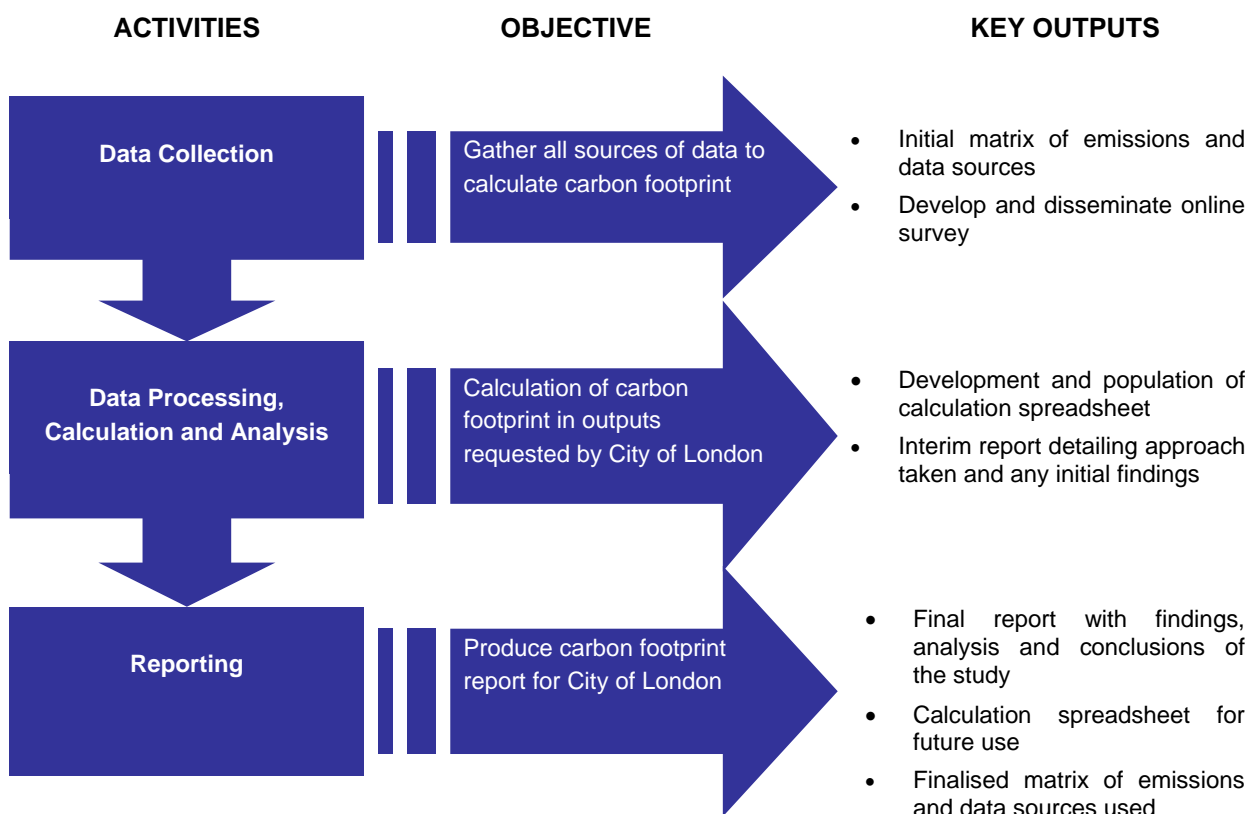
There are a number of expanded carbon footprinting models that could be considered in the future including the manufacture and transportation of goods and consumables used in the City, emissions associated with waste disposal and treatment, and emissions from public transport and through traffic.

Appendix A - Data Collection and Calculation Methodology

URS Methodology

The key objective of this survey was to generate a carbon footprint for the Square Mile. The diagram below illustrates the key steps and associated outputs in this study. The following sections describe the data sources used and the methodology applied to calculate the final footprint and are presented in the following sections:

- Energy use including electricity, gas and petroleum products;
- Heat provided by the City’s combined heat, power and cooling plant;
- Water consumption and energy used to treat the water supply;
- Floor space and population; and
- Carbon emissions factors and conversions.



Energy Use

Data on energy use (electricity, gas and petroleum products) for the City was collected from the UK Department for Business, Enterprise & Regulatory Reform's (BERR) Regional Energy Statistics. Data on energy consumption across the UK has been collected by BERR since 2003. The data is obtained from energy suppliers and distributors, via data aggregators and Gemserv (UK energy market consultants). Consumption data for electricity and gas is collected by similar methods through specialists for the two utilities. Electricity consumption data is generated by data aggregators, acting as agents for the energy suppliers, who collate/aggregate electricity consumption levels for each customer meter or electricity MPAN (meter point administration number). From Gemserv, BERR receive a meter postcode address file, which provides the geographical location of each MPAN, including the full address and postcode.

Gas consumption is collated by Xoserve for each gas MPRN (meter point reference number) from the four major gas distributors in Great Britain (National Grid, Scotia, Wales and West Utilities and Northern Gas Networks). Mapping of MPRNs to the Local Authority areas occurs using the National Statistics Post Code Directory (NSPD).

The Regional Energy Statistics are collated and published by BERR annually¹⁶. The Statistics are categorised by Local Authorities, according to the NSPD. The NSPD reflects current and terminated UK postcodes and relates postcodes to administrative and electoral areas using information supplied on a monthly basis by Royal Mail.

Before using the data attributed in the BERR data to the City we first checked that the postcodes allocated to the City of London aligned with those provided by the Corporation. Using accurate postcode data (postcode poly-gons) from the City of London Surveyors Department, URS mapped the postcodes contained within the City's operational boundary with the City's postcodes as described in the NSPD. Removing all terminated postcodes, a discrepancy of 1.5% of postcodes was found – 32 postcodes that are recognised as within the City of London by the Corporation but are not by the NSPD. As this is a small variation and the inclusion of these postcodes is likely not to make a significant impact on the final carbon footprint for the City, the City's boundaries as defined in the NSPD are accepted.

Using the assumption that the BERR data correctly aligns with the City of London's boundaries, electricity and gas consumption data attributed to the City in the Regional Energy Statistics was used for this footprint exercise. Also included is the use of petroleum (used for non-transport purposes) that is described in the Regional Energy Statistics. Petroleum data is compiled as part of the National Atmospheric Emissions Inventory (NAEI). The NAEI uses a combination of site source (estimates of fuel use) and area source (employment based) data at a 1km by 1km level to model estimates for a number of different sources and fuels.

¹⁶ The Regional Energy Statistics are published as NUTS4 (Nomenclature of Units for Territorial Statistics) and refers to the 354 individual London boroughs/metropolitan districts/unitary authorities/local authority districts in England, the 22 individual unitary authorities in Wales, the 41 individual or groups of whole/part unitary authorities and/or local enterprise company areas in Scotland, and the 26 individual district unitary authorities in Northern Ireland. They are available from BERR here:

<http://www.berr.gov.uk/whatwedo/energy/statistics/regional/index.html>

The City of London's non-gas, non-electricity and non-road transport energy consumption as calculated for the Regional Energy Statistics is limited to petroleum use by industrial, domestic and agriculture.

However, the fuel category 'Petroleum' includes a range of different fuel sources with varying CO₂ conversion factors, shown below.

Fuel Name	Fuel Category	Emissions factor kg CO ₂ / kWh
Aviation turbine fuel	Petroleum	0.258
Burning oil	Petroleum	0.258
Flare gas	Petroleum	No Defra emission factor available
Fuel oil	Petroleum	0.282
Gas oil	Petroleum	0.265
LPG	Petroleum	0.225
Lubricants	Petroleum	0.263
Naphtha	Petroleum	0.250
OPG	Petroleum	0.217
Orimulsion	Petroleum	No Defra emission factor available
Petrol	Petroleum	0.252
Petroleum coke	Petroleum	0.361

After discussions with the City of London Corporation staff on the typical petroleum products used for energy within the City, it was agreed this petroleum use could be a selection of burning oil, gas oil or fuel oil. In the absence of more data, we have chosen to assumed all petroleum fuel is fuel oil since this is the worst cast scenario emission factor (0.282 kgCO₂ / kWh).

During 2008 BERR published its most recent Regional Energy Statistics on 2006 data. This data has been used for the footprint calculation in the absence of more up-to-date energy consumption data.

City of London Combined Heat and Power

A large scale Combined Heat and Power (CHP) scheme has been in operation in the City of London since 1993. The system is owned by an ESCO, Citigen (London) Ltd and is a 'tri-generation' system generating hot water for heating, chilled water for air conditioning and electricity. The CHP engines are fuelled 95% by natural gas and 5% from diesel oil and produce in total about 30 MW of electricity and 25 MW of heat. All electricity (about 28 MW after station loads) goes to the local distribution grid, no customers take direct supplies. Hot and chilled water are distributed to customer properties by a district energy pipework system. There are 14 properties supplied by the CHP – 10 are Corporation owned and 4 are private. There is only one domestic load on the system - a Peabody sheltered housing unit, which is outside of the City's boundaries. The load of this is about 150 kW out of a total district heat load of around 15 MW at peak winter conditions, so very small indeed.

As all of the electricity (power) generated by the plant goes directly into the grid, it can be assumed for the purposes of this footprint that we only need to consider the carbon burden associated with the heat and cooling elements. Some research was conducted to attempt to quantify the emissions from cooling, however, with time constraints there was insufficient information obtained to achieve this. Future work may be able channel further research into this area. The only data on heat consumption

was available from the Corporation's own annual usage, equal to 21,000 MWh. Using information from the CHP official at the City of London, it was agreed that an additional 15% would be added to this heat consumption to account for the private properties that use this heat. Therefore, the total amount of heat supplied annually from the CHP plant is 24,150 MWh. A similar step was carried out for chilled water, however, an additional 20% was added to the Corporation's chilled water consumption as agreed with the City's official. As such, total chilled water consumption from the CHP plant was 61,038 MWh.

In addition to the two CHP engines, there are natural gas boilers that provide the CHP outputs when the engines do not. It is estimated in 2006 that 20% of the CHP heat was provided by the engines and 80% provided by the boilers. Therefore annual CHP heat provided was estimated as 4,830 MWh and heat from the boilers was 19,320 MWh. The energy from the boilers was added to the total gas consumption within the calculation spreadsheet, while the energy from the CHP engines was calculated using the Defra equation for calculating CHP heat emissions.

At the time of writing, Citigen and the City are developing carbon factors for heat and cooling supplies.

Clean Water Consumption

Annual City of London water consumption was provided by Thames Water. Thames Water supply 60 megalitres (Ml) of water a day to the City, 21,900 Ml of water annually. It was not possible to get a domestic / non-domestic split for water consumption from Thames. To do this split we used the Thames Water specific average consumption for domestic (l/day/head) that is given in the Water Services Regulation Authority (Ofwat)'s Security of Supply 2006-07 Report¹⁷. The average Thames Water daily consumption per person is 169.5 litres. This is averaged for both metered and unmetered supplies. Using this figure and the residential population of the City (7,800), we estimated domestic usage to be 482.6 litres per annum. The reminding supply (21,417 Ml) was attributed to the commercial sector.

Questionnaire

To gain additional information on energy practices of a selection of businesses in the City, URS conducted an online survey with members of the Clean City Awards. 1,400 members were invited to complete the survey. The survey asked both quantitative and qualitative questions such as annual electricity and gas consumption, and whether the company currently has any policies or programmes in place to reduce their impact on climate change. A copy of the survey is available in Appendix B of this report.

The responses to the survey were analysed with particular focus on sector responses to allow a more valuable comparison.

¹⁷ Water Services Regulation Authority (Ofwat)'s Security of Supply 2006-07 Report is available at:

http://www.ofwat.gov.uk/aptrix/ofwat/publish.nsf/Content/SecuritySupply_06-07

Floorspace & Population

Commercial Floorspace

Data on commercial floorspace was collected from the Neighbourhood Statistics¹⁸ published by the Office of National Statistics. For this exercise, we used the most up-to-date commercial floorspace figures that were revaluated in 2005. Data on floorspace is collected from the Valuation Office Agency (VOA) and are processed by Communities and Local Government. This dataset provides information on five different types of commercial and industrial premises (known as hereditaments) in England and Wales. These are broadly known as 'bulk classes' and include the following premises:

- Retail premises;
- Offices (disaggregated into commercial, and 'other' office types);
- Factories;
- Warehouses; and
- Other bulk premises (see below).

For each bulk class the number of hereditaments, total floorspace, total rateable value, and rateable value per m² are provided.

The VOA assesses the 1.8 million non-domestic properties in England and Wales that are liable for business rates and collects information on these premises, including the floorspace and rateable value. For many of the more common types of commercial premises, the VOA measures floor area as part of the detailed internal surveys of buildings that it undertakes to assess rateable values. These surveys are based both on drawings and site visits, as well as information about other characteristics that affect property values.

The bulk classes are retail premises, offices, factories, warehouses and 'other bulk premises'. The 400,000 hereditaments across the UK not in any one of the five bulk classes are collectively known as the 'non-bulks'. The non-bulks include any property that does not fit into one of the five bulk classes above, such as public houses; advertising rights; and car parks. Statistics for non-bulk properties are not presented on the Neighbourhood Statistics website as most of the descriptive statistics are not available for these types of properties. This is believed to be very minor for City of London and as such, has been excluded from this exercise.

Communities and Local Government uses the Matchcode address matching product (Matchcode uses the Royal Mail's Postcode Address File or PAF) to match individual hereditaments to Census Output Areas (OA).

¹⁸ Available at: <http://www.neighbourhood.statistics.gov.uk/dissemination/>

Residential and Worker Population

Data on residential population and total job numbers for 2006 was sourced from the Official Labour Market Statistics published by the Office of National Statistics¹⁹.

Emission Factors and Methodology

To calculate the carbon dioxide (CO₂) emissions resulting from the Square Mile's energy and water consumption, activity data (e.g. quantity of electricity used) is multiplied by the relevant emission factors (e.g. CO₂ emissions per unit of fuel used). URS used emission factors from the Department of Environment, Food and Rural Affairs (Defra)²⁰ and Thames Water listed in Table A1 below.

Table A1 Electricity, Fuel and Water CO₂ Emission Factors

Fuel Type	Units	Emission Factor (kgCO ₂ per unit)
Electricity - grid	kWh	0.53702
Electricity - green tariff 'renewable'	kWh	0.53702
Electricity - onsite renewable	kWh	0.000
Natural Gas	kWh	0.206
City of London CHP	kWh	0.188
Fuel Oil	kWh	0.282
Thames Water consumption	litre	0.291

¹⁹ Office of National Statistics Official Labour Market Statistics are available at: <https://www.nomisweb.co.uk/>

²⁰ Defra, Guidelines to Defra's GHG conversion factors for company reporting (updated June 2007), <http://www.defra.gov.uk/environment/business/envrp/pdf/conversion-factors.pdf>

Appendix B - Survey Questionnaire

City of London Carbon Footprint Questionnaire

The following questions apply only to those operations / buildings of your company that fall within the City of London Square Mile.

1. Please provide details of your company:

- Your Name:
- Your Company:
- Organisation's Postcode:

2. What is your industry/sector?

Drop down list:

Banking

Insurance

Legal

Accounting

Other Financial Services (Credit Granting, Security Broking, Fund Management, etc.)

Printing and Publishing

Other Business Services

Manufacturing & Wholesale

Construction

Retail

Transport

Utilities

Government and Central Office

Other Public Sector

Hospitals and Medical Services

Hotels & Restaurants

Tourism-related

Education

Other Industries

3. What is your company's floor space in m²?

4. What is your company's number of employees?

5. What is your company's annual electricity consumption (using meter readings or electricity invoices) in kWh?

6. What is your company's annual gas consumption (using meter readings or gas invoices) in kWh?

7. What is your company's annual water consumption (using meter readings or water invoices where possible) in m³?

8. Besides electricity and gas, what other fuels and sources of energy does your company use (excluding transport)? Please indicate the litre / kWh / gallon / tonne amount and units used annually.

- On-site renewables (e.g. micro generation, wind turbines, solar panels)
- Green tariff energy
- Fuel oil

- Diesel
- Gas oil
- Imported heat / steam
- Other – please specify

9. Please estimate the proportion of energy used within the different activities in your company:

Drop down menu of different range of % (i.e. 0, 1-10, 10-25, 25-50, 50-75, 75-99, 100)

- | | |
|--|-------------------|
| • Data centre management | <i>Range of %</i> |
| • Heating, lighting, etc. | <i>Range of %</i> |
| • Building maintenance | <i>Range of %</i> |
| • Air-conditioning | <i>Range of %</i> |
| • Tills / service counters | <i>Range of %</i> |
| • Refrigeration | <i>Range of %</i> |
| • Video- and tele-conferencing | <i>Range of %</i> |
| • Other equipment (copiers, printers, etc.) | <i>Range of %</i> |
| • Catering | <i>Range of %</i> |
| • Other – if you have any different types of activities please list them here. | <i>Range of %</i> |

10. Does your company have any policies/programmes in place or planned to reduce carbon emissions

