Max Fordham Offices UKGBC Net Zero Carbon Buildings Report

Covering the period June 2018 to June 2019

14.02.2020

Revision F

MAX FORDHAM

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REVISION HISTORY

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Typos and formatting corrected for web publishing. Clarification on the REEB benchmarks added.
No changes to the auditable data.

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Executive summary added.
No changes to the auditable data.

Revision D : 14.11.19
Version sent to Etude for 3rd Party Audit

MAX FORDHAM LLP TEAM CONTRIBUTORS

Engineer (Initials)	Role
HPo	Lead
HPe	Contributor
BW	Contributor

CONTENTS

MAX FORDHAM

EXECUTIVE SUMMARY

Introduction

This report (along with the associated documents listed in the appendices) sets out the case for our portfolio of five offices to be deemed net zero carbon in accordance with the UKGBC Net Zero Carbon Building Framework.

The scope considered is for operational carbon emissions only, for the period 26th June 2018 to 26th June 2019. Embodied (construction) emissions are not included in this analysis. Emissions incurred from other business-related activities (such as transport and the goods we buy) are also not included within this analysis.

Within this report we present the building, energy consumption, carbon emissions and carbon offsetting data required to demonstrate a net zero carbon emissions balance. We also include discussion relating to if and how our offices meet the qualitative characteristics of net zero carbon buildings described by the UKGBC Framework. That is, that they are "highly energy efficient and powered by renewable energy".

Furthermore, we describe our approach to carbon offsetting and our proposed strategy for continual improvement (in reducing carbon emissions from our offices), which goes beyond the requirements of the UKGBC Net Zero Carbon Building Framework Definition.

Our annual energy use and carbon emissions

Estimates have been made of the energy consumption and associated carbon emissions from each of our 5 offices for the period June 2018 to June 2019. The majority of the estimates were derived from readings from meters dedicated to the areas we occupy. A small fraction was derived from estimates. Overall, the quality and accuracy of the (energy meter) data, and therefore the energy consumption estimates, is thought to be high.

The results can be seen in the adjacent charts. In general we found that our Edinburgh and Cambridge offices have very good energy efficiency; both consume around 65% less energy than the DEC D benchmark, which would be representative of a typical office of the existing UK building stock. Our Manchester and London offices are not quite as good, consuming around 30% less energy than the DEC D benchmark. Our Bristol office is not energy efficient, consuming around 20% more energy than the DEC D benchmark, however Bristol's contribution is a very small fraction of our total portfolio energy consumption.

Overall, our five-office portfolio consumes around 40% less energy than the DEC D (typical UK office building) benchmark.

Our London office has a roof mounted PV array. The data shows that this generates an amount of electricity equivalent to 1% of our total five office portfolio energy consumption.

Using up-to-date carbon factors (200g CO_2/kWh for gas, 280g CO_2/kWh for electricity), the annual carbon emissions for our five-office portfolio have been calculated at 73tCO_2. This is around 35% less than an (approximate) DEC D benchmark.

There are some distinct challenges to us improving our buildings' energy efficiency. The main challenge is that 75% of our portfolio by area (London, Manchester, Bristol) is contained within historic (pre 1900), listed buildings. The second challenge is that in all of our buildings we are tenants, not owners. Both factors make it difficult to carry out building works in order to improve energy efficiency and on-site renewable electricity generation.

However, we acknowledge that more can and should be done (to reduce building energy demand) on a sustainable route to net zero carbon, the questions is, at what cost? These issues are addressed in the following paragraphs.

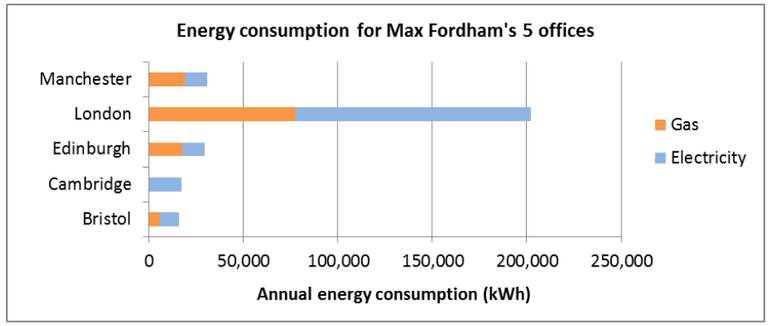
Carbon offsets, pricing and our annual carbon fund

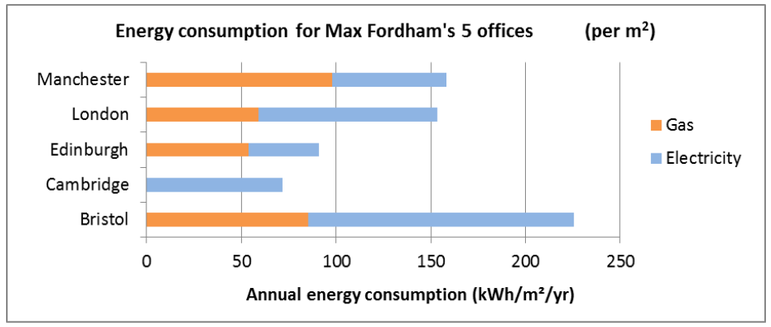
The UKGBC Framework does not require or recommend a carbon price. It is possible to purchase accredited carbon offsetting from a variety of providers for as little as 2 £/tCO_2e. If we did this our annual carbon offset cost would be £146, less than £1 per staff member per year. We're not convinced that this is a reliable path to net zero carbon. If the true cost of reducing carbon emissions was this cheap then wouldn't the problem be solved by now? Furthermore, such a low price means there is no incentive for building operators to invest in energy efficiency improvements which are a reliable (and UKGBC preferred) path to net zero carbon. Our research has found that various other sources (such as the Centre for Climate Change Economics and Policy) think that the price of carbon needed to instigate improvements in the UK Building Stock is in the region of 30 to 200 £/tCO_2.

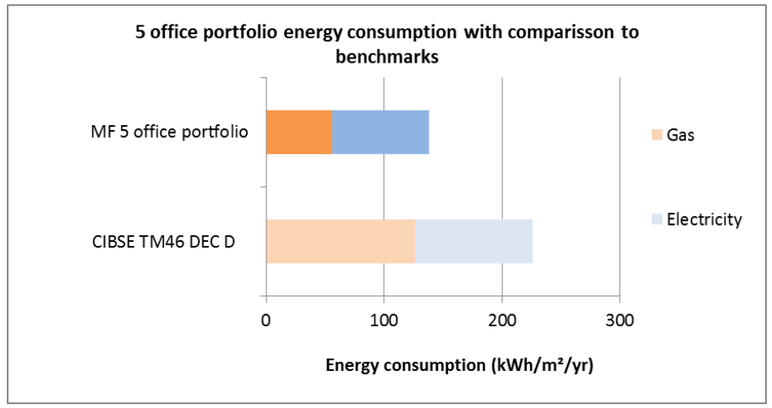
Considering the factors described in the previous paragraph, we have decided to voluntarily pay 100 £/tCO_2 to offset our emissions so that our annual carbon fund is £7,300.

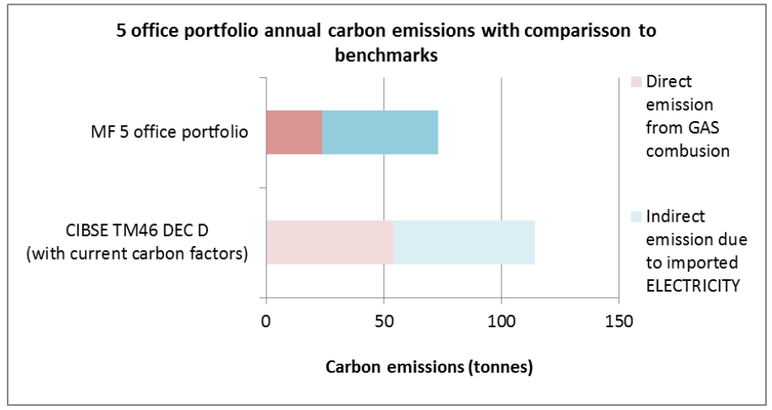
We have chosen to fund UK woodland creation to mitigate our emissions. The scheme we have procured is Woodland Creation for Carbon Capture by Forest Carbon Ltd. The location is at Arnott's Loan, East Lothian, UK. The scheme is accredited under the Woodland Carbon Code.

The sale price from Forest Carbon is 7.50 £/tCO_2 compared to our annual fund of 100 £/tCO_2. We have therefore purchased 13 times more offsetting than required, £7,300 worth of woodland creation for carbon capture. This equates to around 2.5Ha of woodland and is reported to sequester 974 tCO_2e over its 60-year lifetime.









Continual improvement

In conjunction with voluntarily paying a 100£/tCO_2e carbon offset price, we plan to periodically (every 3 years or so) asses our buildings for potential design modifications that would results in energy demand and carbon emissions reductions. If we can find design options that are predicted to result in emissions reductions at a cost of less than 100£/tCO_2e we will consider investing in these in preference to purchasing offsetting. In addition to this, each year we will review and potentially adjust the 100£/tCO_2e offset price.

A back-of-envelope analysis has been carried out to look at the option of incorporating air source heat pump heating into our London office. Initial analysis based on a 20-year analysis period with an average grid carbon factor of 100gCO_2/kWh indicates that costs could be in the region of 200£/tCO_2 for a 100% ASHP system and 100£/tCO_2 for a hybrid ASHP + gas boiler system. However, neither of these figures include the costs that might be required for a) increasing the size of our electrical supply or b) renting additional space to site the plant.

Transparency, disclosure and UKGBC Framework verification

This report and associated documents listed in the appendices are in the process of being audited by a 3rd party, Etude https://www.etude.co.uk to verify the claims made relating to our net zero carbon balance.

The methods used to calculate our buildings' energy consumption, carbon emissions are described in this report. Also included are references to the original sources of meter data, copies of which have been provided to the 3rd party Verifier. Details of the carbon offsetting schemes we have purchased are also included.

Following verification this report is due to be published on our website, on which we have a dedicated section (called MF: Net Zero) related to net zero carbon buildings. The web address is https://www.maxfordham.com/mf-net-zero/

The UKGBC Framework defines a net zero carbon building as being "highly energy efficient and powered by renewable energy". However it does not put any figures to these requirements. The judgement of whether our five-office portfolio meets this definition is therefore subjective. Given the information presented in this report it is up to the 3rd party verifier to decide.

The energy consumption and carbon emissions from our five-office portfolio is around 35% less than a DEC D typical building benchmark. 1% of our annual consumption is met by on-site renewable electricity generation.

Given the challenges of operating as tenants within in historic, listed buildings, we propose that these standards of energy efficiency and renewable energy supply for our office portfolio are reasonable and, when combined with our strategies for carbon offset pricing and continual improvement, make us worthy of being considered in accordance with the UKGBC Net Zero Carbon Building Framework Definition.

1.0 INTRODUCTION

1.1 Purpose and content of this report

This report (along with associated documents listed in the appendices) provides the analysis, results, methods and evidence required to demonstrate that our portfolio of 5 offices can be deemed net zero carbon in accordance with the UKGBC Net Zero Carbon Building Framework (1).

The scope considered is for operational carbon emissions only, for the period 26th June 2018 to 26th June 2019. Embodied (construction) emissions are not included in this analysis.

The report presents the building, energy and carbon emissions data specified in Appendix B of the UKGBC Framework Definition. In addition to this, we also include discussion relating to if and how our offices meet the qualitative characteristics of net zero carbon buildings described by the UKGBC Framework Definition (highly energy efficient and powered by renewable energy). The approach used (comparison to benchmarks) could be considered by the UKGBC for general adoption.

We discuss some of the challenges in meeting the UKGBC Framework Definition, in particular for tenants and for historic, listed buildings.

Furthermore, through the process of producing this report we have encountered some issues not addressed by the UKGBC Framework, for example, what do to when meter readings cannot be obtained. We have developed a method of how this issue can be addressed, a description of which is included. This method could be considered for general adoption by the UKGBC for inclusion in the next revision of their Framework Definition.

1.2 The UKGBC Net Zero Carbon Building Framework

The UKGBC Net Zero Carbon Building Framework provides the following definition of a net zero carbon building for operational energy:

"When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset"

And

"Net zero carbon for operational energy is achieved when a building's total annual net CO_2e emissions equal zero, that is, all carbon impacts are balanced by all carbon credits [provided by offsetting]"

Other key features of the UKGBC Framework (or operational energy related emissions) are the following:

- **The polluter pays**. That is, the individual or organisation who uses the energy (which incurs carbon emissions) should be the same individual or implements measures to mitigate those emissions.
- **Improve measurement and transparency**. As far as possible, building emissions should be based on measurement (e.g. meter readings) rather than estimates. Public disclosure of emissions should also provide transparency about how this information has been collected and the approach taken by a building to achieve net zero carbon.
- **Act today and improve over time**. The current UKGBC Framework does not include minimum standards of energy efficiency, but it is expected to do so in the future.
- **Reductions in energy demand and consumption should the first priority.** For example, by enhancing insulation so that heat demand and gas consumption are reduced.
- **Increasing renewable energy supply is the second priority.** Incorporating on-site systems (such as a roof mounted PV array) are considered preferable to off-site systems.
- **The last step is carbon offsetting.** Any remaining carbon should be offset using a recognised offsetting framework.
- **Verify and publish.** An auditable package of information is to be produced that reports the building characteristics, building energy use, carbon emissions, and methods used to calculate them along with details of any offsetting used. This information should be the subject of third-party auditing to avoid self-made claims.

1.3 Structure of this report

Section 2 of this report describes methods we have used to demonstrate our net zero carbon balance in accordance with the UKGBC Net Zero Carbon Building Framework.

Section 3 presents the data and results for our portfolio of 5 offices. Also included is a discussion on how our 5 office portfolio meets the UKGBC Framework for being highly energy efficient and powered from renewable energy sources.

Section 4, Appendix A presents the details for each one of our offices. The details of each office are described in accordance with Appendix B of the UKGBC Framework Definition.

The remaining sections of this report provide further information and references.

1.4 3rd Party Verifier

This report and associated documents listed in the appendices have been audited by Etude https://www.etude.co.uk to verify the claims made relating to our net zero carbon balance. Etude are a London based consultancy of sustainability engineers with experience in energy policy, low energy building design, environmental assessment, and construction inspection. Their team includes Chartered Engineers, environmental scientists, renewable energy specialists, doctorates, Architects, Passivhaus Designers and builders.

1.5 Transparency and disclosure

The methods used to calculate our buildings' energy consumption, carbon emissions are described in this report. Also included are references to the original sources of meter data, copies of which have been provided to the 3rd party Verifier. Details of the carbon offsetting schemes we have purchased are also included.

Following verification this report is due to be published on our website, on which we have a dedicated section (called MF Net Zero) related to net zero carbon buildings. The web address is https://www.maxfordham.com/mf-net-zero/

2.0 METHODS

This section describes the methods used for measuring and calculating each of our buildings' energy consumption and carbon emissions. Also included are details of how we have used building energy benchmarks to demonstrate the efficiency of the buildings we occupy. Also included are details of how we determine our carbon offset contribution to net zero along with a strategy for continual improvement of energy efficiency.

2.1 Floor Areas

Floor area definitions

- Gross internal area (**GIA**): total building area measured inside external walls.
- Treated floor area (**TFA**): gross areas less plant rooms and other areas (e.g. stores, covered car parking, and roof spaces) not directly heated.
- Nett lettable area (**NLA**): GIA less common areas and ancillary spaces. Agent's lettable area. Also known as **NIA** (net internal area).

Floor area for energy and carbon metrics
Where drawings are available we have used these to estimate the building internal floor areas. Where drawings are not available we have used data from the UK Government Valuation Office Agency Business Rates (2).

We have used the treated floor area (TFA) as the basis for the energy and carbon emissions metrics. This is the method recommended by CIBSE in the report ENERGY CONSUMPTION GUIDE 19: Energy use in offices (also known as ECON19) (3), which states "Treated floor area (TFA) is used as the denominator for energy indices … because it is the area best related to energy consumption."

Floor area conversion factors
ECON 19 provides the following conversion factors for the different floor area types:

Type	Treated % of gross	Nett % of treated	Nett % of gross
1 	95	80	76
2 	95	80	76
3 	90	80	72
4 	85	80	68

Table B4 Area conversion factors

The definitions of the different office types are as follows:

- Type 1 Naturally ventilated cellular
- Type 2 Naturally ventilated open-plan
- Type 3 Air-conditioned, standard
- Type 4 Air-conditioned, prestige

All of our 5 offices are reasonably described by as Type 2, Naturally ventilated open-plan.

Where relevant we have used these conversion factors to produce estimates of TFA for our offices. It is assumed that the floor area given by the Valuation Office Agency Business Rates are the NLA. A list of the estimated building floor areas with links to the relevant Valuation Office data sources is included in Appendix B.

2.2 Energy consumption estimates

Wherever possible we have based our energy consumption estimates on meter readings. In some cases our tenancies have dedicated meters, in which case these have been used. In some cases, where this is not available we have used meter readings covering the whole building to estimate the whole building energy consumption and then taken a fraction of this in proportion to our floor area fraction. In one case we have used heat (rather than gas) meter readings and estimated the gas consumption using an assumption for the heating system efficiency.

Where metered data cannot be obtained
In one case (Bristol electricity) no metered data could be obtained. The UKGBC Framework does not provide any guidance on what to do in this situation so we have developed a method we think is reasonable. In the event of meter readings not being available we propose to use worst-in-class benchmark data along with a penalty factor to estimate the building consumption. For example, for Bristol we have used the highest electricity consumption value from all of the benchmarks reviewed (see Section 2.4) for the building type in question, namely a naturally ventilated (non-air conditioned) office. This is represented by the REEB Non Air Conditioned Typical Practice electricity benchmark (108 kWh/m2/yr). In addition to this we have modified the benchmark by applying a penalty factor (of 1.3) to penalise the fact that the energy use is not based on meter data (which is the preference of the UKGBC Framework). We propose that so long as the total energy consumption estimated by this (benchmark) method is a small fraction of the total being assessed (for example 20%) then the approach is reasonable. This approach could be considered for general adoption into the Net Zero Carbon Building Framework by the UKGBC.

2.3 Fuel and electricity carbon factors

For both gas and electricity we have used the figures given in in the "UK Government GHG Conversion Factors for Company Reporting 2018" report (4). These are the following:

Type	Carbon factor ($kgCO_2e$ / kWh)
Natural gas	0.20
Mains electricity consumed or displaced by on-site generation	0.28

2.4 Comparisons to other buildings

Throughout this report we make comparisons of our office energy consumption estimates to benchmark data. A collection of different benchmarks are illustrated in the chart o the following page.

ECON 19 (3) (which is the same data as given in the CIBSE F Guide) is derived from energy metered data taken in the mid-90s. The sample size is unknown.

REEB stands for the Real Estate Environmental Benchmarks (5) which is a publicly available benchmark of operational environmental performance for commercial property in the UK. REEBs are based on annual utility consumption data on a 3-year rolling average and are updated each year. The data used is from 2017 and the sample size for offices was 391 air-conditioned and 38 non air-conditioned.

REEB data metrics are based on net lettable area (NLA). We have used the ECON 19 floor area conversion factors to covert the metrics to be based on TFA.

The CIBSE TM46 (6) gives the statutory building energy benchmarks prepared to complement the production of Display Energy Certificates for use in England, Wales and Northern Ireland. The values were derived from ECON19. To a reasonable approximation the TM46 benchmark represents are DEC rating of D and are representative of a typical building within the existing UK building stock.

Throughout this report, where we make comparisons to the DEC D standard, these are only approximate. This is because the actual method to calculate a DEC rating is different to the approximations we have used. The differences include aspects such as different carbon factors, different floor areas and weather and occupancy correction factors.

An aspect we have presented is an approximate DEC asset rating. Again this is only approximate for the reasons stated above, and because we our calculation is based on energy consumption, rather than carbon emissions.

TM46 data metrics are based on gross internal area (GIA). We have used the ECON 19 floor area conversion factors to covert the metrics to be based on TFA.

For the purpose of this study we compare our offices to the REEB Non-air conditioned (naturally ventilated) best practice and typical benchmarks and also the CIBSE TM46 (DEC D) benchmark. Drastically lower energy consumption and carbon emissions than those of the DEC D benchmark would indicate a highly efficiency building of its type.

Clarification on the REEB Benchmarks
The REEB benchmarks presented and used as comparators in this report are the total of the REEB published data for their definitions of fuels (gas) and electricity. This quantity is different to the REEB total energy (electrical equivalent) benchmark which makes use of a scaling factor for gas, which is not used in this report.

2.5 Carbon offsets, pricing and our annual carbon fund

The UKGBC Framework does not stipulate a required or recommend carbon price, but we think it probably should. A multitude of carbon offset options are available to buy online at a range of prices. For example, the following are available:

Offsetting / carbon credit scheme	Approximate sale price available online(£/tCO_2e)
Buying carbon credits from a **windfarm in India** that claims to displace the use of carbon intensive grid electricity (VCS[1]).	2
Buy carbon credits from an **Amazon forest conservation** project in Brazil that claims to reduce atmospheric carbon emissions resulting from deforestation and degradation (VCS).	3
Buying carbon credits from an **improved cooking stoves project in Kenya** that claims to reduce the amount of wood fuel and associated emissions required to cook food	5
Buying carbon credits from a **borehole rehabilitation project in Uganda** that claims to reduce the amount of wood fuel and associated emissions required to boil water (GS[2]).	6
Buying carbon credits from a **UK woodland creation** project that claims to sequester (absorb) CO_2 from the atmosphere by photosynthesis of the woodland (WCC[3])	8

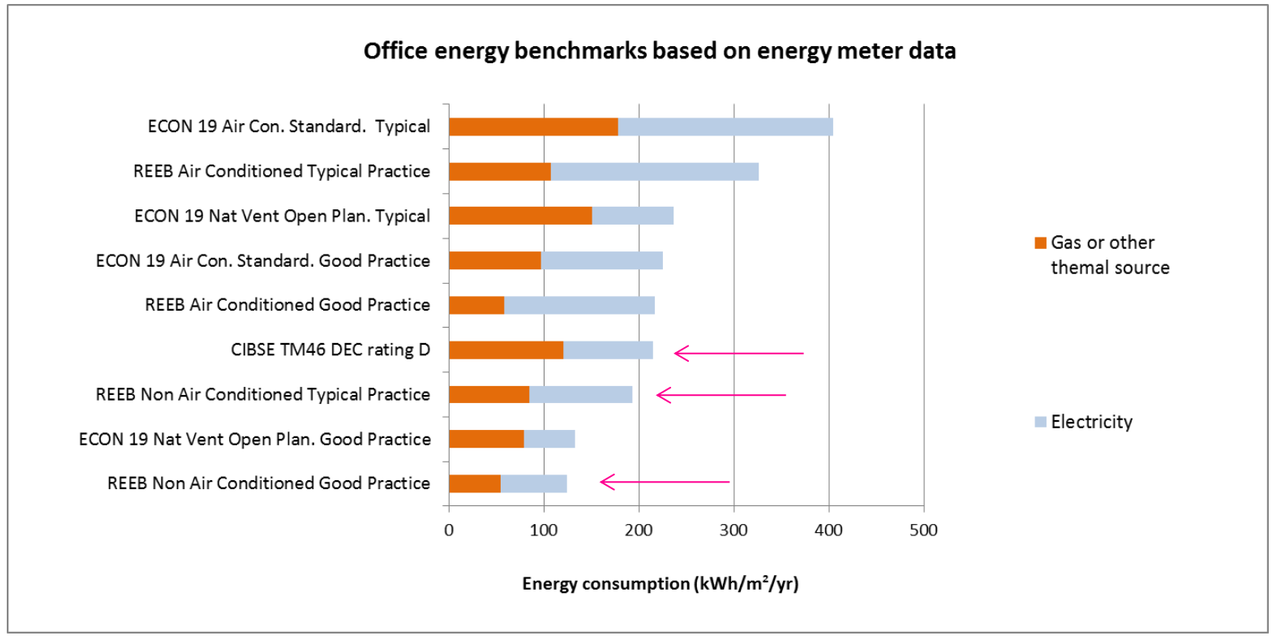
Conversely, various sources claim that much higher carbon prices are required in order to instigate change to the way that UK buildings are constructed and operated in order to reduce their carbon emissions. AECOM carried out a study that looked at the capital costs required to undertake a range of energy and emissions reducing interventions on existing buildings and infrastructure (7). The work resulted in a recommended carbon price range of 32 to 191 £/tCO_2e.

Similarly, The Centre for Climate Change Economics and Policy (CCCEP) undertook a study into carbon pricing (8). They conclude "The UK government needs to reform its approach to carbon pricing if its new commitment to net-zero emissions by 2050 is to be credible" and recommend a carbon price associated with emissions from buildings of 40 to 100 £/tCO_2e.

To us, relying on very cheap offsetting seems a high-risk strategy for reducing global greenhouse gas concentration and not in-line with the true costs of reducing energy demand and carbon emissions from UK buildings. In response to this we have decided (for the time being) to voluntarily pay 100 £/tCO_2e for the emissions resulting from the operation of the buildings we occupy. The way we will do this is to define an annual carbon offset fund (our annual emissions x 100£/tCO_2e.) and then purchase that value of carbon credits from an offset provider. This means that we are actually buying around 20 times more carbon offsetting than would be required by the UKGBC Net Zero Carbon Building Framework

2.6 Continual improvement

In conjunction with voluntarily paying a 100£/tCO_2e carbon offset price we plan to periodically (every 3 years or so) asses our buildings for potential design modifications that would results in energy demand and carbon emissions reductions. If we can find design options that are predicted to result in emissions reductions at a cost of less than 100£/tCO_2e then (if feasible) we will invest in these in preference to purchasing offsetting. In addition to this, each year we will review and potentially adjust the 100£/tCO_2e offset price.



Benchmark data from meter readings in actual buildings. Comparison to this data has been used to determine the energy (and carbon) efficiency of the building we occupy.

2.7 Potential improvements

Our energy demands and emissions are dominated by the contributions for our London office so this is the place where big winds could be made. An option of retrofitting air source heat pump heating to our London office has been considered. Initial analysis based on a 20-year analysis period indicates that costs could be in the region of 200£/tCO_2 for a 100% ASHP system and 100£/tCO_2 for a hybrid ASHP + gas boiler system. However, neither of these figures include the costs that might be required for a) increasing the size of our electrical supply or b) renting additional space to site the plant.

[1] Verified Carbon Standard, a carbon offsetting certification scheme
[2] Gold Standard, a carbon offsetting certification scheme
[3] Woodland Carbon Code, an assurance scheme for woodland carbon credits

3.0 DATA AND DISCUSSION ON MAX FORDHAM'S 5 OFFICE PORTFOLIO

Dates of achievement
June 2018 to June 2019

Verified by
See Section 1.4

Building location
Various, see details for each building in Section 4.

Building type
All 5 buildings are of planning class: B1(a): Office

Building description
Various, see details for each building in Section 4.

Energy efficiency features
Various, see details for each building in Section 4.

Renewable energy sources
Only our London office has on-site renewable electricity generation. It has a roof mounted solar PV array.

See details for each building in Section 4.

Energy scope
In all cases we are tenants occupying parts of multi-unit buildings. In general the scope of the energy and carbon emissions assessments are the areas of our tenancies. Areas outside of our tenancies are excluded.

See details for each building in Section 4.

Assessed floor area
In all cases the floor area used for the energy and carbon metrics is the treated floor area (TFA).The total assessed TFA is 2145m^2.

See details for each building in Section 4.

Percentage of total building area
In each office Max Fordham only occupy a part of the building floor area. The sum total floor area of all the buildings (including parts not leased by Max Fordham) is estimated to be 14,570m^2. The area of Max Fordham's tenancies, the area covered by this assessment is 15% of this. See Appendix B for further details.

See details for each building in Section 4.

Emission factors
See Section 2.3

Data sources
Copies of the sources of meter data (for example utility bills or reports from our landlords) are included in Appendix D

Further data sources used are referenced and listed in Appendix C

Metering
Various, see details for each building in Section 4.

Building energy use and carbon emissions estimates
The tables on the following pages present the energy consumption, generation and carbon emissions data for our 5 office portfolio. The energy figures are presented for each office and for the 5 office combined. The details of how these were arrived at for each office are presented in Section 4.

Results and discussion on the energy and carbon emissions estimates

a) **Quality of the energy consumption estimates**
Overall the quality is thought to be high, but with room for improvement. Most of our energy consumption estimates derive from reading meters dedicated to our tenancies. A small fraction of these readings are utility estimates. A smaller fraction of our estimates derive from taking area fraction estimates from whole-building consumption derived from whole building meter readings.

The total energy demand we have estimated using benchmarks, rather than using metered data is 9828 kWh. This is 3% of the estimated energy consumption of the total Max Fordham 5-Office portfolio demonstrating that the benchmark approach we have taken is reasonable as it represents a small fraction of the total energy consumption being assessed.

b) **Is our 5 office portfolio highly energy efficient and powered by renewable energy?**

The results of the energy consumption analysis, illustrated on the following page show that our Cambridge and Edinburgh offices consume 68% and 60% less energy than the TM46 DEC D TM46 (typical building) DEC D benchmark and are therefore can be reasonably described as highly energy efficient.

Our 5 office portfolio consumes 138kWh/m^2/yr. This is 39% less than the TM46 (typical building) DEC D benchmark and would probably rate our 5 office portfolio at a DEC C level. The energy consumption of our 5 office portfolio lies in between the REEB Typical and Best practice benchmarks.

This level of energy efficiency is reasonable, as it is significantly less than that of a typical building but might not be described as "highly energy efficient". However, there are 2 important factors that need to be considered. The first is that in all our offices, we are tenants, not building owners. It is therefore more difficult and in some cases, not possible for us to implement energy efficiency measures such as improving the building fabric or installing a more efficient plant. The second and most important factor is the fact that 75% of our building area (London, Manchester, Bristol) is contained within historic, listed buildings dating from the 1800s. These types of buildings are always going to be much harder to make highly energy efficient than a new build office (such as our Edinburgh office).

Taking these factors into consideration we believe that the energy efficiency of our 5 office portfolio is good, but with room for improvement.

In terms of renewable energy, only our London office has an on-site generator; a roof mounted PV array that meets 1% of our 5 office portfolio total energy consumption. Again, the challenges of being tenants not owners and occupying historic, listed buildings at inner city locations are challenging barriers to us increasing the amount of on-site renewable energy supply to our offices.

Overall, for our 5 office portfolio we have broadly implemented the design approach set out in the UKGBC Net Zero Carbon Building Framework. Specifically, we have invested significant sums of money in:

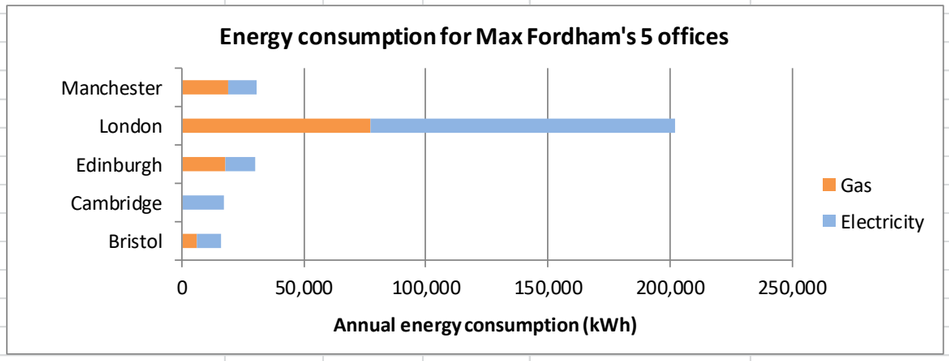
a) implementing energy efficiency measures to reduce energy demand and consumption. Examples include low energy refurbishments to our London and Cambridge offices.
b) increasing renewable energy supply by investing in a roof mounted PV array at our London office

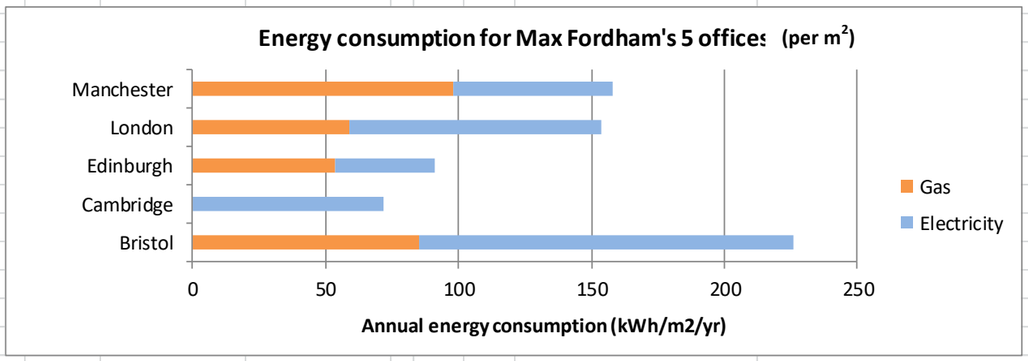
3.1 Energy consumption and carbon emissions for our 5 office portfolio

5 office portfolio: energy consumption for each office

												June 2018 to June 2019
		Annual energy consumption (kWh)							Estimates based on benchmarks rather than meter data?			
	Area, TFA (m2)	Gas	Electricity	Single office total	Total annual electricity generated by on-site renewables (kWh)	Energy consumption fraction of total	Renewable electrcity generation fraction of total	Gas	Elec.	Benchmark method contribution (kWh)	Benchmark method contribution of total portfolio energy consumption
Bristol	70	5,974	9,828	15,802	0	5%	0%		y	9828	3%
Cambridge	238	0	17,102	17,102	0	6%	0%			0	0%
Edinburgh	326	17,506	12,196	29,702	0	10%	0%			0	0%
London	1,317	77,521	124,815	202,336	3,705	68%	1%			0	0%
Manchester	194	19,024	11,652	30,677	0	10%	0%			0	0%
5 office porfolio overall	2,145	120,026	175,594	295,620	3,705		1%			9,828	3%

	Annual energy consumption (kWh/m2/yr)						
	Gas	Electricity	Single office total	Total annual electricity generated by on-site renewables (kWh/m2/yr)	% improvement compared to REEB Typical Practice	% improvement compared to TM46 DEC D	Approximate DEC Asset Rating
Bristol	85	140	226	0	-17%	0%	100
Cambridge	0	72	72	0	63%	68%	30
Edinburgh	54	37	91	0	53%	60%	40
London	59	95	154	3	20%	32%	70
Manchester	98	60	158	0	18%	30%	70
5 office porfolio overall	56	82	138	1.7	29%	39%	60



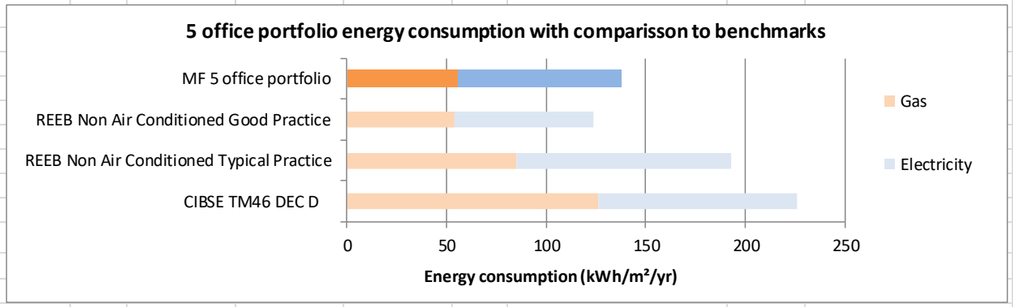


5 Office Portfolio: annual energy consumption and carbon emissions

5 office portfolio		
Building floor area (TFA)	2145	m²
Analysis period	from	26-Jun-18
	to	26-Jun-19

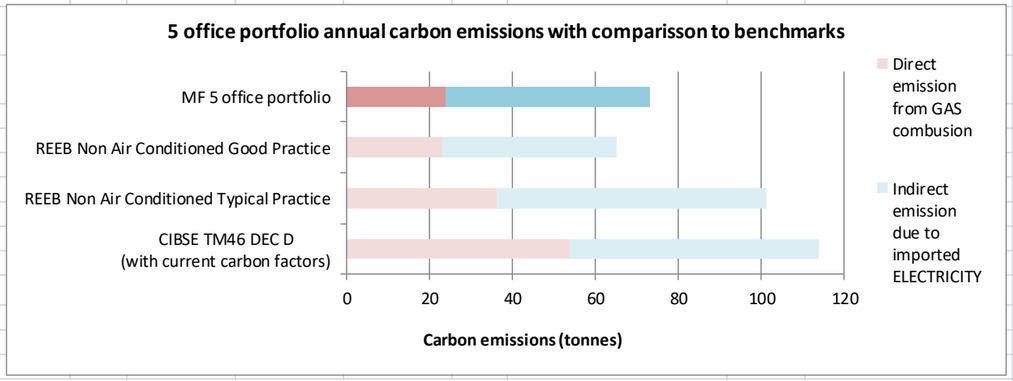
Energy

Indicator	kWh	kWh/m²
Total annual energy consumption	295,620	138
Total Annual electricity consumption	175,594	82
Total Annual gas consumption	120,026	56
Total annual electricity generated by on-site renewables	3,705	2



Carbon

Indicator	t CO_2	Kg CO_2/m^2
Total annual indirect CO2e emissions from imported electricity	49	23
Total Annual direct CO2e emissions from combustion of gas on-site	24	11
Total Annual indirect CO2e emissions from combustion of fuel (all other sources eg heat network)	0	0
Total annual displaced CO2e emissions from electricity generated by on-site renewable energy sources minus storage losses	1	0.5
Total annual CO2 emissions	73	34
Total annual displaced CO2e emissions from offsets	greater than 73	greater than 34
Total annual net CO2e emissions	0	



Offsets

Amount and type of offsets procured, including relevant framework used	See main report
Expected verification processes	See main report
Cost per tonne of CO2e:	See main report

Carbon factors		
Taken from	UK Government GHG Conversion Factors for Company Reporting 2018	
URL	https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018	
Type	**Carbon factor**	
Natural gas	0.2	kgCO2e / kWh
Mains electricity consumed or generated	0.28	kgCO2e / kWh

3.2 Carbon offsets for our 5 office portfolio

The results of energy and carbon emissions analysis carried out for our 5-office portfolio show annual carbon emissions of 73 tCO_2e/yr.

As described in Section 2.5 we have decided to voluntarily pay 100 £/tCO_2e for our emissions so that our annual carbon fund for this period is £7300.

Amount and type of offsets procured, including relevant framework used
When selecting an offsetting scheme, we considered pros, cons and perceived likelihood of success (actually reducing atmospheric CO_2 levels). We have chosen to purchase UK woodland creation. The main influencing factors for choosing this were a) growing biomass is a carbon sink. Carbon sinks are needed as part of a net zero future, b) because the project is in the UK, if we want to we can visit it to verify that it does indeed exist c) woodland creation brings other ecological benefits and d) we thought that investing all of our fund in one project would increase its likelihood of success.

The scheme we have procured is Woodland Creation for Carbon Capture by Forest Carbon Ltd. The location is Arnott's Loan, East Lothian, UK. A copy of the certificate can be seen in the adjacent image.

The reported amount of carbon capture (offset) is 974 tCO_2. The area of woodland is around 2.5Ha.

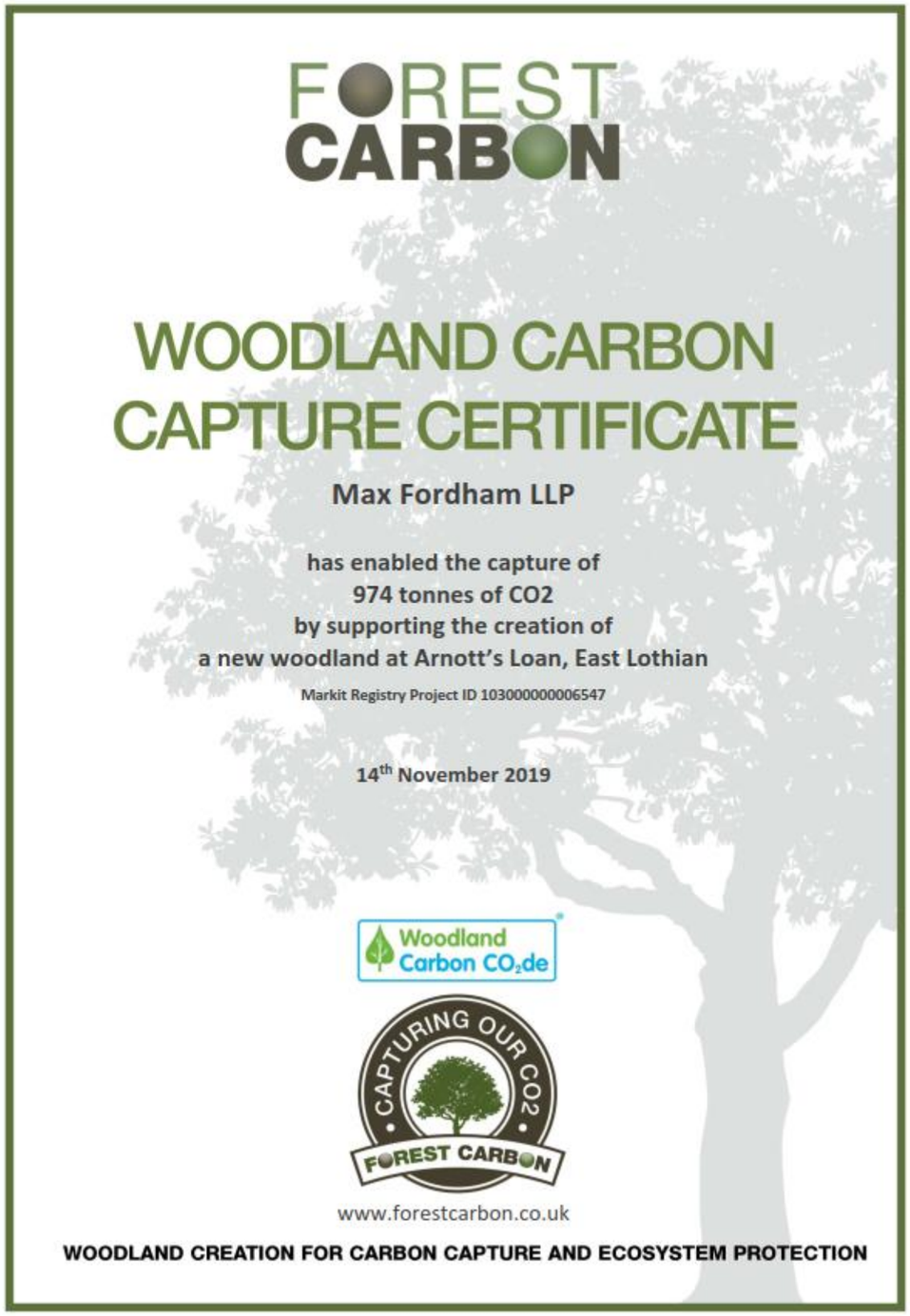
The woodland carbon sequestration calculations used by Forest Carbon and validation documents can be found at The Environmental Registry by IHS Markit. The link is the following:

https://mer.markit.com/br-reg/public/index.jsp?name=Max%20Fordham&entity=assignment&entity_domain=Markit,GoldStandard

Expected Verification Processes:
Woodland Carbon Code.

Cost Per Tonne of $C0_2e$
7.5 £/tCO_2e.

See Section 2.5 for further details.



4.0 APPENDIX A: DETAILS OF EACH OFFICE

4.1 London office (The Rotunda)

Dates of achievement
June 2018 to June 2019

Verified by
See Section 1.4

Building location
42-43 Gloucester Crescent, London, NW1 7PE.

Building type
Planning class: B1(a): Office

Building description
Our London office has been in The Rotunda for over 40 years. It is a 5 storey Grade II listed former piano factory in Camden Town. The approximate date of original construction is 1850. The building has been remodelled and refurbished many times since then but many original features remain.

An example floor plan can be seen on the next page. The majority of space is used for general office use for computer based tasks. In addition to the main office space, meeting rooms, kitchenette, WCs, showers and storage are also present. Lower ground floor includes and bike store and server room.

Descriptions of various aspects of the building including its energy consuming/generating systems are given in the following table.

Building aspect	Description
Structure	Load bearing masonry and steel.
Façade	Solid brick, mostly un-insulated. Listed external steel frame single glazed windows with modern internal secondary glazing.
Roof	Tiles on steel and timber frame. Moderate amount of insulation.
Heating	Gas boilers serving radiators.
Hot water	Heated by gas boilers. Some storage.
Vent and cooling	Main offices naturally ventilated. Mechanical extract vent for WCs. No air conditioning or similar cooling systems.
Lighting	Mixture of low energy fluorescent and LED fittings. Most areas with occupancy and daylight dimming controls.
Auxiliary (fans, pumps, controls)	Heating pumps, Fans for WCs. BMS controls for some aspects.
Equipment	Mostly for computers and IT systems. Some desk / floor fans in summer. Kitchenette equipment on each floor.
Other Energy Uses	Server room including IT equipment and cooling fans. Lift (but not within our tenancy).
Renewable Energy	Roof mounted PV array.

Energy efficiency features
The London office has very good daylight and makes use of natural ventilation rather than fans and air conditioning.

Even though we are only tenants, not building owners we have invested significant sums of money on energy efficiency improvements in our London office. Over the course of the last 20 years we have implemented the following:

- Added insulation to the roof to reduce heat loss
- Added internal secondary glazing to reduce heat loss through the windows
- Added a draught lobby to the main entrance to reduce infiltration heat loss
- Added openable roof vents to enhance natural ventilation so the building does not require mechanical cooling
- Upgraded internal blinds to enhance passive cooling
- Installed new boilers and heating controls
- Installed high efficiency fluorescent and LED lighting with automatic lighting controls
- Invested in energy efficient IT equipment
- Installed "kill switch" power controls that power down whole areas when not in use
- A team of Energy Champions who develop, implement and refine our energy management procedures

Renewable energy sources
We have a roof mounted PV array of approximately 30 m^2.

All of our electricity for our London office is purchased from Green Energy. Green Energy claim that their supply is 100% renewable, generated from a mix of solar, wind, hydro, biomass and anaerobic digestion and in accordance with the EKOenergy ecolabel (9). At this moment in time it is not clear if this type of supply meets the UKGBC's requirements for demonstrating additionality of off-site renewable energy and so is not included our analysis.

Energy scope
We do not own the building; we are a tenant in a multi-unit building. We occupy the entire lettable area of the 3 upper levels and a portion of the lower ground floor. We own and operate most of the building services systems. Communal areas outside our tenancy are excluded.

Assessed floor area
The floor area used for the energy and carbon metrics is the treated floor area (TFA).

The building floor area has been estimated from drawings of the building. An example is shown on the following page. The 1st, 2nd and 3rd floors have the same foot print. The GIA was estimated from measuring the floor plans. The TFA was estimated by subtracting unheated areas and using the ECON19 conversion factors. The estimates are given below.

Gross Internal Areas		
Lower ground floor (GIA)	54	m²
1st floor (GIA)	462	m²
2nd floor (GIA)	462	m²
3rd floor (GIA)	462	m²
Total GIA	1440	m²
Total GIA minus unheated lower ground floor	1386	m²
ECON19 reduction factor for TFA from GIA	0.95	
Treated Floor Areas		
Lower ground floor (TFA)	0	m²
1st floor (TFA)	439	m²
2nd floor (TFA)	439	m²
3rd floor (TFA)	439	m²
1st and 2nd floor (TFA)	878	m²
Total TFA	1317	m²

Percentage of total building area
The parts of the building not leased by Max Fordham have been estimated to cover 951m² so that the total building floor area is estimated to be 2391m² (GIA).

The (GIA) fraction of the total building area leased by Max Fordham and covered by this carbon emissions assessment is 60%.

Emission factors
See Section 2.3

Data sources
Copies of the sources of meter data (for example utility bills or reports from our landlords) are included in Appendix D.

Further data sources used are referenced and listed in Section 6.

Metering
For our London office we have access to and are in control of our utility meters. Our building energy use and on-site generation is covered by the following meters:

MF Meter Ref.	**Areas served and type of energy**	**Notes**
Gas Utility Meter 1	1st and 2nd floor heat	Lower ground floor comprises of storage and plant areas. They are not heated and have no hot water provision.
Gas Utility Meter 2	3rd floor heat	
Electricity Utility Meter 1	1st floor electricity	
Electricity Utility Meter 2	2nd floor electricity	
Electricity Utility Meter 3	3rd floor electricity	
Electricity Utility Meter 4	Lower ground floor electricity	
Electricity Generation Meter 1	Roof mounted PV array generated electricity	Connected to 3rd floor

In addition to utility meters we also have a range of our own electricity sub meters.

We have 2 different automatic meter reading systems that pick up most (but not all) of the building's energy metering. One is an EcoDriver system, the other is a KNX-Loxone system.

Building energy use and carbon emissions estimates
For the purpose of this work our energy consumption is derived from utility bill meter reading (or estimate) values (rather than data from the automatic meter reading systems). A challenge we are facing and are working on resolving is that the automatic meter reading systems do not appear to be reliable.

The data on the following pages provide the details of meter readings, how these have been used to make the annual energy consumption estimates along with comparisons to benchmark data. Also included are references to the relevant utility and/or manual meter reading records, copies of which are included in Appendix D.

Results and discussion on the energy and carbon emissions estimates
The results of the meter reading analysis show that the London office (Rotunda) energy consumption and carbon emissions are both about 20% less than the REEB Typical Practice benchmark (when using the carbon factors as stated earlier in this report). The London office energy consumption and carbon emissions are both about 30% less than the CIBSE TM46 benchmark which would be used to set the standard for a DEC "D" rating (using the carbon factors stated and ignoring occupancy and weather correction factors).

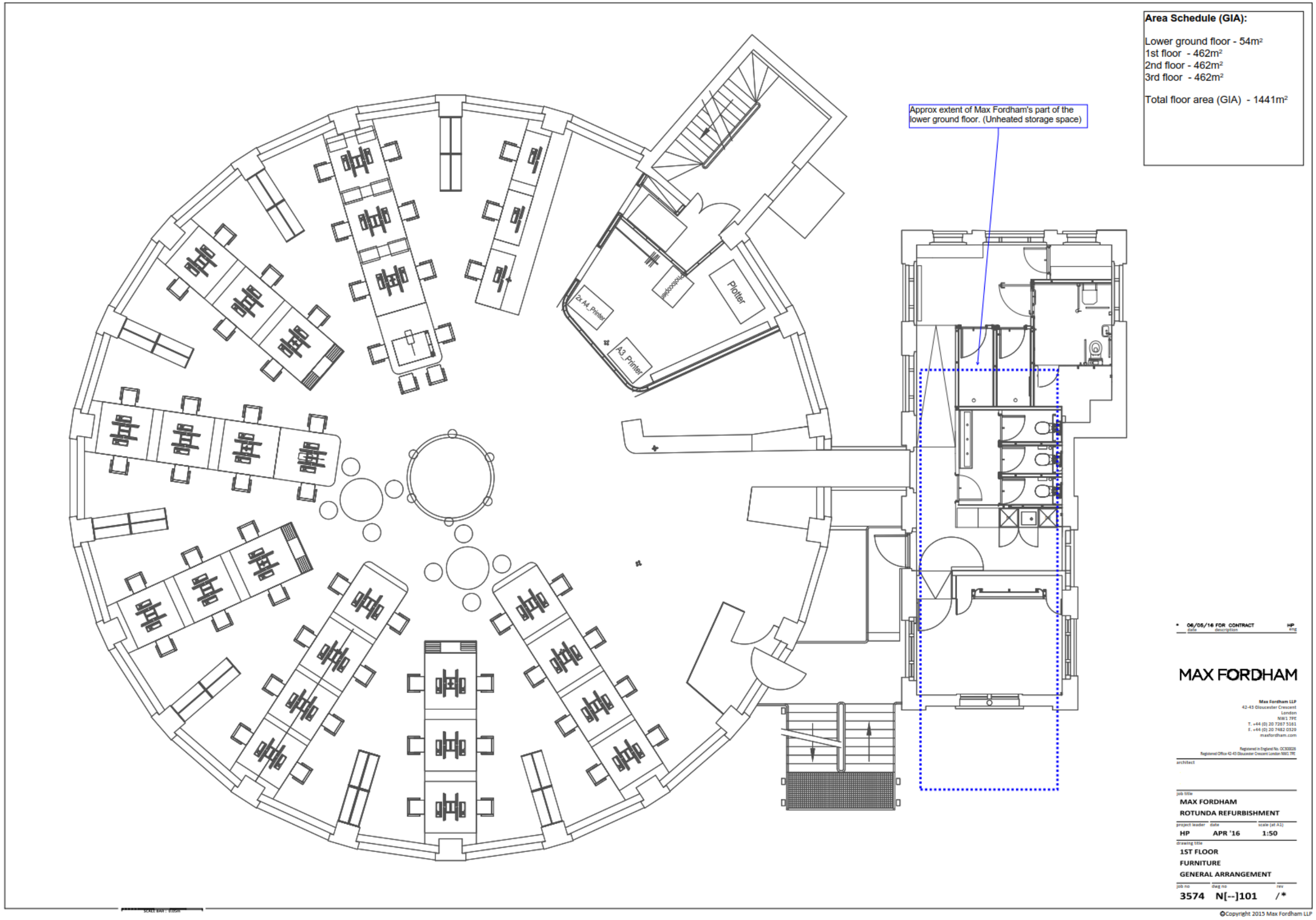
This is encouraging; this standard of energy performance is quite good for a building as old as the Rotunda. The energy efficiency improvements we have invested in seem to be working.

Our London office houses the IT server for all of our 5 offices which adds a significant load to London, not present in the other offices. If the server room energy demand is excluded from the analysis we find that the London office's energy consumption approaches those of the REEB Good Practice benchmark.

We do not have a full year data set for the PV generated energy. This won't make any difference to the electrical consumption data as any electricity generated when there is a building demand just prevents the utility meter from turning. It is not likely to make much difference to the reported office carbon emissions as the only "missing" contribution is the amount of electricity exported to the grid, which for our system will be a very small fraction of the total.

We are therefore under-reporting the amount of renewable electricity generated on-site and choosing to purchase a larger amount of carbon offsetting than if we would otherwise have to if we had the meter data available.

London office example floor plan

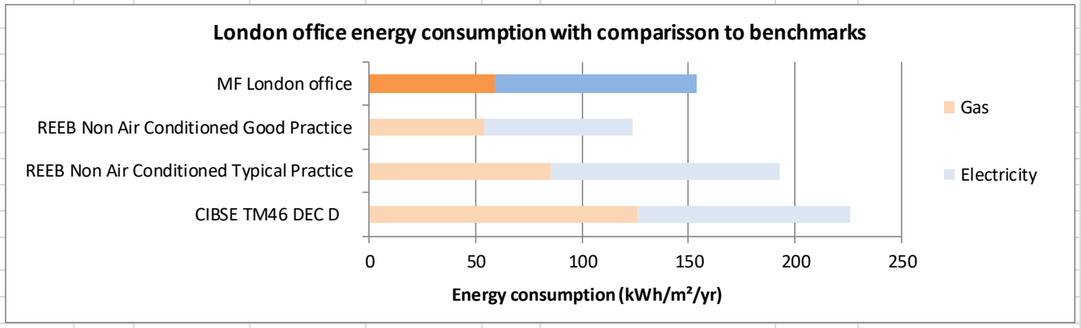


London office: annual energy consumption and carbon emissions

London office		
Building floor area (TFA)	1317	m²
Analysis period	from	26-Jun-18
	to	26-Jun-19

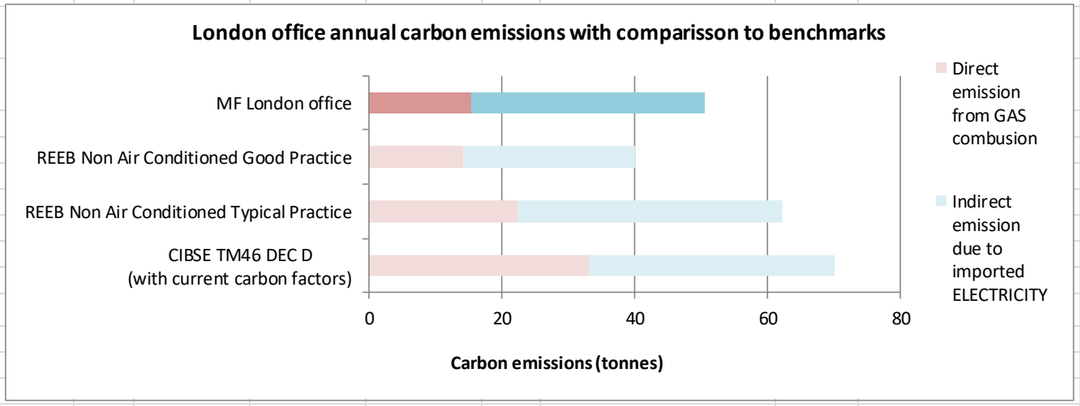
Energy

Indicator	kWh	kWh/m²
Total annual energy consumption	202,336	154
Total Annual electricity consumption	124,815	95
Total Annual gas consumption	77,521	59
Total annual electricity generated by on-site renewables	3,705	3



Carbon

Indicator	t CO_2	Kg CO_2/m^2
Total annual indirect CO2e emissions from imported electricity	35	27
Total Annual direct CO2e emissions from combustion of gas on-site	16	12
Total Annual indirect CO2e emissions from combustion of fuel (all other sources eg heat network)	0	0
Total annual displaced CO2e emissions from electricity generated by on-site renewable energy sources minus storage losses	1.0	0.8
Total annual CO2 emissions	50	38
Total annual displaced CO2e emissions from offsets	greater than 50	greater than 38
Total annual net CO2e emissions	0	



Offsets

Amount and type of offsets procured, including relevant framework used	See main report
Expected verification processes	See main report
Cost per tonne of CO2e:	See main report

Carbon factors		
Taken from	UK Government GHG Conversion Factors for Company Reporting 2018	
URL	https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018	
Type	**Carbon factor**	
Natural gas	0.2	kgCO2e / kWh
Mains electricity consumed or generated	0.28	kgCO2e / kWh

London office (Rotunda): gas meter data analysis

NOTES

Data taken from British Gas utility bills.
Note, we have 3 meters. 2 are in use.
The two in use meters serve a) the 1st floor boiler which also serves the 2nd floor and b) the third floor boiler.
The third with MPRN 61541503, Serial G4A00442941301 is capped off and not in use. This meter has recorded no gas flow during the entire analysis period. Hence the bill is for the standing charge only.
The 2 in use gas meters were changed during 2018, so there are 2 sets of meter readings for each
The lower gound floor anex (storage and plant room) is not heated.
Because the MPRN and meter serial numbers have changed due the best way to identify which bill is for which area is via the British Gas account number.

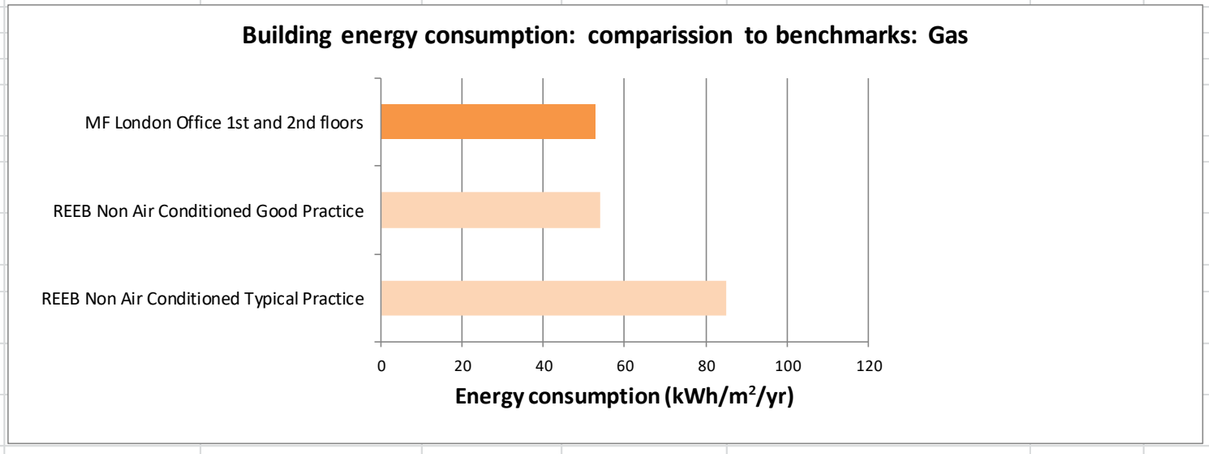
Analysis period			**Building floor areas**	1st and 2nd floor (TFA)	878	m²
From	29-Jun-18			3rd floor (TFA)	439	m²
To	29-Jun-19					
	365	days		Total TFA	1317	m²
			Unit conversion	1m3 of gas is	11	kWhr

1. Using Data from Utility Bills and Manual Meter Readings

a) First and second floor heating and hotwater

Account Number	Bill Number	MPRN	Meter Serial Number	Info source	Reading Date	Reading (m3)	Reading Type	Data Record Files (Bills)	Notes	Units used (m3)
600233915	955379440	3386381905	M016A0353910A6	Online download	17-Apr-18	127259	Utility read	2 _ 600233915 apr 18 to jul 18.pdf	Old meter	
600233915	955379440	3386381905	M016A0353910A6	Online download	26-Jul-18	128591	Manual read	2 _ 600233915 apr 18 to jul 18.pdf		
600233915	953423894	3386381905	M016A0353910A6	Online download	05-Nov-18	129996	Utility estimate	3 _ 600233915 jul 18 to nov 18.pdf		
600233915	952642367	3386381905	M016A0353910A6	Online download	20-Nov-18	130690	Utility read	4 _ 600233915 nov 18 to feb 19.pdf		3431
600233915	952642367	3386381905	E016K0784018D6	Online download	21-Nov-18	0	Utility read	4 _ 600233915 nov 18 to feb 19.pdf	New meter	
600233915	954496266	3386381905	E016K0784018D6	Online download	28-Feb-19	931	Utility estimate	5 _ 600233915 mar 19 to may 19.pdf		
600233915	954496266	3386381905	E016K0784018D6	Online download	31-Mar-19	1155	Utility estimate	5 _ 600233915 mar 19 to may 19.pdf		
600233915	954496266	3386381905	E016K0784018D6	Online download	31-May-19	1155	Utility estimate	5 _ 600233915 mar 19 to may 19.pdf		1155

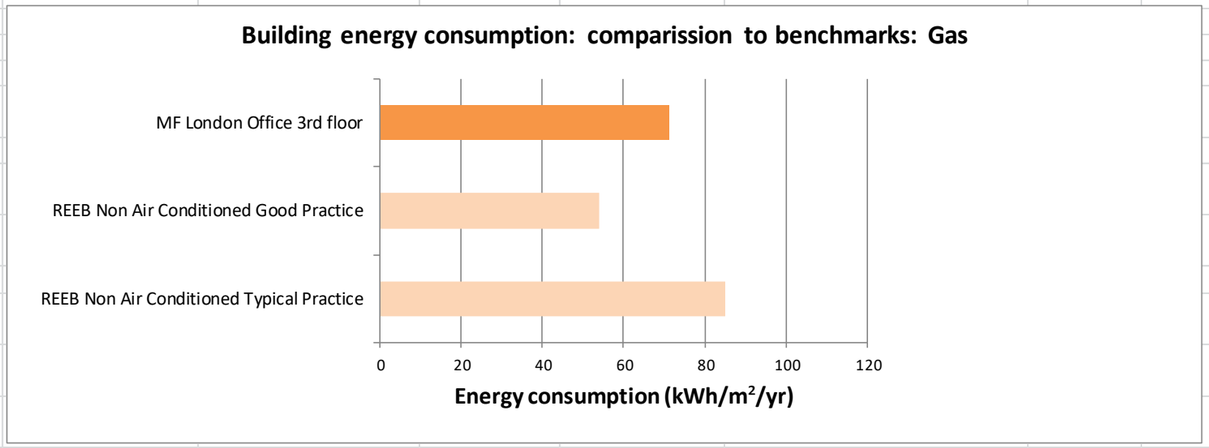
Total data collection period	409	days
Analysis period	365	days
Analysis to data collection period correction factor	0.89	
Units used in data collection period	4586	m3
Units used in analysis period	4093	m3
Gas energy consumption in the analysis period	46383	kWhr/yr
Gas energy consumption in the analysis period	46	MWhr/yr
Gas energy consumption in the analysis period	**53**	**kWhr/m2/yr**



b) 3rd floor heating and hotwater

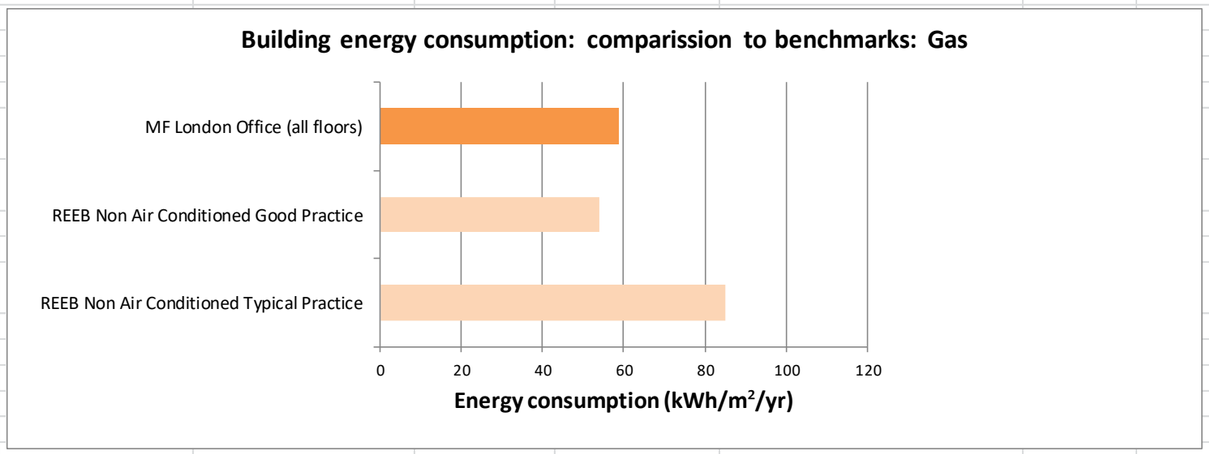
Account Number	Bill Number	MPRN	Meter Serial Number	Info source	Reading Date	Reading (m3)	Reading Type	Data Record Files (Bills)	Notes	Units used (m3)
670065791 (600258116)	103353386	61541604	M016A0204110A6	Paper scan	29-Jun-18	59461	Utility manual	2 _ 600258116 jun 18 to jul 18.JPG	Old meter	
670065791 (600258116)	103353386	61541604	M016A0204110A6	Paper scan	15-Jul-18	59462	Utility manual	2 _ 600258116 jun 18 to jul 18.JPG		
										1
670065791 (600258116)	103353386	61541604	E016K0393618D6	Paper scan	16-Jul-18	0	Utility manual	2 _ 600258116 jun 18 to jul 18.JPG	New meter	
670065791 (600258116)	103353386	61541604	E016K0393618D6	Paper scan	31-Jul-18	0	Utility manual	2 _ 600258116 jun 18 to jul 18.JPG		
670065791 (600258116)	962470901	61541503	E016K0393618D6	Online download	31-May-19	2732	Smart	10 _ 670065791 jun 19.pdf		
670065791 (600258116)	962470901	61541503	E016K0393618D6	Online download	30-Jun-19	2754	Smart	10 _ 670065791 jun 19.pdf		2754

Total data collection period	366	days
Analysis period	365	days
Analysis to data collection period correction factor	1.00	
Units used in data collection period	2755	m3
Units used in analysis period	2747	m3
Gas energy consumption in the analysis period	31138	kWhr/yr
Gas energy consumption in the analysis period	31	MWhr/yr
Gas energy consumption in the analysis period	71	kWhr/m2/yr



c) Whole building (London Office) gas use (heating and hotwater)

Analysis period		
From	29-Jun-18	
To	29-Jun-19	
Gas energy consumption in the analysis period	77521	kWhr/yr
Gas energy consumption in the analysis period	78	MWhr/yr
Treated floor area	1317	m2
Gas energy consumption in the analysis period	59	kWhr/m2/yr



London office (Rotunda): electricity meter data analysis

NOTES

For consumption the data taken from Utility bill records

Copies of utility bills saved and compiled in the file "Rotunda elec meter bill copies 2018 to 2019.pdf"

For PV generation the data is taken from MF's FM team's manual meter readings log book

A copy of the MF FM team log books are in the follo file: Rotunda manual meter readings april 2019 to july 2019 by MF FM team.pdf

Analysis period			**Treated Floor Areas**		
From	26-Jul-18		Lower ground floor (TFA)	0	m²
To	26-Jul-19		1st floor (TFA)	439	m²
	365	days	2nd floor (TFA)	439	m²
			3rd floor (TFA)	439	m²
			Total TFA	1317	m²

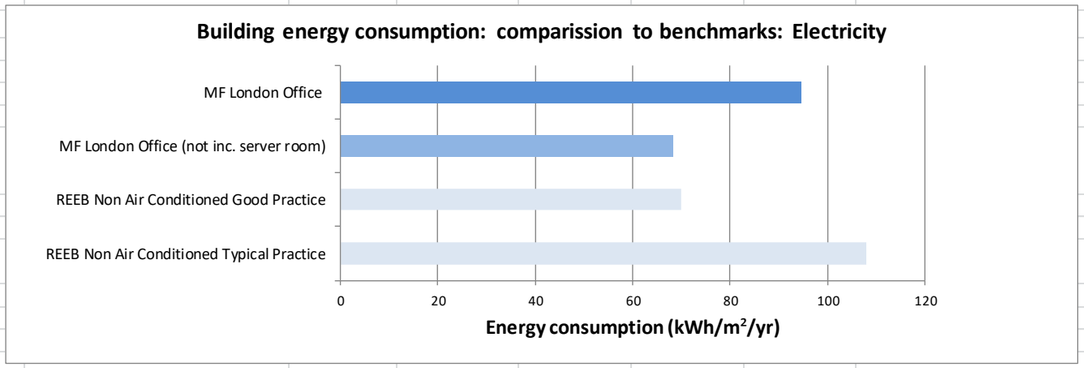
1. Using Data from Utility Bills and Manual Meter Readings

Data from Utility bills

MF Meter Ref	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (kWh)	Data Source	Reading Type	Data record file	Electricity used in the data collection period (kWhr)	Data Collection Period (days)	Collection to Analysis period correction factor	Electricity used in the data analysis period (kWhr)	Electricity used in the data analysis period (kWhr/m2/yr)	Notes
Elec Utility Meter 1	1st floor electricity	K09A04692	26-Jul-18	258029	Utility bill	Utility read	Rotunda elec meter bill copies 2018 to 2019.pdf						
Elec Utility Meter 1	1st floor electricity	K09A04692	18-Jul-19	284756	MF FM team log book	Manual read by MF FM team							
Elec Utility Meter 1	1st floor electricity	K09A04692	31-Jul-19	285577	Utility bill	Utility estimate	Rotunda elec meter bill copies 2018 to 2019.pdf	27548	370	0.99	27176	62	Utility estimate reasonable since it is greater than the previous manual reading taken on 18th July (2 weeks earlier)
Elec Utility Meter 2	2nd floor electricity	K11A003079	26-Jul-18	260352	Utility bill	Utility read	Rotunda elec meter bill copies 2018 to 2019.pdf						
Elec Utility Meter 2	2nd floor electricity	K11A003079	18-Jul-19	280174	MF FM team log book	Manual read by MF FM team							
Elec Utility Meter 2	2nd floor electricity	K11A003079	31-Jul-19	280768	Utility bill	Utility estimate	Rotunda elec meter bill copies 2018 to 2019.pdf	20416	370	0.99	20140	46	Utility estimate reasonable since it is greater than the previous manual reading taken on 18th July (2 weeks earlier)
Elec Utility Meter 3	3rd floor electricity	S03A01540	26-Jul-18	707343	Utility bill	Utility read	Rotunda elec meter bill copies 2018 to 2019.pdf						
Elec Utility Meter 3	3rd floor electricity	S03A01540	18-Jul-19	749318	MF FM team log book	Manual read by MF FM team							
Elec Utility Meter 3	3rd floor electricity	S03A01540	31-Jul-19	750622	Utility bill	Utility estimate	Rotunda elec meter bill copies 2018 to 2019.pdf	43279	370	0.99	42694	97	Utility estimate reasonable since it is greater than the previous manual reading taken on 18th July (2 weeks earlier)

Elec Utility Meter 4	Lower ground floor electricity (server room)	L72A52127	26-Jul-18	9562	Utility bill	Utility read	Rotunda elec meter bill copies 2018 to 2019.pdf						
Elec Utility Meter 4	Lower ground floor electricity (server room)	L72A52127	18-Jul-19	43792	MF FM team log book	Manual read by MF FM team							
Elec Utility Meter 4	Lower ground floor electricity (server room)	L72A52127	31-Jul-19	44844	Utility bill	Utility estimate	Rotunda elec meter bill copies 2018 to 2019.pdf	35282	370	0.99	34805	n/a	Utility estimate reasonable since it is greater than the previous manual reading taken on 18th July (2 weeks earlier)

Total annual electricity for whole London office	124815	kWh/yr
Total annual electricity for whole London office	125	MWh/yr
Total annual electricity for whole London office	**95**	**kWh/m2/yr**
Total annual electricity use for the London office not including servers	68	kWh/m2/yr



2. PV Generated Electrcity

Meter readigs taken from MF FM team log book spreadsheet

Excerpts below

Date of reading W/C	Electricity From PV's kWh
25/05/2018	14289.2

Date of reading W/C	Electricity From PV's kWh
28/06/2019	18328.7

MF Meter Ref	Area and System Served	Meter Reference Number	Meter Reading Date	Meter Reading (kWhr)	Data Source	Reading Type	Data record file	Electricity generated in the data collection period (kWhr)	Data Collection Period (days)	Collection to Analysis period correction factor	Electricity used or generated in the data analysis period (kWhr)	Electricity generated in the data analysis period (kWhr/m2/yr)	Notes
Electricity Generation Meter 1	Roof mounted PV array generated electricity	12005204	26-May-18	14289	MF FM team log book spreadsheet	Manual read by MF FM Team	Rotunda metering FM team log book spreadsheet.xlsx						
Electricity Generation Meter 1	Roof mounted PV array generated electricity	12005204	28-Jun-19	18329	MF FM team log book spreadsheet	Manual read by MF FM Team	Rotunda metering FM team log book spreadsheet.xlsx	4040	398	0.92	3705	3	

Total PV generated renewable electricity	**3705**	**kWh**
Total PV generated renewable electricity	3	kWh/m2/yr

4.2 Edinburgh office (Exchange Place 3)

Dates of achievement
June 2018 to June 2019

Verified by
See Section 1.3

Building location
Exchange Place 3, 3 Semple Street, Edinburgh, EH3 8BL.

Building type
Planning class: B1(a): Office

Building description
Our Edinburgh office occupies part of the 1st floor of a 5 storey office. The building was constructed in 2010. Our tenancy was refurbished by ourselves in 2015. The building is reported by the landlord to have been designed to a relatively good standard of energy efficiency, exceeding the standards set by Building Regulations Part L that were relevant at the time of design and to have achieved an EPC B+ and BREEAM Excellent ratings (10).

A plan of the 1st floor, (of which we occupy a fraction) and some photographs of the building can be seen the adjacent pictures.

Building aspect	Description
Structure	Presumed steel frame
Façade	Curtain walling. U value 0.3. Double glazed windows with U value 1.7[4].
Roof	Flat and pitched roofs. U values 0.25 and 0.2
Heating	Gas boilers serving radiators.
Hot water	Heated by gas boilers. Some storage. Plus some electric point of use.
Vent and cooling	Main offices naturally ventilated. Mechanical extract vent for drying room. No air conditioning or similar cooling systems.
Lighting	Mixture of low energy fluorescent and LED fittings. Some areas with automatic occupancy controls. Manual dimming controls.
Auxiliary (fans, pumps and controls)	The majority of pumps, fans and controls are not within our tenancy
Equipment	Mostly for computers and IT systems.
Other Energy Uses	Lift (but not within our tenancy).

Note: the U values are taken from the building outline specification provided by the Landlord.

[4] U Values in Wm^2K^{-1}

Energy efficiency features
The Edinburgh office has good standard of energy efficiency as described by the features in the preceding table. In addition to these we have invested in automatic logging heat meter system (designed by ourselves) so we can understand how much energy we are personally using for space heating. We also have an Energy Champions team who develop, implement and refine our energy management procedures

Renewable energy sources
None.

Energy scope
We do not own the building; we are a tenant in a multi-unit building. We occupy part of the 1st floor of a 5 storey office. We do not own or operate the central building services systems, they provided by the landlord. Communal areas outside of our tenancy are excluded from the analysis.

Assessed floor area
The floor area used for the energy and carbon metrics is the treated floor area (TFA).

The TFA our tenancy has been estimated from drawings to be $326m^2$.

Percentage of total building area
Our landlord has provided us with and area schedule of the whole building. A copy of this is included on the following page. This shows that the total building area is approximately 27,000 sqft ($2700m^2$), so our tenancy, the area covered by this assessment is 13% of the total.

Emission factors
See Section 2.3

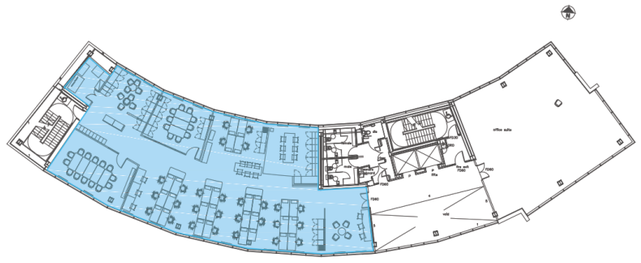
Data sources
Copies of the sources of meter data (for example utility bills or reports from our landlords) are included in Appendix D.

Metering
We understand that electricity to our tenancy is sub-metered. We are billed on this basis by our Landlord. However, we do not have access to the meter, we are reliant on meter reading data taken by and provided to us by our landlord. We have used this data to produce an estimate of our electricity usage.

Low temperature hot water heat is provided to our tenancy by the landlord's boilers. There is no gas sub metering. To estimate the gas use we are responsible for we have use the data recorded from our pipeline heat meters along with an assumption for the efficiency of the landlord's heating system to calculate gas consumption. Details of our heat metering system are included on the following page.

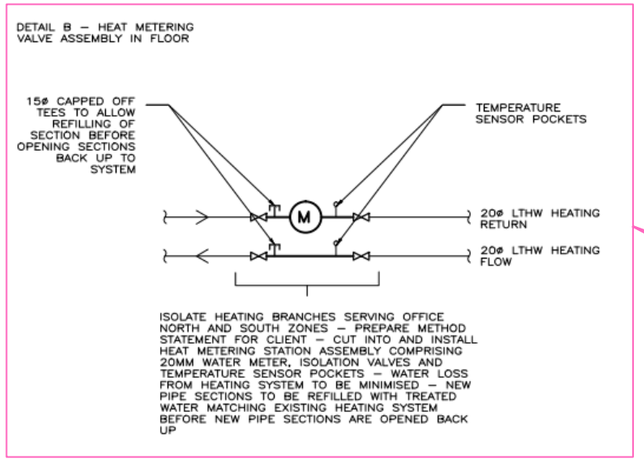
The details of how we have arrived at our energy estimates are included on the following pages. References are included to the sources of meter data.

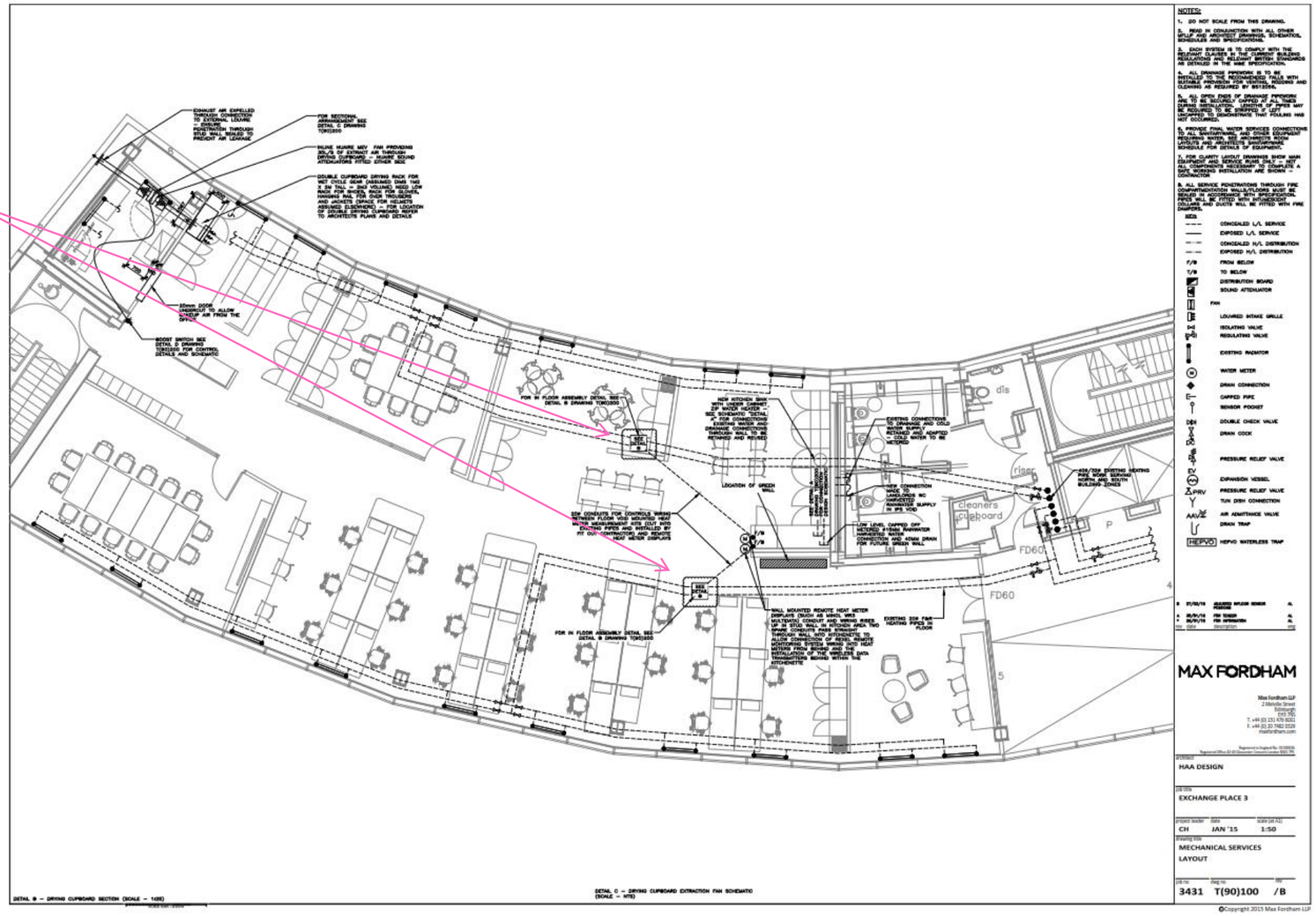
Copies of the original meter reading data documents from our landlord and heat meters are included in Appendix D.



Floor plan. Shaded area shows Max Fordham's tenancy. Treated floor area as measured from the drawing is $326m^2$.

MAX FORDHAM





Drawings and photographs of the heat meter system installed to measure the amount heat being supplied to our tenancy.

Property : Exchange Place 3
Landlord : Aberdeen Asset Management
Period 01-Jul-2015 to 30-Jun-2016

		Sch 1		Sch 2	
		Offices Only		Whole Building	
Unit Ref	Demise	Floor Space (Sq Ft)	%	Floor Space (Sq Ft)	%
67027003	2nd, 3rd, 4th Floors & 5 CPS	17,697.00	67.3632%	17,697.00	64.7009%
67027008	First Floor, Office 2	1,664.00	6.3340%	1,664.00	6.0837%
67027009	Ground Floor Café	-	0.0000%	1,081.00	3.9522%
67027010	Part Ground Floor	3,412.00	12.9877%	3,412.00	12.4744%
67027011	Part 1st Floor	3,498.00	13.3151%	3,498.00	12.7888%
		26,271.00	100.0000%	27,352.00	100.0000%

Copy of Landlord's whole building area schedule for Exchange Place 3. Our tenancy is "Part 1st Floor".

Building energy use and carbon emissions estimates
The data on the following pages provide the details of meter readings, how these have been used to make the annual energy consumption estimates along with comparisons to benchmark data. Also included are references to the relevant utility and/or manual meter reading records, copies of which are included in Appendix D.

Results and discussion on the energy and carbon emissions estimates
The energy and carbon emissions estimates based on meter readings show that the Edinburgh office energy consumption and carbon emissions are both about 55% less than the REEB Typical Practice benchmark and about 60% less than the CIBSE TM46 DEC D benchmark (when using the carbon factors as stated earlier in this report and ignoring occupancy and weather correction factors). This seems reasonable considering the building's low energy features.

Edinburgh office: annual energy consumption and carbon emissions

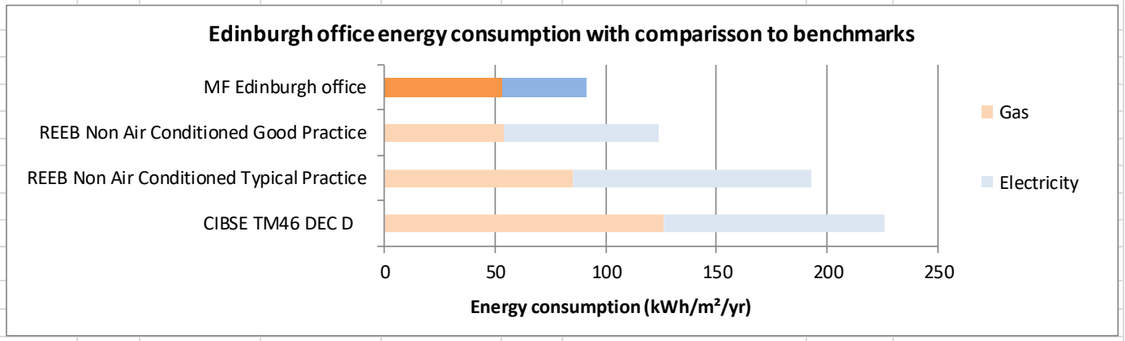
Edinburgh Office (Exchange Place 3)

Annual energy consumption, generation and carbon emissions

Edinburgh office		
Building floor area (TFA)	326	m²
Analysis period	from	26-Jun-18
	to	26-Jun-19

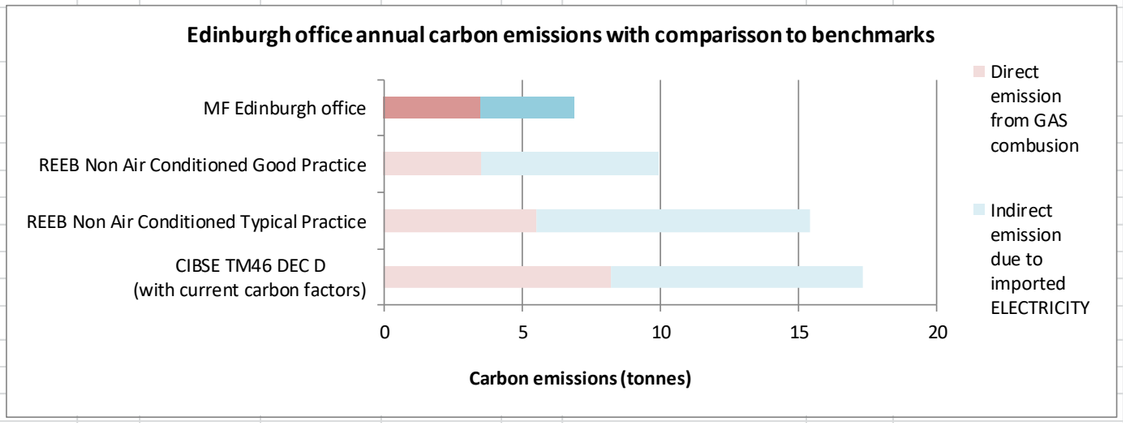
Energy

Indicator	kWh	kWh/m²
Total annual energy consumption	29,702	91
Total Annual electricity consumption	12,196	37
Total Annual gas consumption	17,506	54
Total annual electricity generated by on-site renewables	0	0



Carbon

Indicator	t CO_2	Kg CO_2/m^2
Total annual indirect CO2e emissions from imported electricity	3	10
Total Annual direct CO2e emissions from combustion of gas on-site	4	11
Total Annual indirect CO2e emissions from combustion of fuel (all other sources eg heat network)	0	0
Total annual displaced CO2e emissions from electricity generated by on-site renewable energy sources minus storage losses	0.0	0.0
Total annual CO2 emissions	7	21
Total annual displaced CO2e emissions from offsets	greater than 7	greater than 21
Total annual net CO2e emissions	0	



Offsets

Amount and type of offsets procured, including relevant framework used	See main report
Expected verification processes	See main report
Cost per tonne of CO2e:	See main report

Carbon factors

Taken from	UK Government GHG Conversion Factors for Company Reporting 2018
URL	https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018

Type	Carbon factor	
Natural gas	0.2	kgCO2e / kWh
Mains electricity consumed or generated	0.28	kgCO2e / kWh

Edinburgh Office : meter data and analysis

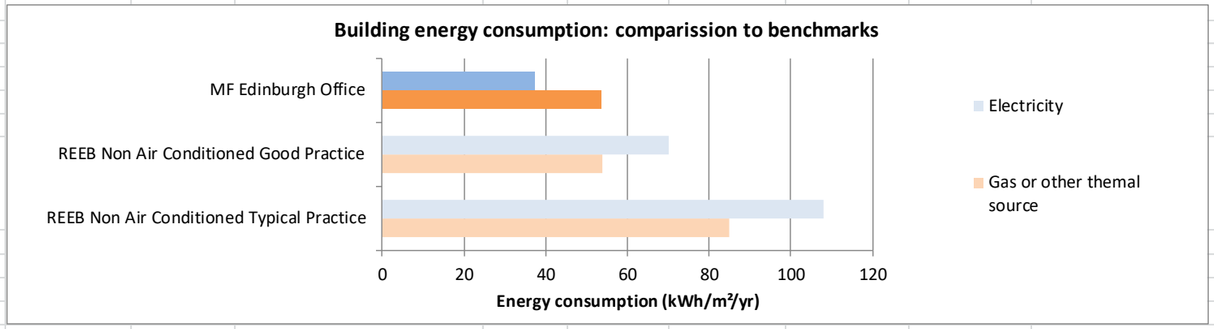
June 2018 to June 2019

NOTES

Electricity metered by a sub meter for our tennancy. Data provided by landlord

Gas estimated from heat meter data. We own our own heat meters measuring heat delivered to our tennnacy.

MF Edinburgh Office		
Building floor area (TFA)	326	m²
Measured from drawings		
Analysis period		
From	26-Jun-18	
To	26-Jun-19	
	365	days



Electricity

Data taken from meter readings provided by Landlord

Excerpts from the reports provided to us by our landlord are shown below

Month Jun-18

Electricity Supplies

Location	Meter Ref	Readings Previous	Readings Present
First Floor West	DB LP 1/1	117010	118114

Month Jun-19

Electricity Supplies

Location	Meter Ref	Readings Previous	Readings Present
First Floor West	DB LP 1/1	130,310	131,325

Meter	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (kWh)	Data Source	Reading Type	Data Record Files (Bills)	Data Collection Period (days)	Electricity used in the data collection period (kWhr)	Data collection to Analysis period correction factor	Electricity used in the data analysis period (kWhr)	Electricity used in the data analysis period (kWhr/m2/yr)	Notes
MF tennancy sub meter	MF tennancy electricity	DB LP 1/1	26-Jun-18	118,114	Lanlord report and bill	by Landlord	13 - T385030 - Elec RChg Jun 18.pdf						
MF tennancy sub meter	MF tennancy electricity	DB LP 1/1	26-Jun-19	130,310	Lanlord report and bill	by Landlord	1 - Knight Frank Electricity Charges for June 2019.pdf	365	12196	1.00	12196	37	

Estimate of annual electricity use	12196	kWh
Estimate of annual electricity use	37	kWhr/m2/yr

Edinburgh office: meter data analysis cont.

Gas

Data taken from manual readings for the 2 heat meters

Excerpts for the meter data logs shown below

Date	Time	Heating Left kWh	Heating Right kWh
24-Jun-18			
25-Jun-18	15:15	24065.7	21399.7
26-Jun-18	15:10	24069.1	21393.2
27-Jun-18	15:00	24069.1	21393.2
28-Jun-18	15:05	24075.2	21398.9
29-Jun-18	15:00	24075.2	21398.9

Date	Time	Heating Left kWh	Heating Right kWh
21-Jun-19	15:05	31779.9	25864.9
22-Jun-19			
23-Jun-19			
24-Jun-19	15:10	31790.9	25870.7
25-Jun-19	15:20	31799.1	25874.6
26-Jun-19	15:00	31824.2	25891.7

Meter	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (kWh)	Data Source	Reading Type	Data Record Files (e.g. Bills)	Data Collection Period (days)	Heat used in the data collection period (kWhr)	Data collection to Analysis period correction factor	Heat used in the data analysis period (kWhr)	Heat used in the data analysis period (kWhr/m2/yr)	Notes
Heat meter 1 : Left hand side	MF tenancy heat supplied south side	Heating Left	26-Jun-18	24,069	MF Energy Champion meter reading spread sheet	Manual	Exchange Place 3 Metering Set-up and readings 2018 -2019.xlsx						
Heat meter 1 : Left hand side	MF tenancy heat supplied south side	Heating Left	26-Jun-19	31,824	MF Energy Champion meter reading spread sheet	Manual	Exchange Place 3 Metering Set-up and readings 2018 -2019.xlsx	365	7755	1.00	7755	24	
Heat meter 2 : Right hand side	MF tenancy heat supplied north side	Heating Right	26-Jun-18	21,393	MF Energy Champion meter reading spread sheet	Manual	Exchange Place 3 Metering Set-up and readings 2018 -2019.xlsx						
Heat meter 2 : Right hand side	MF tenancy heat supplied north side	Heating Right	26-Jun-19	25,892	MF Energy Champion meter reading spread sheet	Manual	Exchange Place 3 Metering Set-up and readings 2018 -2019.xlsx	365	4499	1.00	4499	14	

Total heat used in the analysis period	12254	kWh
Assumption for the combined efficiency of the source boiler and distribution system	70%	
Estimate of annual gas use	17506	kWh
Estimate of annual gas use	54	kWhr/m2/yr

4.3 Cambridge office (St Andrews House)

Dates of achievement
June 2018 to June 2019

Verified by
See Section 1.3.

Building location
St Andrews House, 59 St Andrew's St, Cambridge CB2 3BZ.

Building type
Planning class: B1(a): Office

Building description
Our Cambridge office occupies part of the 3rd (uppermost) floor of St Andrew's House; a four storey multi-let building with retail at the ground floor and three floors of offices above. The building is reported to have been initially constructed in 1958 (11). As to be expected for a building of that era the thermal and energy performance was poor. When we first occupied the building it had a DEC rating of G. However, we have undertaken a low-energy retro-fit conversion and fit out, the details of which are provided in the following paragraphs. As a result our office now has a DEC rating of B.

A plan of the 3rd floor, (of which we occupy a fraction) and some photographs of the building can be seen the adjacent pictures.

Building aspect	Description
Structure	Presumed reinforced concrete frame
Façade	Tile outer with insulated cavity mansard roof. Approx. U value 0.4 or better. Single glazed original outer windows with secondary double glazing inner. Estimated U value 0.8[5].
Roof	Highly insulated flat roof. U values 0.21
Heating	Electric room heaters
Hot water	Electric point of use.
Vent and cooling	MVHR for fresh air in winter. Summer vent and additional cooling with natural ventilation. No air conditioning or similar cooling systems.
Lighting	LED fittings throughout, with daylight dimming. Some areas with automatic occupancy controls
Auxiliary (fans, pumps and controls)	Very minimal due to the electric heating and nat vent strategies.
Equipment	Mostly for computers and IT systems.
Other Energy Uses	Kitchenette

[5] U Values in Wm^2K^{-1}

Energy efficiency features
Thanks to our low energy refurbishment our Cambridge office has an excellent standard of energy efficiency. The key features include the following:

- Highly insulated roof
- Highly insulated façade and windows
- Variable U value windows that changed from triple gazing in winter to single glazed in summer
- Ventilation with heat recovery during heating season
- Natural ventilation for summer vent and cooling (no other cooling sources)
- Efficient lighting with automatic controls
- Detailed energy sub-meter system with data analysis
- A team of Energy Champions who develop, implement and refine our energy management procedures

Implementing the measures described has resulted in an office space that needs hardly any heating. Detailed energy use analysis as carried out in 2015. The results of this are shown in the graph on the following page. The data shows that the energy use for heating was 2300kWh/yr or 10kWh/m^2/yr which is 80% less than the REEB Good Practice benchmark and 90% less that the TM46 DEC D benchmark.

Renewable energy sources
None.

Energy scope
We do not own the building; we are a tenant in a multi-unit building. We occupy part of the 3rd floor of a 4 storey building. We do own and operate the building services systems serving our tenancy. Communal areas outside of our tenancy are excluded from the analysis.

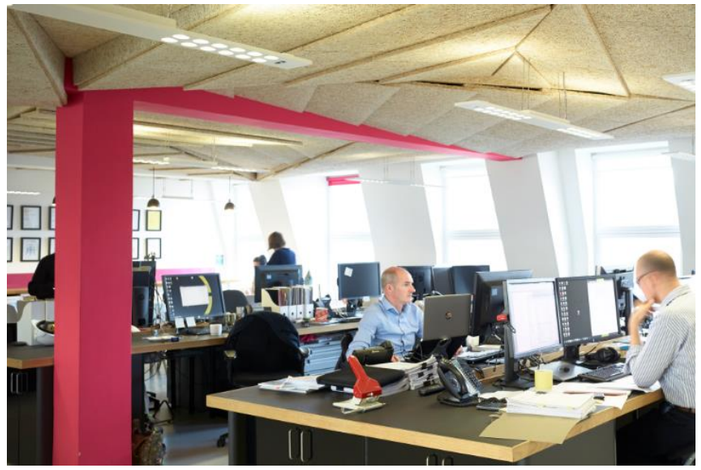
Assessed floor area
The floor area used for the energy and carbon metrics is the treated floor area (TFA).

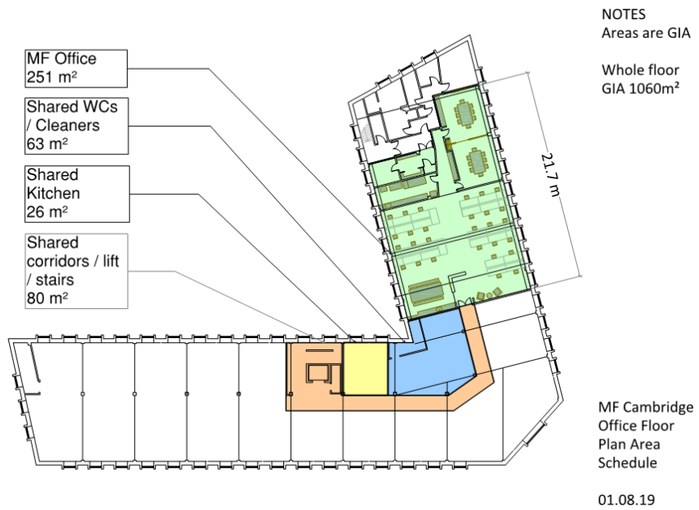
The GIA of our tenancy has been estimated by measuring the floor plans to be 251m^2. The ECON19 conversion factor (0.95) has been used to estimate a TFA of our tenancy of 238m^2.

Percentage of total building area
The floor rea of the whole building has been estimated by assuming that each of the 4 floors has the same footprint. The whole building GIA is estimated to be 4 x 1060 x 0.95 = 4028m^2, so our tenancy (251 m^2), the area covered by this assessment is 6% of the total.

Emission factors
See Section 2.3.

Data sources
Copies of the sources of meter data (for example utility bills or reports from our landlords) are included in Appendix D.



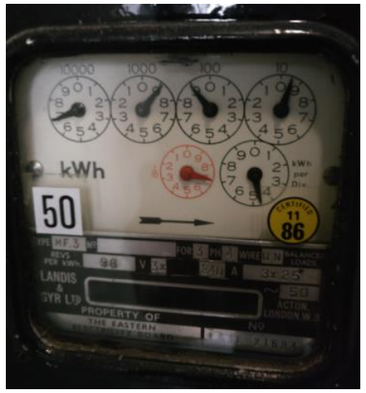


Metering
Our Cambridge office is 100% electric, there is no gas. There is a landlord owned sub meter (pictured adjacent) that meters the electricity used within our tenancy.

We are given access to this meter to take manual readings, which we do once per month. We use these meter readings to calculate the amount of energy used within our tenancy for the net zero carbon analysis.

The details of how we have arrived at our energy estimates are included on the following pages. References are included to the sources of meter data.

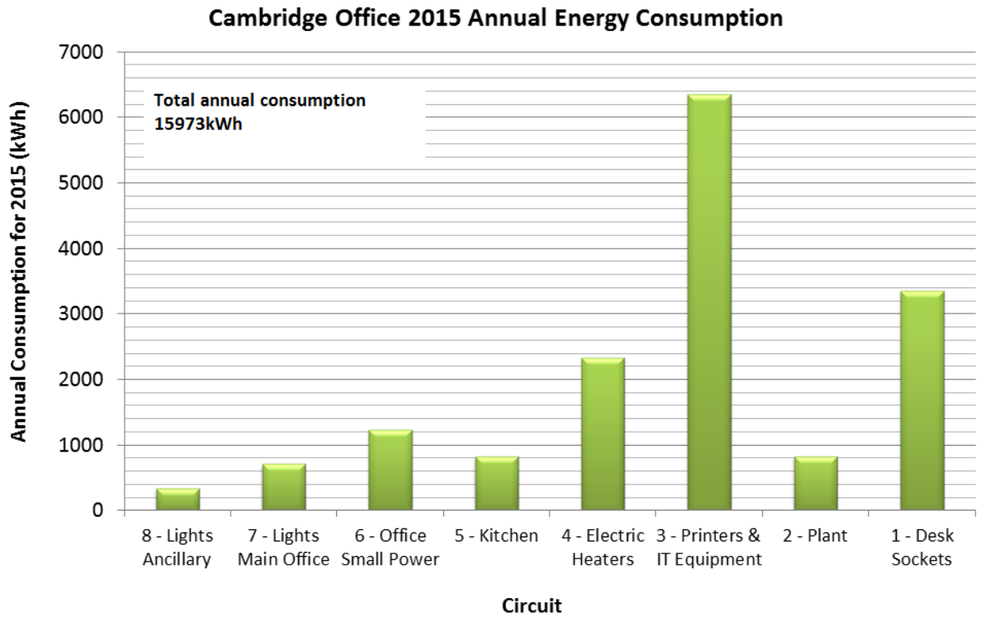
Copies of the original meter reading data documents from our landlord and heat meters are included in Appendix D.



Single sub meter metering our tenancy.

Building energy use and carbon emissions estimates
The data on the following pages provide the details of meter readings, how these have been used to make the annual energy consumption estimates along with comparisons to benchmark data. Also included are references to the relevant utility and/or manual meter reading records, copies of which are included in Appendix D.

Results and discussion on the energy and carbon emissions estimates
The energy and carbon emissions estimates based on meter readings show that the Cambridge office energy consumption and carbon emissions are both about 60% less than the REEB Typical Practice benchmark and about 65% less than the CIBSE TM46 DEC D benchmark (when using the carbon factors as stated earlier in this report and ignoring occupancy and weather correction factors). This seems reasonable considering the building's low energy features.



Detailed meter data from 2015 showing where energy is being used. Equivalent data isn't available for 2018-2019.
The 2018 – 2019 data provided on the next pages used for the net zero carbon analysis and was derived from the single sub meter metering our tenancy (pictured above).

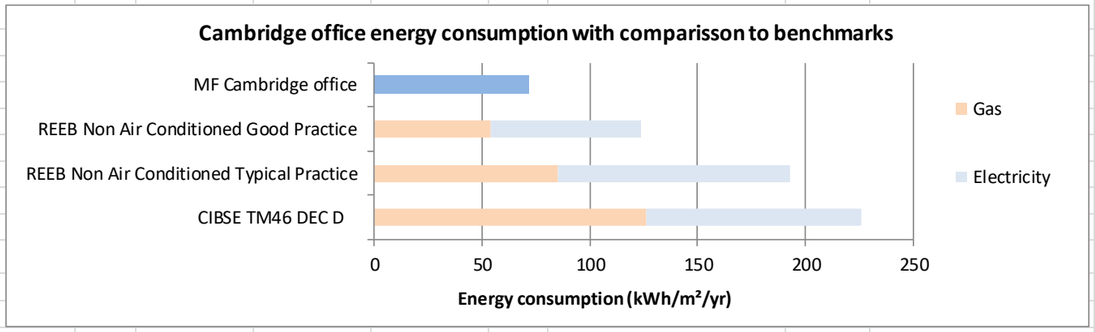
Cambridge Office

Annual energy consumption, generation and carbon emissions

Cambridge office		
Building floor area (TFA)	238	m²
Analysis period	from	26-Jun-18
	to	26-Jun-19

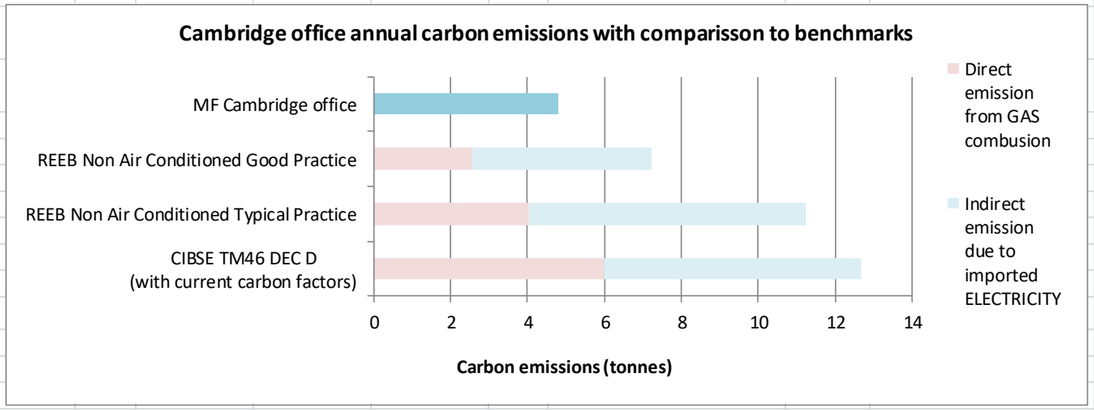
Energy

Indicator	kWh	kWh/m²
Total annual energy consumption	17102	72
Total Annual electricity consumption	17102	72
Total Annual gas consumption	0	0
Total annual electricity generated by on-site renewables	0	0



Carbon

Indicator	t CO_2	Kg CO_2/m^2
Total annual indirect CO2e emissions from imported electricity	5	20
Total Annual direct CO2e emissions from combustion of gas on-site	0	0
Total Annual indirect CO2e emissions from combustion of fuel (all other sources eg heat network)	0	0
Total annual displaced CO2e emissions from electricity generated by on-site renewable energy sources minus storage losses	0.0	0.0
Total annual CO2 emissions	5	20
Total annual displaced CO2e emissions from offsets	greater than 5	greater than 20
Total annual net CO2e emissions	0	



Offsets

Amount and type of offsets procured, including relevant framework used	See main report
Expected verification processes	See main report
Cost per tonne of CO2e:	See main report

Carbon factors

Taken from	UK Government GHG Conversion Factors for Company Reporting 2018	
URL	https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018	
Type	**Carbon factor**	
Natural gas	0.2	kgCO2e / kWh
Mains electricity consumed or generated	0.28	kgCO2e / kWh

Cambridge office: meter data analysis

Cambridge Office : meter data and analysis

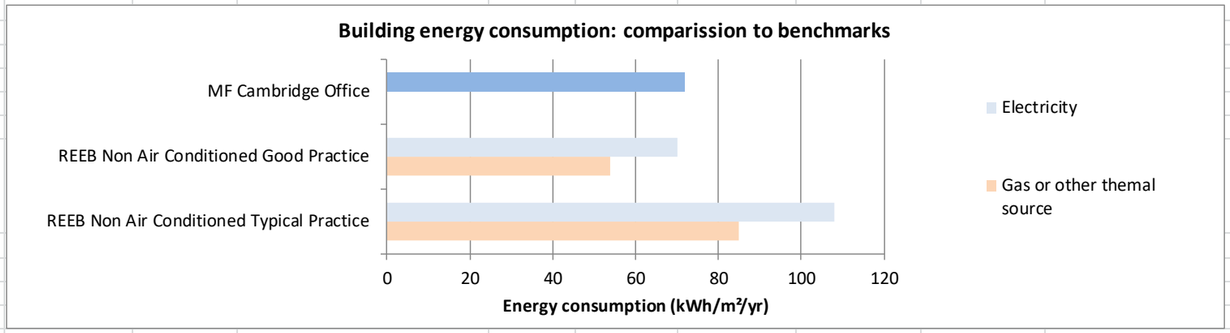
June 2018 to June 2019

NOTES

Electricity metered by a sub meter for our tennancy. Data provided by landlord

Gas estimated from heat meter data. We own our own heat meters measuring heat delivered to our tennnacy.

MF Cambridge Office		
Building floor area (TFA)	238	m²
Measured from drawings		
Analysis period		
From	26-Jun-18	
To	26-Jun-19	
	365	days



Electricity

Data taken from manual meter readings by MF staff.

Excerpts from MF meter reading record spreadsheet are shown below

Cambridge Office Energy Use
Meter Number: L53E21694

Date	Reading
30/04/2018	70322
31/05/2018	71468
30/06/2018	72400
31/07/2018	73290

Cambridge Office Energy Use
Meter Number: L53E21694

Date	Reading
30/04/2019	87869
04/06/2019	89135
01/07/2019	90023
02/08/2019	91005
30/08/2019	91935

Meter	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (kWh)	Data Source	Reading Type	Data Record Files (e.g. bills, log book etc)	Data Collection Period (days)	Electricity used in the data collection period (kWhr)	Data collection to Analysis period correction factor	Electricity used in the data analysis period (kWhr)	Electricity used in the data analysis period (kWhr/m2/yr)	Notes
MF tenancy sub meter	MF tenancy electricity	L53E21693	31-May-18	71,468	MF meter reading log	Manual by MF	MF Cambridge Office Electricity Meter Readings.xlsx						
MF tenancy sub meter	MF tenancy electricity	L53E21693	01-Jul-19	90,023	MF meter reading log	Manual by MF	MF Cambridge Office Electricity Meter Readings.xlsx	396	18555	0.92	17102	72	

Estimate of annual electricity use	17102	kWh
Estimate of annual electricity use	72	kWhr/m2/yr

Gas

There is no gas. The building and hot water are electrically heated

4.4 Bristol office (Queens Square House)

Dates of achievement
June 2018 to June 2019

Verified by
See Section 1.3.

Building location
Suite 1.6 1st Flr 18, Queen Square, Bristol, BS1 4NH

Building type
Planning class: B1(a): Office

Building description
Our Bristol office occupies part of the 1st floor of Queens House; a historic, grade II listed three-storey building in Bristol city centre. The building is reported to have been constructed in 1889 (12). As to be expected for a listed building of this age the thermal and energy performance is fairly poor. The Building is reported to have an EPC of grade E.

A plan of the 1st floor, (of which we occupy a fraction) and some photographs of the building can be seen the adjacent pictures.

Building aspect	Description
Structure	Structural stone and masonry. Includes a small basement (but not in our tenancy)
Façade	Terracotta and brick with marble. Assumed un-insulated. Timber framed sash windows. Probably single glazed.
Roof	Unknown
Heating	Radiators assumed to be served by a landlord owned gas boiler.
Hot water	Presumed gas heated but not within our tenancy
Vent and cooling	Natural ventilation. No air conditioning or similar cooling systems.
Lighting	Low energy fluorescent.
Auxiliary (fans, pumps and controls)	Unknown. Landlord owned and operated.
Equipment	Mostly for computers and IT systems.
Other Energy Uses	Shared kitchenette but not within our tenancy.

Energy efficiency features
Queens Square House does not have a good energy performance. Our scope for addressing this is very limited since as a) we are tiny tenant within a much larger development, b) the building is historic and listed, c) we may well be moving soon as we are outgrowing the space.

That said, our office space does have energy efficient light and natural ventilation, rather than mechanical cooling such as air conditioning. There is also an Energy Champion staff member who develops, implements and refines our energy management strategies. Since as our Bristol office accounts for only 3% of the total Max Fordham office area the fact that is not very energy efficient has little impact on the energy efficiency of our portfolio as a whole.

Energy scope
We do not own the building; we are a tenant in a multi-unit building. We occupy part of the 1st floor of a 3 storey office. We do not own or operate the central building services systems, they provided by the landlord. Communal areas outside of our tenancy are excluded from the analysis.

Assessed floor area
The floor area used for the energy and carbon metrics is the treated floor area (TFA).

The building plans (provided by our Landlord) state the NIA of our office to be 70m^2. In this case, due to the room layouts this is equivalent to the TFA.

Percentage of total building area
The building plans report that the total building area (NIA) is 3376m^2. So our tenancy, the area covered by this assessment is 2% of the total building area.

Emission factors
See Section 2.3.

Data sources
Copies of the sources of meter data (for example utility bills or reports from our landlords) are included in Appendix D.

Metering
Our Bristol office does not have gas or electricity sub-meters to our tenancy. We are billed by our landlord via a service charge that does not contain meter reading data.

We have been provided with whole building gas meter data by our Landlord. To estimate the gas use we are responsible for we have used this data and scaled it in proportion to our tenancy's floor area fraction of the whole building (2%). This is the method recommended for the production of Display Energy Certificates when meter readings of individual tenancies are not available.

We have not been able to obtain electricity meter data for our tenancy or the whole building. The UKGBC Framework does not provide any guidance on what to do in this situation so we have developed a method we think is reasonable. In the event of meter readings not being available we propose to use benchmark data to estimate the electricity use. We have chosen to use the highest electricity consumption value from all of the benchmarks reviewed (see Section 2.4) for the building type in question, namely a naturally ventilated (non-air conditioned) office. This is represented by the REEB Non Air Conditioned Typical Practice electricity benchmark (108 kWh/m^2/yr). In addition to this we have modified the benchmark by applying a penalty factor (of 1.3) to penalise the fact that the energy use is not based on meter data (which is the preference of the UKGBC Framework). We propose that so long as the total energy consumption estimated by this

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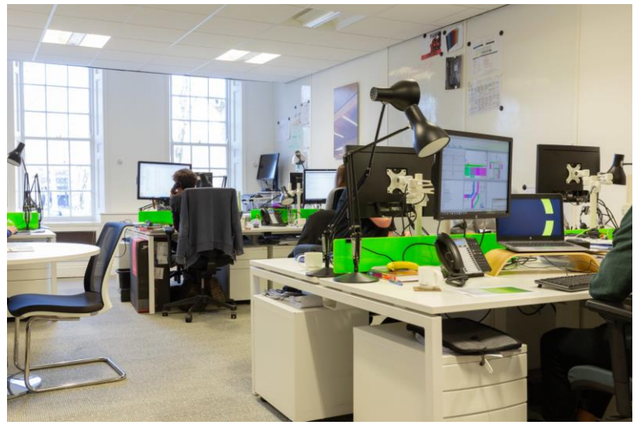
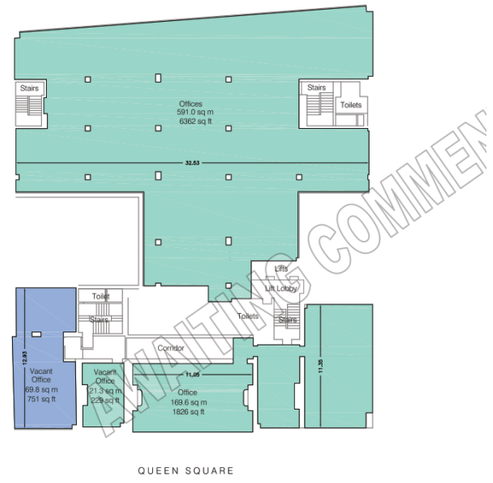




1st Floor plan. Shaded area shows Max Fordham's tenancy. Floor area reported on the drawing is 70m^2.

MAX FORDHAM

Building energy use and carbon emissions estimates
The data on the following pages provide the details of meter readings and other estimates, how these have been used to make the annual energy consumption estimates along with comparisons to benchmark data. Also included are references to the relevant utility and/or manual meter reading records, copies of which are included in Appendix D.

Results and discussion on the energy and carbon emissions estimates
The energy and carbon emissions estimates based on meter readings and modified benchmark estimates show that the Bristol office energy consumption and carbon emissions are both about 20% more than the REEB Typical Practice benchmark and 0 to 5% more than the CIBSE TM46 DEC D energy and carbon benchmarks (when using the carbon factors as stated earlier in this report and ignoring occupancy and weather correction factors).

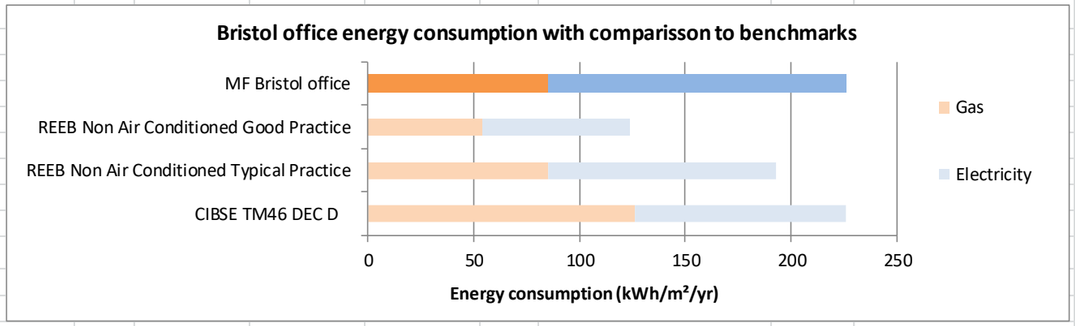
Bristol Office (Queen's Square House)

Annual energy consumption, generation and carbon emissions

Bristol office		
Building floor area (TFA)	70 m²	
Analysis period	from	26-Jun-18
	to	26-Jun-19

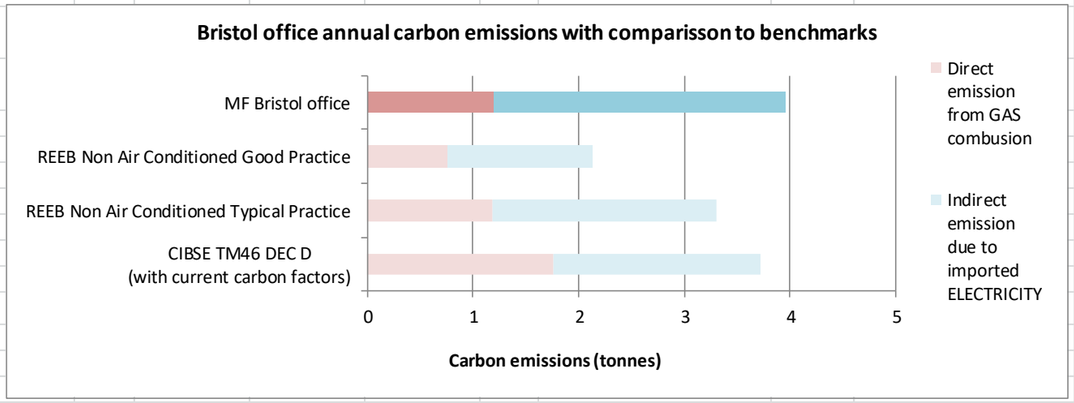
Energy

Indicator	kWh	kWh/m²
Total annual energy consumption	15,802	226
Total Annual electricity consumption	9,828	140
Total Annual gas consumption	5,974	85
Total annual electricity generated by on-site renewables	0	0



Carbon

Indicator	t CO_2	Kg CO_2/m^2
Total annual indirect CO2e emissions from imported electricity	3	39
Total Annual direct CO2e emissions from combustion of gas on-site	1	17
Total Annual indirect CO2e emissions from combustion of fuel (all other sources eg heat network)	0	0
Total annual displaced CO2e emissions from electricity generated by on-site renewable energy sources minus storage losses	0.0	0.0
Total annual CO2 emissions	4	56
Total annual displaced CO2e emissions from offsets	greater than 4	greater than 56
Total annual net CO2e emissions	0	



Offsets

Amount and type of offsets procured, including relevant framework used	See main report
Expected verification processes	See main report
Cost per tonne of CO2e:	See main report

NOTE : electricty use estimated from benchmark as metered data not available

Carbon factors

Taken from	UK Government GHG Conversion Factors for Company Reporting 2018
URL	https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018

Type	**Carbon factor**
Natural gas	0.2 kgCO2e / kWh
Mains electricity consumed or generated	0.28 kgCO2e / kWh

Bristol office: meter data analysis

Bristol Office : meter data and analysis

June 2018 to June 2019

NOTES

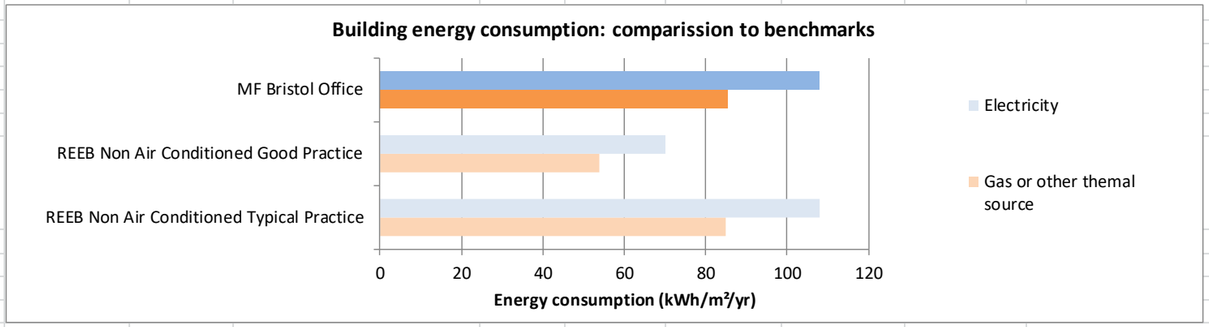
There are no sub meters to our office area

Gas estimates from whole building meter data

Scaled by floor area fraction

The electricity bill data we have from the Landlord is not useable. Therefore we are using bechmark data instead.

MF Bristol Office		
MF tenancy floor area (TFA = NIA in this case)	70	m²
Whole building floor area (NIA)	3376	m²
Stated on Landlord drawings		
MF floor area fraction	2%	
Analysis period		
From	26-Jun-18	
To	26-Jun-19	
	365	days



Electricity

Meter	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (kWh)	Data Source	Reading Type	Data Record Files (Bills)	Data Collection Period (days)	Electricity used in the data collection period (kWhr)	Data collection to Analysis period correction factor	Electricity used in the data analysis period (kWhr)	Electricity used in the data analysis period (kWhr/m2/yr)	Notes
No meter data available	MF tennancy electricity												
No meter data available	MF tennancy electricity							0	0	#DIV/0!	#DIV/0!	#DIV/0!	

Substitute benchmark	REEB Non Air Conditioned Typical Practice : Electricity Use		The Bristol office is not-air conditioned
Substitute benchmark value	108	kWhr/m2/yr	(Based on TFA)
Penalty factor for not having meted data	1.3		
Resulting benchmark value	140	kWhr/m2/yr	(Based on TFA)
Estimate of annual electricity use	9828	kWh	
Estimate of annual electricity use	140	kWhr/m2/yr	

Gas

Data taken from meter readings provided by Landlord for the whole building

Excerpts from the reports provided to us by our landlord are shown below

Note, these readings are in hundreds of cubic feet

Page: 1 of 1

Meter Point Reference	Meter Serial Number	Previous Read Date	Previous Read	
5214404	6402222SC	01/07/2018	220685	E

Meter Point Reference	Meter Serial Number	Previous Read Date	Previous Read		Present Read		Present Read Date	Metered Consumption
5214404	6402222SC	01/06/2019	229418	E	229759	E	01/07/2019	341

Unit conversion		
Correction Factor	1.02264	
Calorific Value	39.5	
Conversion m3 to ft3	2.83	
Conversion m3 to kWh	3.6	
1 cubic ft (ft3) equals	32	kWh

Converting units to kWh

Imperial meters (cubic feet or ft³) start at step 1.
Metric meters (cubic meters or m³) start at step 2.

1. Convert the units into cubic meters- multiplying by 2.83
2. Multiply the cubic meters by the Correction Factor 1.02264
3. Multiply this by the Calorific Value 39.10
4. Divide this by 3.6 to convert to kWh

Meter	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (ft3)	Data Source	Reading Type	Data Record Files (e.g. Bills)	Data Collection Period (days)	Units used in the data collection period (ft3)	Gas used in the data collection period (kWhr)	Data collection to Analysis period correction factor	Gas used in the data analysis period (kWhr)	Notes
Landlords whole building gas meter	Whole building heat source	6402222SC	01-Jul-18	220,685	Utility bill	Utility estimate	13275815.pdf						
Landlords whole building gas meter	Whole building heat source	6402222SC	01-Jul-19	229,759	Utility bill	Utility estimate	14144746.pdf	365	9,074	288139	1.00	288139	Whole building

Total gas used in the analysis period: whole building	288139	kWh
MF tenancy floor area factor	2%	
Estimate for gas use associated with MF's tenancy	5974	kWh
Estimate of annual gas use	85	kWhr/m2/yr

MAX FORDHAM

4.5 Manchester office (Carvers Warehouse)

Dates of achievement
June 2018 to June 2019

Verified by
See Section 1.3.

Building location
Pt 3rd Flr (right) Carvers Warehouse 77, Dale Street, Manchester, M1 2HG.

Building type
Planning class: B1(a): Office

Building description
Our Manchester office occupies part of the 3rd floor of Carvers Warehouse; a historic, grade II listed four-storey building in Manchester city centre. The building is reported to have been constructed in 1806 (13). The building was remodelled in 2007 incorporating conversion and new build elements; we were part of that design team. The building comprises of approximately 70% converted historic building and 30% new-build. The overall thermal energy performance is thought to be quite good considering the age and listed nature of the main part of the building. The new build parts were constructed to Part L 2006.

Building aspect	Description
Structure	Historic part: Structural stone and masonry. Includes a basement (but not in our tenancy). Timber roof and floors. New build part: Steel frame with concrete floors and roof.
Façade	Historic part: Mortared stone approx. 700mm, estimated U value 2. New double glazed windows. Estimated U value 2.2. New build part: Stone and concrete panels with insulation. Estimated U value 0.4. Large areas of glazed façade. New double glazed windows. Estimated U value 2.2. Insulated ground floor throughout. Estimated U value 0.2.
Roof	Historic part: Unknown, presumed new insulated roof New build part: concrete slab with insulation. Estimated U value 0.2.
Heating	Radiators served by a landlord owned modern gas boiler.
Hot water	Gas heated with storage and circulation. Some point of use electric
Vent and cooling	Mechanical ventilation with heat recovery for fresh air. Natural ventilation for cooling.
Lighting	Low energy fluorescent.
Auxiliary (fans, pumps and controls)	Central air handling unit with variable speed drive controlled on return air temperature. BMS
Equipment	Mostly for computers and IT systems.
Other Energy Uses	Lifts and shared kitchenette but not within our tenancy.

Energy efficiency features
Many of the energy efficiency features have already been described, the main ones being:

- Natural ventilation, rather than air-conditioning
- Reasonable insulation in the new build parts
- Reasonable glazing U values throughout
- Efficiency lighting
- Ventilation heat recovery
- Efficient plant and controls
- A team of Energy Champions who develop, implement and refine our energy management procedures

Renewable energy sources
None.

Energy scope
We do not own the building; we are a tenant in a multi-unit building. We occupy part of the 3rd floor of a 4 storey building. We do not own and operate the building services systems serving our tenancy. Communal areas outside of our tenancy are excluded from the analysis.

Assessed floor area
The floor area used for the energy and carbon metrics is the treated floor area (TFA).

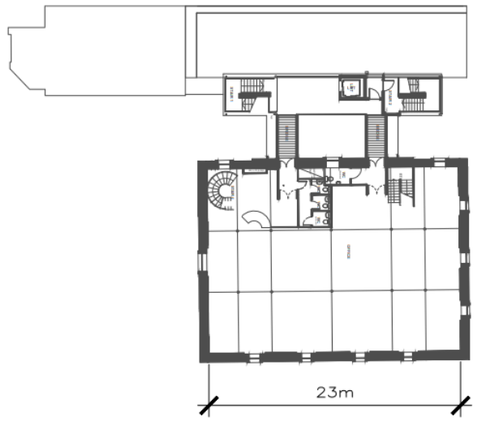
Information from our Landlord states the NIA of our office to be 194m^2. In this case, due to the room layouts this is equivalent to the TFA.

Percentage of total building area
Our landlord informs us that the total building area (NIA) is 22,202 sqft[6] which is equal to 2075m^2. So our tenancy, the area covered by this assessment is 9% of the total building floor area.

Emission factors
See Section 2.3.

[6] See MF Manc office floor area and meter data from Landlord.pdf in Appendix D.

Data sources
Copies of the sources of meter data (for example utility bills or reports from our landlords) are included in Appendix D.



3rd Floor plan. Max Fordham's tenancy occupies a part (about 60%) of this.

Metering
For our Manchester office, for electricity we have been provided with meter readings form our landlord for our tenancy, which implies they have access to a sub-meter. We don't have access to this meter; we are reliant on data from our landlord. For electricity consumption we have used the meter reading data provided to us by our landlord.

We have been provided with whole building gas meter data by our Landlord. To estimate the gas use we are responsible for we have used this data and scaled it in proportion to our tenancy's floor area fraction of the whole building (9%). This is the method recommended for the production of Display Energy Certificates when meter readings of individual tenancies are not available.

Building energy use and carbon emissions estimates
The data on the following pages provide the details of meter readings and other estimates, how these have been used to make the annual energy consumption estimates along with comparisons to benchmark data. Also included are references to the relevant utility and/or manual meter reading records, copies of which are included in Appendix D.

Results and discussion on the energy and carbon emissions estimates
The energy consumption and carbon emissions estimates based on meter readings show that the Manchester office energy consumption and carbon emissions are both about 20% less than the REEB Typical Practice benchmark and 30% less than the CIBSE TM46 DEC D energy and carbon benchmarks (when using the carbon factors as stated earlier in this report and ignoring occupancy and weather correction factors).

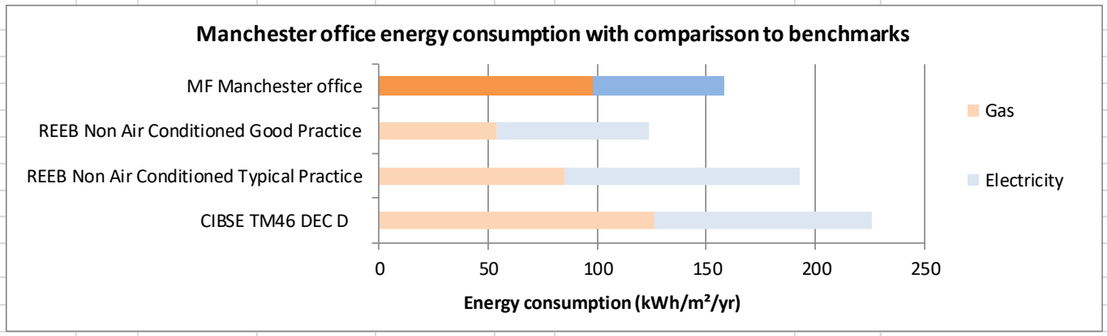
MAX FORDHAM

Manchester office: meter data analysis

Manchester office		
Building floor area (TFA)	194	m^2
Analysis period	from	26-Jun-18
	to	26-Jun-19

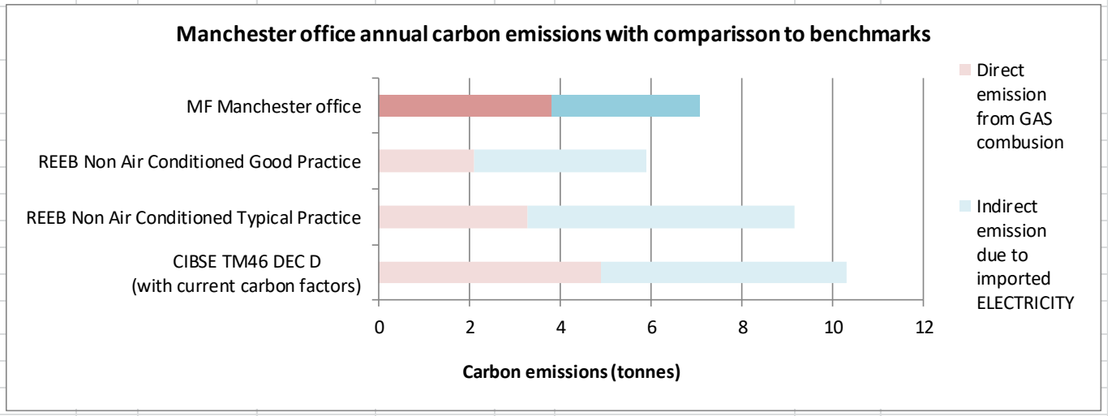
Energy

Indicator	kWh	kWh/m^2
Total annual energy consumption	30,677	158
Total Annual electricity consumption	11,652	60
Total Annual gas consumption	19,024	98
Total annual electricity generated by on-site renewables	0	0



Carbon

Indicator	t CO_2	Kg CO_2/m^2
Total annual indirect CO2e emissions from imported electricity	3	17
Total Annual direct CO2e emissions from combustion of gas on-site	4	20
Total Annual indirect CO2e emissions from combustion of fuel (all other sources eg heat network)	0	0
Total annual displaced CO2e emissions from electricity generated by on-site renewable energy sources minus storage losses	0.0	0.0
Total annual CO2 emissions	7	36
Total annual displaced CO2e emissions from offsets	greater than 7	greater than 36
Total annual net CO2e emissions	0	



Offsets

Amount and type of offsets procured, including relevant framework used	See main report
Expected verification processes	See main report
Cost per tonne of CO2e:	See main report

Carbon factors		
Taken from	UK Government GHG Conversion Factors for Company Reporting 2018	
URL	https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018	
Type	**Carbon factor**	
Natural gas	0.2	kgCO2e / kWh
Mains electricity consumed or generated	0.28	kgCO2e / kWh

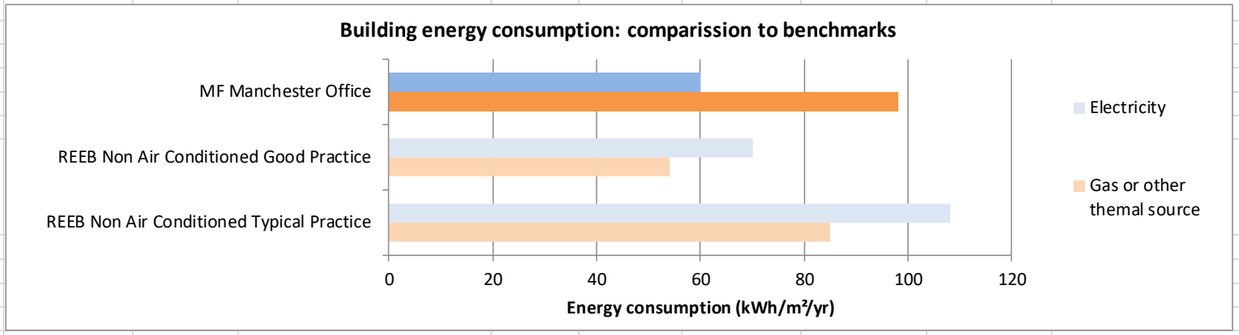
Manchester office: annual energy consumption and carbon emissions

Manchester office : meter data and analysis

June 2018 to June 2019

NOTES
Electricty taken from sub-meter data provided by Landlord
Gas taken from gas meter for whole building and scaled according to floor area

MF Manchester Office		
MF tenancy floor area (TFA = NIA in this case)	194	m²
Whole building floor area (NIA)	2075	m²
Stated in email from landlord		
MF floor area fraction	9%	
Analysis period		
From	26-Jun-18	
To	26-Jun-19	
	365	days



Electricity

Data taken from info provided by Landlord. Excerpts below.

Jun-18	93331	Jul-19	105941

Meter	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (kWh)	Data Source	Reading Type	Data Record Files (e.g. bills)	Data Collection Period (days)	Electricity used in the data collection period (kWhr)	Data collection to Analysis period correction factor	Electricity used in the data analysis period (kWhr)	Electricity used in the data analysis period (kWhr/m2/yr)	Notes
Landlord sub-meter	MF tenancy electricity	n/a	01-Jun-18	93,331	Email from Landlord	Taken by Landlord	MF Manc office floor area and meter data from Landlord Rev A.pdf						
Landlord sub-meter	MF tenancy electricity	n/a	01-Jul-19	105,941	Email from Landlord	Taken by Landlord	MF Manc office floor area and meter data from Landlord Rev A.pdf	395	12610	0.92	11652	60	

Estimate of annual electricity use	11652	kWh
Estimate of annual electricity use	60	kWhr/m2/yr

Gas

Data taken from copies of bills. Excerpts below

Gas Charges 01 Jun 18 to 30 Jun 18 (Non Daily Metered)

Meter Readings

Meter ID	Previous Read	Current Read	Units Used	Correction Factor	Calorific Value	Energy Used
M025K0143013D6	76354.0 (E)	76841.0 (E)	487.0m³	1.02264	39.6	5478.3kWh

Gas Charges 01 Jun 19 to 30 Jun 19 (Non Daily Metered)

Meter Readings

Meter ID	Previous Read	Current Read	Units Used	Correction Factor	Calorific Value	Energy Used
M025K0143013D6	95413.0 (Z)	95436.0 (Z)	23.0m³	1.02264	39.2	256.1kWh
	96098.0 (Z)	96119.0 (Z)	21.0m³	1.02264	38.8	231.5kWh

Unit conversions	
m3 to kWh	11

Meter	Area and Systems Served	Meter Reference Number	Meter Reading Date	Meter Reading (m3)	Data Source	Reading Type	Data Record Files (e.g. Bills)	Data Collection Period (days)	Units used in the data collection period (m3)	Gas used in the data collection period (kWhr)	Data collection to Analysis period correction factor	Gas used in the data analysis period (kWhr)	Notes
Whole building gas	Whole building heating and hot water	M025K0143013D6	01-Jun-18	76,354	Utility bill	Utility estimate	June 18 Gas Carvers.pdf						
Whole building gas	Whole building heating and hot water	M025K0143013D6	26-Jun-19	96,119	Utility bill	Utility smart	June 19 Gas Carvers.pdf	390	19,765	217415	0.94	203478	Whole building
Total gas used in the analysis period: whole building	203478	kWh					The Manchester office is not-air conditioned (is Nat Vent)						
MF tenancy floor area factor	9%												
Estimate for gas use associated with MF's tenancy	19024	kWh											
Estimate for gas use associated with MF's tenancy	98	kWhr/m2/yr											

5.0 APPENDIX B: BUILDING FLOOR AREAS

The following information (links to Valuation Office data) provides a way that a 3rd party auditor can check the floor areas we've reported and used and analysis area reasonable.

Office	General Address	Detailed Address (government record description)	Local Authority Ref.	Link to gov. data record	Valuation Office Rateable Net Internal Area (m2)	ECON 19 Office Type	ECON 19 conversion factor for TFA to NIA	Estimated Treated Floor Area, TFA by the V.O. method (m2)	V.O. method used for the TFA in further analysis?	TFA used in the energy and carbon analyses (m2)	% of total TFA for the 5 office portfolio	Estimate of total building floor area (including parts not leased by Max Fordham) (m2)
London	42-43 Gloucester Crescent London NW1 7PE	The Rotunda (inc Pt Rear Of Lgnd Flr Annex) 42, Gloucester Crescent, London, NW1 7PE	721004243071	https://www.tax.service.gov.uk/business-rates-find/summary/17716908000?uarn=7473842000	1,349	2	80%	1686	No, we've used drawings to calculate the TFA in this case	1,317	61%	2391
Cambridge	St Andrew's House 59 St Andrew's Street Cambridge CB2 3BZ	Suite A 3rd Flr, St Andrews House 59, St Andrews Street, Cambridge, CB2 3BZ	7690059172	https://www.tax.service.gov.uk/business-rates-find/summary/20353577000?uarn=7638958000	229	2	80%	286	No, we've used drawings to calculate the TFA in this case	238	11%	4028
Edinburgh	Exchange Place 3 3 Semple Street Edinburgh EH3 8BL	Exchange Place 3, 3(1F1) Semple Street, Edinburgh, EH3 8BL	130S1983(1F1)	https://www.saa.gov.uk/search/?SEARCHED=1&ST=&SEARCH_TERM=EH3+8BL&ASSESSOR_ID=&SEARCH_TABLE=valuation_roll_cpsplit&DISPLAY_COUNT=10&TYPE_FLAG=C&ORDER_BY=PROPERTY_ADDRESS&H_ORDER_BY=SET+DESC&R_ORDER_BY=SET+DESC&PT=1&DISPLAY_MODE=FULL&UARN=130S1983%281F1%29&PPRN=000000000456233&ASSESSOR_IDX=10#results	328	2	80%	409	No, we've used drawings to calculate the TFA in this case	326	15%	2700
Manchester	Carver's Warehouse 77 Dale Street Manchester M1 2HG	Pt 3rd Flr (right) Carvers Warehouse 77, Dale Street, Manchester, M1 2HG	3008635	https://www.tax.service.gov.uk/business-rates-find/summary/17361094000?uarn=6357045000	194	2	80%	243	No, we're used info form our Landlord who has stated the NIA	194	9%	2075
Bristol	Queen Square House 18-21 Queen Square Bristol BS1 4NH	Suite 1.6 1st Flr 18, Queen Square, Bristol, BS1 4NH	13191018567	https://www.tax.service.gov.uk/business-rates-find/list-valuations?searchBy=Postcode&postCodeQuery=bs14nh&streetQuery=&townQuery=&primaryCriteria=ADDRESS&baRef=&number=&street=&town=&postCode=&billingAuthority=&specialCategoryCode=&descriptionCode=&from=&to=&listYear=2017	68	2	80%	85	No, we've used drawings to calculate the TFA in this case	70	3%	3376
Note									Totals	**2,145**	**100%**	**14,570**
For the total building floors areas (including parts not leased by Max Fordham) listed above no distinction is made between NIA, TFA and GIA.									% of Total	15%		
Where we have used floor area fractions to calculate energy use estimates we have been consistent and used the ratios NIA/NIA or GIA/GIA (Max Fordham tenancy/whole building area).												

6.0 APPENDIX C: REFERENCES

1. **UKGBC .** Net Zero Carbon Buildings:A Framework Definition. [Online] 2019. https://www.ukgbc.org/wp-content/uploads/2019/04/Net-Zero-Carbon-Buildings-A-framework-definition.pdf.

2. **UK Government Valuation Office.** UK Government Valuation Office. [Online] https://www.gov.uk/topic/local-government/business-rates.

3. **Action Energy – formerly the Energy Efficiency Best Practice.** ECON 19: ENERGY CONSUMPTION GUIDE 19 Energy use in offices. [Online] DECEMBER 2000, MINOR REVISIONS, MARCH 2003. http://www.cibse.org/getmedia/7fb5616f-1ed7-4854-bf72-2dae1d8bde62/ECG19-Energy-Use-in-Offices-(formerly-ECON19.

4. **UK Government Department for Business, Energy & Industrial Strategy.** UK Government GHG Conversion Factors for Company Reporting. [Online] 2018. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018.

5. **Better Buildings Partnership.** 2017 REAL ESTATE. [Online] 2018. http://www.betterbuildingspartnership.co.uk/sites/default/files/media/attachment/REEB%20Benchmarking%202017_0.pdf.

6. **CIBSE.** *TM46: Energy benchmarks.* s.l. : CIBSE, 2008.

7. **AECOM.** London Carbon Offset Price: Greater London Authority. [Online] 2017. https://www.london.gov.uk/sites/default/files/london_carbon_offset_price_-_aecom_.pdf.

8. **Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy.** How to price carbon to reach net-zero emissions in the UK. [Online] 2019. http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/05/GRI_POLICY-REPORT_How-to-price-carbon-to-reach-net-zero-emissions-in-the-UK.pdf.

9. **Green Energy (UK) plc.** Our Energy. [Online] https://www.greenenergyuk.com/OurEnergy.

10. **JLL and Cushman & Wakefield.** Exchange Place Edinburgh. [Online] http://www.cushwakesales.com/Data/CWI197/en-GB/Documents/Edinburgh%20-%20Exchange%20Place%20-%20Brochure.pdf.

11. **Cambridge City Council.** Cambridge Historic Core Appraisal: St Andrew's Street. [Online] https://www.cambridge.gov.uk/media/2921/historic-core-appraisal-2016-st-andrews-street.pdf.

12. **Historic England.** QUEEN SQUARE HOUSE AND ATTACHED FRONT AREA WALLS AND PIERS. [Online] https://historicengland.org.uk/listing/the-list/list-entry/1202465.

13. **Town Centre Securities PLC.** TCS Creates Property Hub at Historic Carvers Warehouse. [Online] https://www.tcs-plc.co.uk/news/carvers-refurbishment-announced.

7.0 APPENDIX D: SUPPORTING DOCUMENTS

For each office a range of supporting documents are provided. Typically these are the copies of the sources of meter data information, such as copies of bills or reports from our Landlords.

See the documents in the following folders that accompany this report:

```
+---Appendix D _ Bristol Files
|   \---Gas Invoices
|         13275815.pdf
|         14144746.pdf
|
+---Appendix D _ Cambridge Files
|      MF Cambridge Office Electricity Meter Readings.xlsx
|
+---Appendix D _ Edinburgh Files
|      1 - Knight Frank Electricity Charges for June 2019.pdf
|      13 - T385030 - Elec RChg Jun 18.pdf
|      Exchange Place 3 Metering Set-up and readings 2018 -2019.xlsx
|
+---Appendix D _ London Files
|   |   Rotunda manual meter readings april 2019 to july 2019 by MF FM team.pdf
|   |   Rotunda metering FM team log book spreadsheet.xlsx
|   |
|   +---electricity
|   |      Rotunda elec meter bill copies 2018 to 2019.pdf
|   |
|   \---gas
|      +---Account 600233915
|      |      1 _ 600233915 feb 18 to apr 18.pdf
|      |      2 _ 600233915 apr 18 to jul 18.pdf
|      |      3 _ 600233915 jul 18 to nov 18.pdf
|      |      4 _ 600233915 nov 18 to feb 19.pdf
|      |      5 _ 600233915 mar 19 to may 19.pdf
|      |
|      \---Account 670065791 (600258116)
|            1 _ 600258116 may 18.JPG
|            10 _ 670065791 jun 19.pdf
|            2 _ 600258116 jun 18 to jul 18.JPG
|            3 _ 600258116 aug 18.JPG
|            4 _ 670065791 dec 18.pdf
|            5 _ 670065791 jan 19.pdf
|            6 _ 670065791 feb 19.pdf
|            7 _ 670065791 mar 19.pdf
|            8 _ 670065791 apr 19.pdf
|            9 _ 670065791 may 19.pdf
|
\---Appendix D _ Manchester Files
      June 18 Gas Carvers.pdf
      June 19 Gas Carvers.pdf
      MF Manc office floor area and meter data from Landlord Rev A.pdf
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