Feilden Fowles Studio UKGBC Net Zero Carbon Buildings Report

REV D

25.05.2021

This report covers the period April 2019 to March 2020.

Revision History:

Rev. A - First issue
Rev. B - Internal review
Rev. C - Revised comments
Rev. D - Revised formatting

CONTENTS

Image 01 - Feilden Fowles studio from the courtyard

INTRODUCTION

i. PURPOSE & SCOPE

Feilden Fowles Architects have produced this report (along with associated documents listed in the appendices) to provide the analysis, results, methods and evidence required to demonstrate that our office can 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 April 2019 to March 2020. Embodied (construction) emissions are not included in this analysis.

The report presents the building, energy and carbon emissions data specified in Appendix 1, the UKGBC Framework Definition . In addition to this, we also include discussion relating to if and how our office meets the qualitative characteristics of net zero carbon buildings for operational energy described by the UKGBC Framework Definition (highly energy efficient and powered by renewable energy).

ii. STRUCTURE OF THE REPORT

Section 1 of this report provides an introduction to Feilden Fowles and it's current studio. It sets out the business timeline and future plans to demount and re-erect the building in a new location, providing suitable context to future decisions.

Section 2 presents the data and results recorded from the studio. This is done through the use of meter readings and estimated bills. Also included is a discussion on how the studio meets the UKGBC Framework for being highly energy efficient and powered from renewable energy sources.

Section 3 considers the benefits of completing any short term fabric improvements to the studio. It then sets out the building strategy following the future studio move, including additional fabric improvements and installation of on-site renewables.

Section 4 explores our choice of carbon offsetting scheme, explaining our process and future plans to regularly revise our plans

Lastly, within Section 5 we have attached all of the relevant appendices to demonstrate that the Feilden Fowles' office can be deemed as net zero carbon.

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.*

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

- POLLUTERS PAY;
  As far as possible any emissions should be measured and offset at the time they occur, encouraging reduction and mitigation as first steps.

- 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.

- ENCOURAGE ACTION TODAY AND TIGHTEN REQUIREMENTS OVER TIME;
  The current UKGBC Framework provides high level principles and metrics to guide actions but does not include minimum standards of energy efficiency, but expects to do so in the future.

- REDUCE ENERGY DEMANDS AND CONSUMPTION SHOULD BE THE FIRST PRIORITY;
  For example, by improving natural daylighting to reduce artificial lighting demands.

- INCREASE RENEWABLE ENERGY SUPPLY'S;
  Incorporating on-site systems (such as a roof mounted PV array) helping support a decentralised energy system. On-site renewable energy reduces it's demands on the energy grid, making them 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's characteristics, 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.

iv. THIRD PARTY VERIFICATION

Max Fordham *https://www.maxfordham.com/*, are a UK-based building service engineering company, who will be brought in as a third party verifier's to audit our claims related to net zero carbon balance.

Max Fordham have achieve net zero carbon for all five of their offices, which are located in London, Cambridge, Edinburgh, Manchester and Bristol. They also have additional experience in environmental design, BREEAM and LEED assessments, and sustainability consultancy. Each member of their team are trained in electrical and mechanical engineering, environmental design and building physics.

v. TRANSPARENCY & DISCLOSURE

The methods used to calculate Feilden Folwes' studio's energy consumption and carbon emissions are described within this report. Included are references to the original sources of meter data readings, which has also been provided to the third party verifier. The carbon offsetting scheme which we have elected has been outlined.

The the data used for this report is from the period between April 2019 to March 2020, but future plans to move the studio to a new location have been taken into consideration. In addition to moving the studio, plans for an additional new office would be adopted, most likely using existing building stock.

Following verification of this report by Max Fordham, it is due to be published on our website.

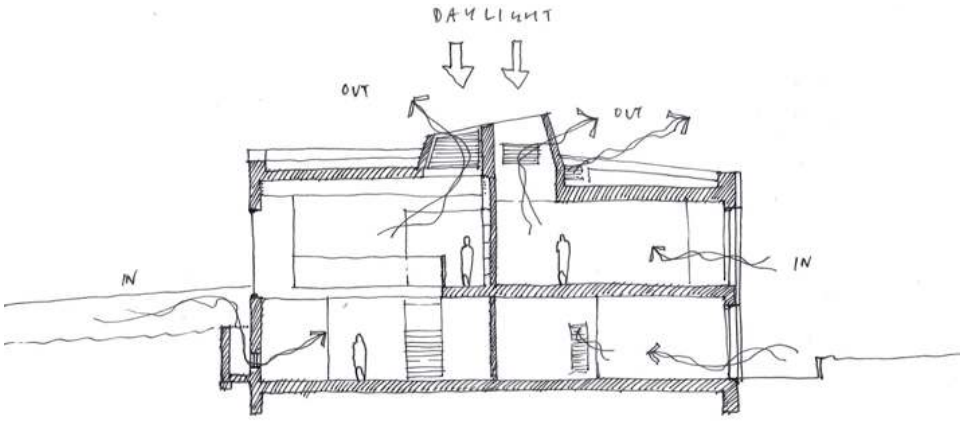
Image 02 - Feilden Fowles studio courtyard

BACKGROUND & CONTEXT

1.1 THE PRACTICE

Feilden Fowles was founded in 2009 by Fergus Feilden and Edmund Fowles. The practice now delivers a range of buildings across the UK, predominantly in the culture and education sectors. The practice currently consists of 21 staff members and occupies a single office in central London.

Within our work we aspire to create unique and adaptable environments fostering links to nature and employing passive design principles wherever possible. Projects are underpinned by a strategy of longevity over short-termism, through the use of robust yet adaptable structures. Careful foresight and planning ahead, through early stakeholder and end user consultation, and a well-considered masterplanning exercise is pertinent to ensuring longevity and sustainability of designs, or even creatively challenging the requirement for a new building up front. In turn, at the end of the project cycle we believe that post occupancy monitoring and evaluation returns important feedback and thus furthers our clients' and our own knowledge.



1.2 THE STUDIO

The entire studio has been designed to embody the values of the practice, as a demonstration of a rational, low impact, and low-cost structure that provides a model typology for contemporary work and education spaces.

FABRIC FIRST

The building form was conceived in conjunction with its cardinal orientation to harness the prevailing climatic conditions and minimise the amount of energy required to heat, cool, and light the space. The structure optimises solar gains in winter, stores heat in its exposed slab and employs southern overhanging eaves to prevent over-heating and glare in summer. Along the northern facade the timber frame projects at high level to incorporate plywood vent panels allowing passive cross-ventilation and articulate a clerestory which provides generous diffuse light.

Image 03 - Feilden Fowles studio

LEAN CONSTRUCTION

Considerable care was taken when procuring the materials for the building to ensure those with the lowest possible environmental impact were selected. The solid douglas fir timber frame was fabricated by Devon-based Timber Workshop, from timbers that were formed at Somerscales Mill in Grimsby and sourced from forests in Scotland, Cumbria and Hampshire.

The studio embodies an economical and rational approach to architecture, demonstrated by the tenet to use the least amount of material required for each building element to perform as needed. The datums and structural grid of the studio's timber frame were carefully calibrated to minimise the cuts and waste of sheathing and cladding materials. Moreover, the building elements have been rigorously designed to maximise their efficacy by providing multiple functions.

RE-ASSEMBLING THE STUDIO

The studio building was designed as a demountable structure, intended to be dismantled and re-erected when the lease of its current site at Waterloo came to an end. Thus, great care was given to the building's life cycle. The structure is formed from a repetitive portal frame, which is assembled using stainless steel pin connections, easily knocked-out when dismantling, and durable enough to be re-used. The migration of the studio building not only reduces potential landfill waste but limits the need for further extraction and production of materials in a new development.

1.3 THE BUSINESS TIMELINE & FUTURE STUDIO MOVE

Feilden Fowles studio's current lease comes to an end in 2022. After this point, the studio will be demounted and relocated to a site, most likely in Bath. In addition to this, we will look to acquire a second studio within London using existing building stock.

Given that the Feilden Fowles studio was only intended to remain in its current location for 4 years, the design did not include a permanent, integreated heating system or renewable energy source. This was considered inappropriate given the resources required to install and then subsequently relocate these systems, and that some elements would not have been able to be reused.

As a result of unforeseen delays to the redevelopment of the site the studio has been able to remain in its current location longer than originally conceived, and the lease is now due to come to an end in 2022.

1.4 STUDIO ENERGY USAGE

The studio is supplied by electricity from the grid (via a 100% renewable supplier). The heating is provided by portable electric radiators (oil filled), and additional cooling is proivded by portable, electric fans. The building is naturally ventilated aside from a small extract fan to the kitchen / WCs which is electrically operated. There is no gas supply to the studio and hence the only energy consumed is electricity.

Image 04 - Feilden Fowles studio - Structural model

METHODS & DATA

This section underlines the methods used in measuring and calculating the energy consumption and carbon emissions of our studio. This will allow us to compare our consumption and emissions to benchmarks and determine our offset targets.

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.*
- *Net lettable area (NLA): is a measurement of the total occupiable floor space taken from the inside surfaces of the exterior walls and/or the mid-line of any shared walls and excludes areas such as common stair wells, toilets, lift lobbies and vertical service ducts.*

Using drawings of the building we have determined internal floor area for the studio, in this instance we have used the treated floor area (TFA) as the basis for the energy and carbon emissions metrics. This method is 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."

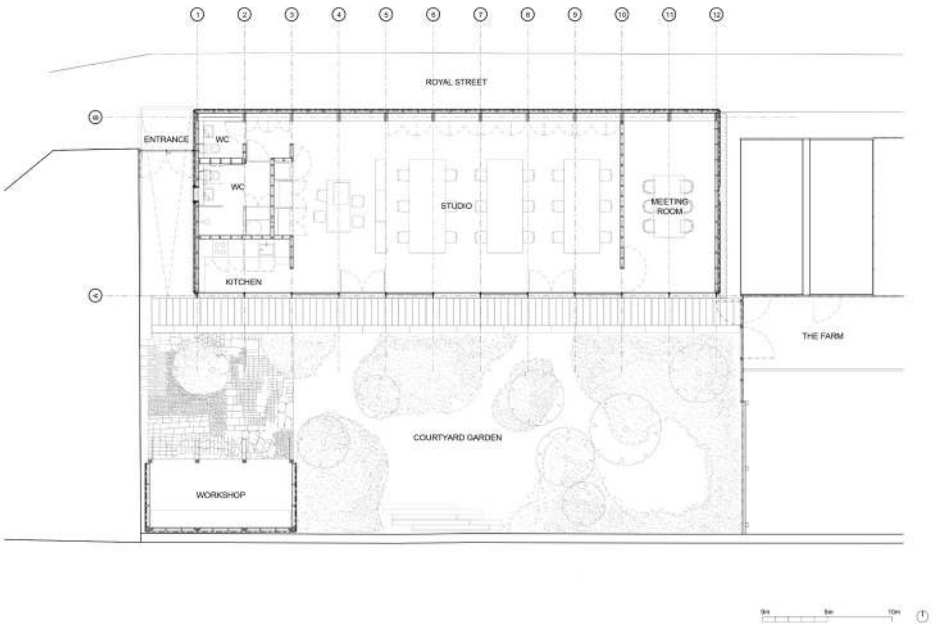


Image 05 - Feilden Fowles studio ground floor plan

The Feilden Fowles Studio is a 'Type 2 - Naturally Ventilated open-plan' with a TFA of:

Studio:	*133.0 sqm*
Garden Room:	*16.2 sqm*
Total:	*149.2 sqm*

Floor Area Conversions

The benchmarks we will be comparing our emissions data to commonly use GIA

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

Table 02: ECON 19 floor area conversion factors

Image 06 - Feilden Fowles studio interior

2.2 METER READINGS AND ESTIMATED BILLS

We have based our energy consumption estimates on monthly estimated meter readings from our energy supplier and actual meter readings.

The electric meter readings were are available are intermittent intervals depending on when the supplier required this information for billing. Furthermore the first lockdown of the COVID-19 pandemic meant that from April 2020 there was a period where minimal electricity was used in the office as the building was unoccupied. We have selected a period from the start of April 2019 to the end of March 2020 for the assessment. We have actual meter readings at the start and end of this period and it also avoids the unoccupied period. This is the most up to date information available pre-COVID-19, and therefore has been used for this assessment.

For future assessments the office intends to take its own meter readings to provide the most accurate information possible.

2.3 FUEL AND ELECTRICITY CARBON FACTORS

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

Type	Carbon Factor (kgCO2 / KWh)
Natural Gas	0.2
Mains Electricity consumed or displaced by on-site generation	0.23

Table 03: Carbon Factor

2.4 COMPARISON TO SIMILAR BUILDINGS

In this report we will be making comparisons of our studios energy consumption estimates to the following benchmark data.

REEB (Real Estate Environmental Benchmark) provides a benchmark of operational environmental performance for commercial property in the UK. REEBs annual utility consumption data is taken on a 3-year rolling average with updates each year. The data we will be comparing our energy consumption to is from 2019 with a sample size of 405 air-conditioned and 103 non air-conditioned buildings. The REEB benchmark is measured using the NLA. To make an accurate comparison we have used ECON 19 floor area conversion factors (table 02) to convert their metrics into TFA.

Our energy consumption estimate will also be compared to the benchmark provided by CIBSE TM46 to accompany the production of Display Energy Certificates for use in England, Wales and Northern Ireland. The TM46 benchmark rate is approximately representative of a DEC rating of D. The DEC rating is calculated using different carbon factors, weather and occupancy correction factors and implements different floor areas to the calculations we have undertaken for our studio. We are therefore only able to make approximate comparisons to the CIBSE TM46 benchmarks.

We will be comparing our studio primarily to the REEB benchmarks and best-practice for non air-conditioned buildings. Secondarily we will be comparing to the CIBSE TM46 (DEC D) benchmarks as these will be less comparable approximations.

Dates of achievement
April 2019 to March 2020

Verified by
See Section 0 (.iv) Third Party Verifiication

Building location
8 Royal Street
London, SE1 7LL

Building type
Type 2 - Naturally ventilated open-plan

Building description
See Section 1.2

Energy efficiency features
See Section 1.2

Energy Supplier and Tariff
Green Energy UK - 100% Renewable Tariff

Renewable energy sources
No renewable energy source currently on-site

Energy Scope
We own and occupy the entire property and have full control over the energy used within the studio

Assessed floor area
Floor area used for the energy and carbon metrics is treated floor area (TFA). The total TFA for the Feilden Fowles studio is 149.2 sqm

Percentage of total building area
Feilden Fowles occupies all of the total studio floor area. The TFA assessed is outlined in Section 2.1

Emission factors
See Section 2.3

Data sources
Copies of the data sources have been outlined in the Appendix's

Metering
See Section 2.2

Building energy use and carbon emissions estimates
On the next page, we present the energy consumption and carbon emissions data for the Feilden Fowles studio. How we arrived at these figure is detailed in the 'Methods & Data' section (Section 2).

Feilden Fowles Studio	REV A 01.02.21											
Electricity Bills												
Green Energy UK	100% Renewable Energy Supplier and Tariff											
	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20
Monthly Estimated Meter Readings kWh	*942*	***5476***	*1112*	*1143*	*1051*	*1123*	*1256*	*1340*	*2410*	*2802*	*1086*	*1121*
Actual Meter Readings kWh		42340								52167		
Energy Consumption Total annual energy consumption	20,862.0 kWh											

***Bold meter reading (May 2019) is higher due to underestimated meter readings in the preceding 6 months.**

The studio meter readings were reviewed for the last three years. The selected April 2019 - March 2020 is consistent with the average earlier usage and includes two actual meter readings.

It is also the most up to date information available pre COVID.

Office Floor Area (GIA / TFA)

Gross Internal Area (GIA) / CIBSE recommend using Treated floor area (TFA): gross areas less plant rooms and other areas (e.g. stores, covered car parking, and roof spaces) not directly heated.

Feilden Fowles Studio classes as Office Type 2, Naturally ventilated, open plan

GIA	
Studio	140.0 sqm
Garden Room	17.0 sqm
Total	157.0 sqm
Usage (GIA)	132.9 kWh / m2/yr
TFA	
Studio	133.0 sqm
Garden Room	16.2 sqm
Total Treated Floor Area	149.2 sqm
Usage (TFA)	139.8 kWh / m2/yr

Total annual indirect CO2e emissions from imported electricity (although note 100% renewable tariff - refer to assumptions)	4.8	32.2
Total annual displaced CO2e emissions from offsets	< 4.8	< 32.2

Carbon Factors

Based on Mains electricity consumed or generated 0.23 kgCO2e / kwh

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

	Energy Usage		CO2 Emitted	
GIA	132.9	kWh / m2/yr	37.2	kg CO2/m2
TFA	139.8	kWh / m2/yr	32.2	kg CO2/m2

BUILDING ENERGY USE AND CARBON EMISSIONS ESTIMATES

On the next page, we present the energy consumption and carbon emissions data for Feilden Fowles' studio. How we arrived at these figure is detailed in the 'Methods & Data' section (Section 2).

RESULTS AND DISCUSSION OF ENERGY AND CARBON EMISSIONS ESTIMATES

a) Quality of energy data

The energy data for our studio is of a high quality as it is procured from our energy supplier through meter readings. As the sole tenants, owners and designers of the studio we have been able to accurately define the TFA of our premises to calculate our annual energy usage.

b) How energy ffficient is our studio?

Through calculating the TFA of our studio and annual energy meter readings we have calculated that our studio uses - 139.8 KWh/m^2/yr.
Overall this equates to 5.8 tonnes of CO_2 emitted in this period.
Our studio uses 13.47% less energy per m^2/year than the REEB Good benchmark and 0.07% less energy per m^2/year than the CIBSE Guide F Good Practice.

Benchmark comparisons are illustrated in the below graph.

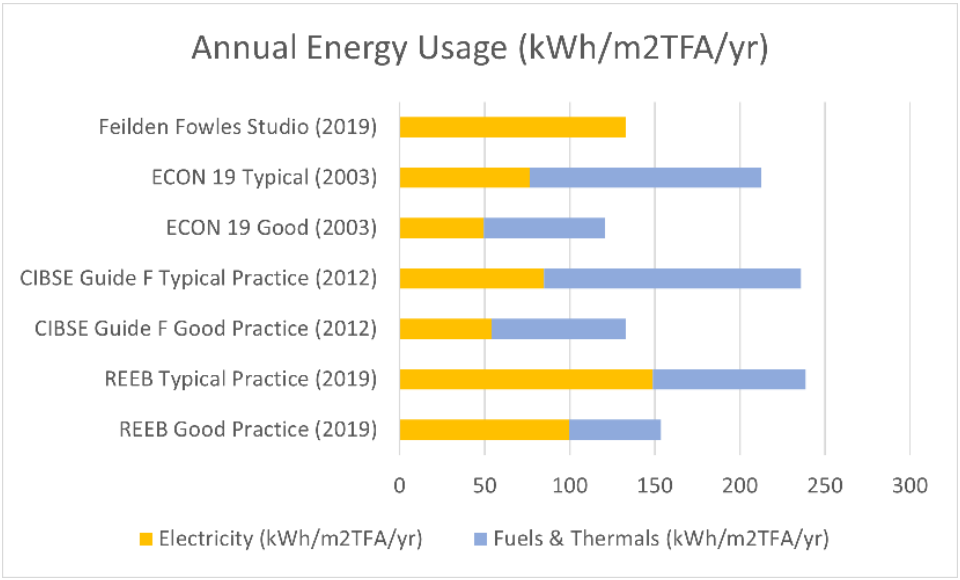


Table 04 - Annual energy usage comparisons

BUILDING IMPROVEMENTS

3.1 POST-OCCUPANCY ANALYSIS

Since the completion of the studio in 2016, we have learned many valuable lessons. Reflection on our occupancy over the past 4 years has helped inform our approach to future fabric improvements for the studio when we relocate in 2022.

The studio does not currently have an integrated heating system which requires the use of electric oil heaters in the winter months. This would ideally be replaced with an integrated passive system powered by on site renewables.

3.2 SHORT TERM FABRIC IMPROVEMENTS

It is not considered appropriate to make building improvements, such as adding an on-site renewable energy source, given the limited time left on the current lease and a risk of not being able to reuse all the elements used. The practice is currently obtaining planning permission for the building to be relocated onto its new site and the building improvements which are most suitable on the Waterloo site may not necessarily be the same as those on the new site.

3.3 FUTURE FABRIC IMPROVEMENTS

When the studio relocates to its new location, there are planned fabric improvements which will be undertaken to ensure that the office emissions are reduced. This is in alignment with the Oxford Offsetting Principle 1 to cut emissions and reduce the need to achieve net zero.

This future fabric improvements will likely include (but not be limited to):

- *Increasing the insulation within the walls;*
- *Laying an insulated limecrete slab or suspended timber floor, depending on the new site;*
- *Improving the glazing on the southern face, for better thermal performance.*

Possible implementation of system efficiency:

- *Adding MVHR units;*
- *Adding a permanent heating system;*
- *Improving the air tightness performance.*

3.4 FUTURE USE OF RENEWABLE

We are also seeking to implement on-site renewable energy sources when the studio is relocated. This will likely be PV (photovoltaics) panels capturing solar energy or a ground/air-source heat pump.

As a practice we see the goal of net zero as the first step in a journey towards having a positive impact on our environment. As we develop renewable energy infrastructure on our sites we aim to produce more energy than is needed by the practice so we can sell back to the grid and take an active role in the green energy production.

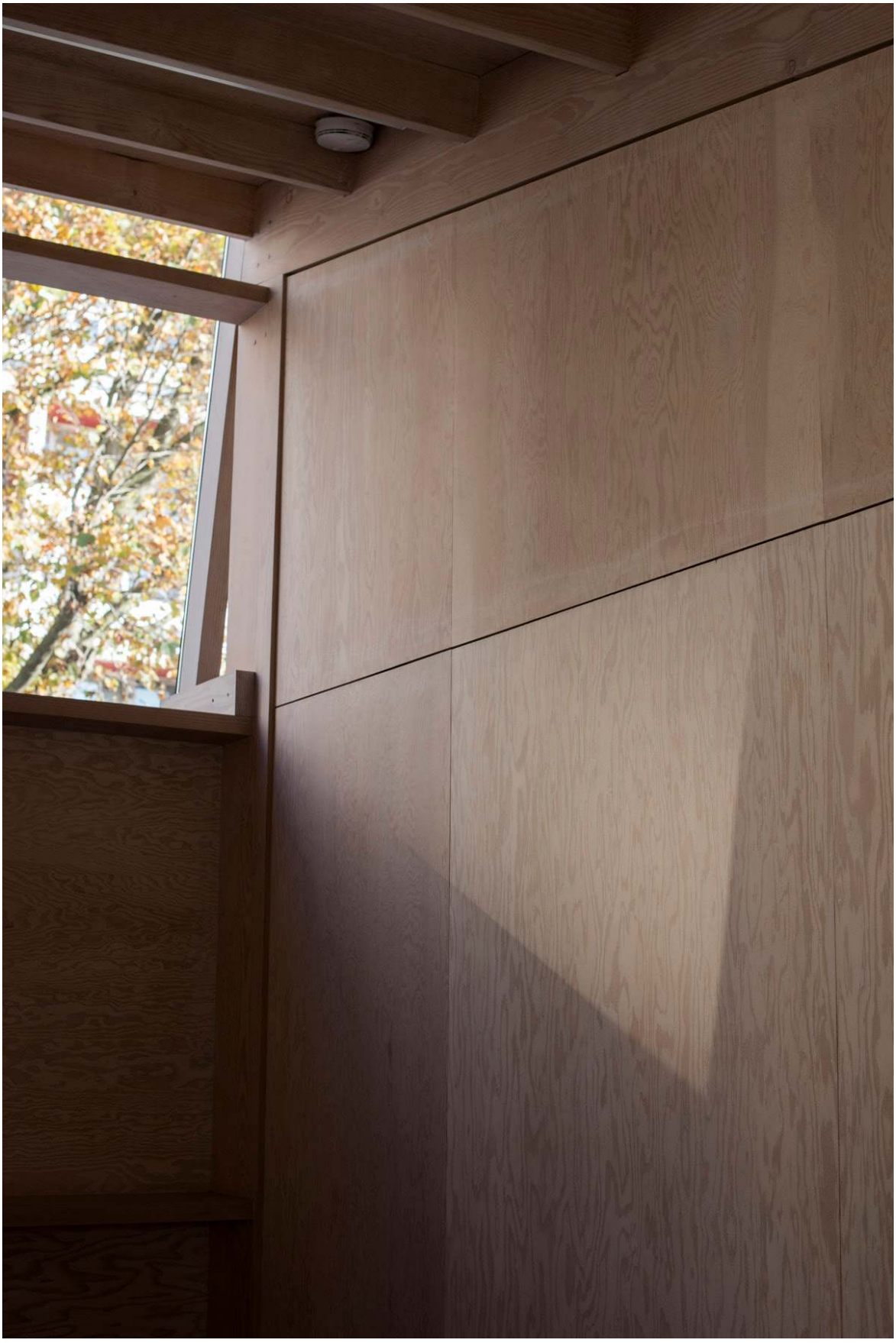


Image 07 - Feilden Fowles studio interior detail

CARBON OFFSETTING

4.1 CHOICE OF CARBON OFFSETTING SCHEME

There are a variety of carbon offsetting schemes to choose from on the market. Research and analysis of these schemes was key to finding a portfolio which reflects the ambitions and principles of Feilden Fowles. In the process we used Max Fordham's 'Carbon Offsetting Guidance' as a useful resource in providing an oversight into what is on the market, plus a price rationale, to evaluate our carbon price £/tCO2.

Some of the schemes which are available to purchase are:

- *UK Tree Planting - this scheme coordinates planting of native British broad-leaved trees.*
- *Solar Schools - this scheme coordinates the installation of solar PVs into schools across the UK. Energy savings equate to cost savings for schools that can be put to academic use. Our programme supports installations of systems including 4kW, 8kW and 10kW power.*
- *Forest Carbon - leading UK woodland creation for carbon capture. The scheme is assured by the UK government's Woodland Carbon Code and the IUCN's Peatland Code.*

Our duty as built environment professionals requires us to positively impact our society and the natural world. We have therefore chosen to invest our carbon offsetting fund into UK woodland creation with the ambition of sequestering more carbon than we currently emit whilst aiding in the development of environment and ecosystems.

4.2 ANNUAL CARBON OFFSET FUND

To determine the amount of funding we provide to offset our carbon emissions we have looked at a number of carbon offsetting options. The amount that can be paid to offset carbon varies widely. We have chosen to follow the guidance of Max Fordham who have been informed by studies undertaken by AECOM and the CCCEP (The Centre for Climate Change Economics and Policy) who recommend between 32-191 £t/CO2e and 40-100 £/tCO2e respectively. We have therefore chosen to voluntarily commit 100 £tCO2eto our carbon offsetting fund.

4.3 ANNUAL RE-ASSESSMENT

Every year we will reassess our carbon emissions to determine how much we contribute to our annual carbon fund. This also provides the valuable opportunity to track our progress in reducing overall emissions and will give us insights into the effectiveness of our attempts to reduce our overall emissions.

In line with the Oxford principles in carbon offsetting our primary aim is to reduce our carbon emissions in the future as much as possible. As a growing practice it is unlikely that we will be able to reduce our energy needs to the point that it will not be necessary to offset our emissions. Therefore as the practice grows we aim to build up our renewable energy infrastructure in line with our growth.

This will be achieved by procuring a plot of brownfield land to re-wild, allowing us to offset carbon emissions ourselves by planting and maintaining woodland. By taking on the responsibility of creating and maintaining woodland we would be able to develop a diverse environment of native tree species and create new habitat for wildlife in a holistic manner.

The development of our own land would also allow us to explore additional practices in sequestering carbon on a long-term basis. This will include establishing renewable energy sources on the site to give back to the grid to further offset our emissions.

Image 08 - The studio shares a site with Waterloo City Farm

CONCLUSION

In summary, after having underggone our initial assessment, we understand Feilden Fowles studio is deemed to be a net zero carbon builidng in accordance with the UKGBC framework described herein.

Effectively, whilst our energy is sourced from a 100% green energy supplier, meaning that carbon offsetting is not required to achieve net zero carbon status, we believe that in order to incentivise a lower energy consumption, and uphold our environonmental values, that voluntarily offsetting our emissions via our elected scheme is the appropriate action.

We look forward to continuing our assessment of the studio, and monitoring future progress particularly when it comes to the relocation of the existing studio, in order to take advanctage of increasing the existing fabric efficiency, and with the potenital to introduce on site renewable energy generation methods.

APPENDIX

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. 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.

3. Better Buildings Partnership. 2019 REAL ESTATE. [Online] 2019. https://www.betterbuildingspartnership.co.uk/real-estate-environmental-benchmark-2019

4. Department for Business, Energy & Indistrial Stratergy. GHG Conversion Factors for Company Reporting. UK Government. [Online] 2020. https://www.gov.uk/government/publications/greenhouse-gas-reportingconversion-factors-2020

5. CIBSE. Guide F: Energy benchmarks, Benchmarking Tool : CIBSE, 2012. https://www.cibse.org/Knowledge/Benchmarking

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

7. 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/wpcontent/uploads/2019/05/GRI_POLICY-REPORT_How-to-price-carbon-toreach-net-zero-emissions-in-the-UK.pdf.

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