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Anglia Square, Norwich
Energy Assessment and Sustainability Strategy Report

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Weston Homes

Anglia Square, Norwich

Energy Assessment and Sustainability Strategy Report

Planning Issue

Issue P2 – 05 April 2022

Weston Homes

MEINHARDT

ANGLIA SQUARE, NORWICH

ENERGY ASSESSMENT AND SUSTAINABILITY STRATEGY REPORT

PLANNING ISSUE

Quality Assurance Page

Issue	Date	Prepared By	Checked By	Approved By	Remarks
P1	24/3/2022	Mr R. Wilkes			Draft Issue
P2	5/4/2022	Mr R. Wilkes			Planning Issue

Figure 1: Illustrative aerial view of the proposed development

Table of Contents

1 Executive Summary

1.1 Introduction

This Energy Assessment and Sustainability Strategy Report has been prepared by Meinhardt (UK) Ltd on behalf of Weston Homes (the Applicant) in support of a hybrid (part detailed/part outline) planning application submitted to Norwich City Council (NCC) for the comprehensive redevelopment of Anglia Square and various parcels of mostly open surrounding land (the Site) as shown within a red line on drawing '35301-ZZ-00-DR-A-01-0200'.

The Site is located in a highly accessible position within the northern part of Norwich City Centre and comprises a significant element of the Anglia Square/Magdalen Street/St Augustines Large District Centre, (the LDC). It is thus of strategic importance to the City, and accordingly has been identified for redevelopment for many years within various local planning policy documents, including the Northern City Centre Area Action Plan 2010, (NCCAAP), (now expired), the Joint Core Strategy for Broadland, Norwich and South Norfolk 2014, (JCS), and NCC's Anglia Square and Surrounding Area Policy Guidance Note 2017, (PGN). The Site forms the principal part of an allocation (GNLP 0506) in the emerging Greater Norwich Local Plan (GNLP).

This application follows a previous application on a somewhat smaller development parcel, (NCC Ref. 18/00330/F) made jointly by Weston Homes Plc as development partner and Columbia Threadneedle Investments, (CTI), the Site's owner, for a residential-led mixed use scheme consisting of up to 1250 dwellings with decked parking, and 11,000 sqm GEA flexible ground floor retail/commercial/non-residential institution floorspace, hotel, cinema, multi-storey public car park, place of worship, and associated public realm and highway works. This was subject to a Call-in by the Secretary of State (PINS Ref. APP/G2625/V/19/3225505) who refused planning permission on 12th November 2020, (the 'Call in Scheme').

In April 2021, following new negotiations with Site owner CTI, Weston Homes decided to explore the potential for securing planning permission for an alternative scheme via an extensive programme of public and stakeholder engagement, from the earliest concepts to a fully worked up application. The negotiations with CTI have secured a "Subject to Planning" contract to purchase the Site, (enlarged to include the southeastern part of Anglia Square fronting Magdalen Street and St Crispins Road), which has enabled a completely fresh approach to establishing a redevelopment scheme for Anglia Square. This has resulted in a different development brief for the scheme, being to create a replacement part of the larger LDC suited to the flexible needs of a wide range of retail, service, business and community uses, reflective of trends in town centre character, integrated with the introduction of homes across the Site, within a highly permeable layout, well connected to its surroundings.

The new development proposal seeks to comprehensively redevelop the Site to provide up to 8,000 sq m Net Internal Area, (NIA), flexible commercial and other non-residential floorspace and up to 1,100 new residential dwellings (the Proposed Development). These figures are maxima in view of the hybrid nature of the application. This proposes part of the scheme designed in full, to accommodate 6,062 sq m non-residential floorspace and 367 dwellings, with the remaining large part of the Site for later detailed design as a "Reserved Matters" application, up to those maxima figures.

This Energy Assessment and Sustainability Strategy Report demonstrates to Norwich City Council how the scheme satisfies national, regional, and local planning guidance in relation to sustainability and climate change mitigation/adaption.

As this is a hybrid application, the report demonstrates the strategy for the detailed application based on a full assessment including appropriate modelling. The report also provides an overview of the expected strategy for the outline application area including estimates of the carbon reductions that are likely to be achieved.

1.2 Carbon Reduction Policy and Targets

1.2.1 National Planning Policy Framework (NPPF)

The NPPF recommends that plans should take a proactive approach to mitigating and adapting to climate change. New development should take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Plans should provide a positive strategy for the use and supply of renewable and low carbon energy and heat, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts).

1.2.2 Greenhouse Gas Emissions Policy

In June 2019 the UK Government made a commitment to bring all greenhouse gas emissions to net zero by 2050. This has been followed by further commitments in December 2020 and April 2021, to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

Norwich City Council have recently set a revised target of achieving net zero emissions across the city by 2045.

1.2.3 Building Regulations

An updated Building Regulations Part L was published in December 2021 that will deliver a 30% reduction in carbon emissions for domestic buildings and a 27% reduction for non-domestic, when introduced in June 2022.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

1.2.4 Joint Core Strategy (JCS) for Broadland, Norwich and South Norfolk

Development should include sources of decentralised and renewable or low-carbon energy providing at least 10% of the scheme's expected energy requirements.

Renewable energy generation schemes will be strongly promoted and encouraged as part of development proposals where reasonably practicable.

1.2.5 Emerging Draft Greater Norwich Local Plan (GNLP)

There is an emerging development plan, the Greater Norwich Local Plan (GNLP) which is being prepared by Broadland DC, South Norfolk Council, NCC and Norfolk County Council, (the Partnership), that will supersede the Joint Core Strategy for Broadland, Norwich and South Norfolk (2014) (JCS) and Norwich Site Allocations and Site Specific Policies Local Plan (2014) (NSASSP) once adopted. The GNLP Reg 19 version was submitted to the Secretary of State for examination on 30th July 2021.

The examination process is underway, for which hearing sessions took place during February and March 2022. As a result of the hearings, many policies, including the emerging allocation for the Site were subject to debate, addressing their soundness and the consequential need for amendment, alongside requests for additional information by the Inspectors. It is therefore considered likely the Council will prepare and consult upon Modifications or at least minor changes to both policy text and supporting text, relevant to this application. This process, and the publication of the Inspectors' report may extend beyond the determination of this application, and so final GNLP policy wording may not be available at that stage.

Paragraph 48 of the National Planning Policy Framework 2021 (NPPF) requires decision makers to give weight to relevant policies of emerging Local Plans according to the stage of preparation, the extent of unresolved objections, and the degree of consistency between emerging policies and the NPPF. In this instance, there are currently unresolved objections, in respect of some of which the Inspectors have requested additional information, and accordingly there are likely to be Modifications to some policies relevant to this application before they can be considered sound. On this basis, it is considered that in respect of those policies, the

emerging development plan currently holds limited weight in decision making. In this context, those policies are not considered in detail.

The GNLP requires development to minimise energy demand through the design and orientation and maximise the use of sustainable energy, local energy networks and battery storage.

All new development should provide a 19% reduction against Part L of the 2013 Building Regulations.

1.3 Detailed Application (Blocks A, B, C, D, KL, M, J3)

1.3.1 Carbon Reduction Strategy

The energy strategy for the detailed application follows the normal energy hierarchy approach of Be Lean, Be Clean and Be Green as below to reduce carbon emissions.

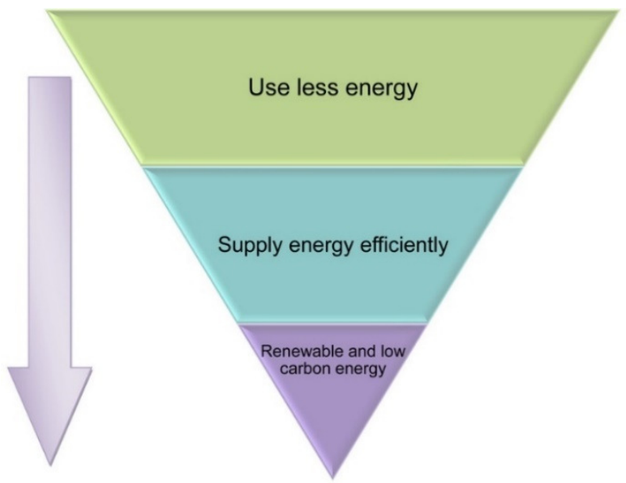


Figure 2: The energy hierarchy

The residential areas of the detailed application have been assessed using Elmhurst Energy's updated version of the Standard Assessment Procedure (SAP) - Design SAP 10 Beta - which has been released to reflect the confirmed updates to the Building Regulations which take effect later this year.

The final updated SAP methodology has not yet been released by the Ministry of Housing, Communities and Local Government, so Design SAP Beta provides the best indication currently available of the performance of the residential dwellings against the version of Building Regulations applicable when they are constructed.

SAP 10 Beta uses the SAP 10.1 methodology and carbon emission factors.

For the residential parts of the detailed application, performance against Part L 2013 has been estimated by applying the Part L 2013 (SAP2012) carbon emission factors to the SAP 10 Beta results.

The non-residential areas of the detailed application have been assessed using IES dynamic thermal modelling software (SBEM) in line with the latest National Calculation Methodology (NCM) guidance which reflects the requirements of Part L 2013.

There is currently no SBEM software available to demonstrate compliance with Part L 2021, so for the non-residential areas of the detailed application performance against Part L 2021 has been estimated by applying the SAP 10.1 carbon emission factors to the Part L 2013 SBEM results.

1.3.2 Carbon Reductions

Domestic Carbon Emissions and Savings (Detailed Application)

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential parts of the detailed application.

The graph demonstrates that the residential element of the detailed application achieves an overall on-site reduction of 63.2% in regulated carbon dioxide emissions over Part L 2021 (around 70.9% over Part L 2013).

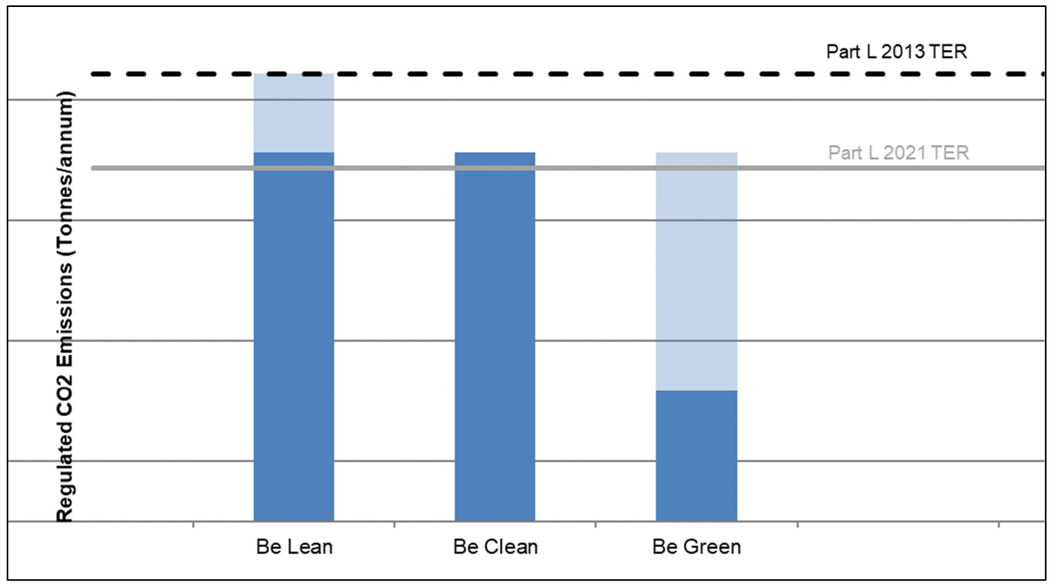


Figure 3: Domestic energy hierarchy for the detailed application

Energy demand in the residential areas has been significantly reduced, achieving a reduction of around 17.5% in regulated carbon emissions over Part L 2013 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the domestic elements.

	Carbon dioxide emissions for domestic buildings (Tonnes CO_2 per annum)		
	Regulated Building Regs 2013 (SAP 2012 Emission Factors)	**Regulated Building Regs 2021 (SAP 10.1)**	**Unregulated (SAP 10.1 Emission Factors)**
Baseline:	385.3	304.6	98.4
Be Lean: After energy demand reduction	363.5	317.9	83.4
Be Clean: After heat network	363.5	317.9	83.4
Be Green: After renewable energy	427.3	112.0	83.4

Table 1: Carbon dioxide emissions for domestic elements of the detailed application

	Regulated domestic carbon dioxide savings over Part L 2013 Baseline		Regulated domestic carbon dioxide savings over Part L 2021 Baseline	
	Tonnes CO_2 per annum	%	Tonnes CO_2 per annum	%
Be lean: Savings from energy demand reduction	67.4	17.5%	-13.2	-4.3%
Be clean: Savings from heat network	0.0	0.0%	0.0	0.0%
Be green: Savings from renewable energy	205.9	53.4%	205.9	67.6%
Cumulative on site savings	273.3	70.9%	192.7	63.2%

Table 2: Carbon dioxide savings for domestic elements of the detailed application

Non-Domestic Carbon Emissions and Savings (Detailed Application)

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the non-residential parts of the detailed application.

The graph demonstrates that the non-residential element of the detailed application achieves an overall on-site reduction of 46.5% in regulated carbon dioxide emissions over Part L 2021 (around 83.7% over Part L 2013).

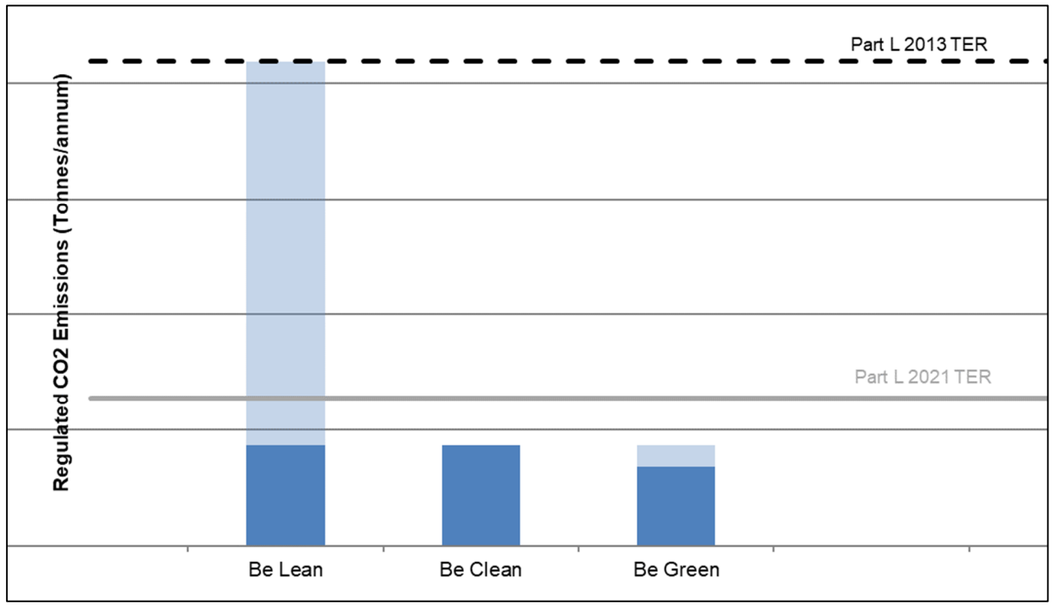


Figure 4: Non-domestic energy hierarchy for the detailed application

Energy demand in the non-residential areas has been significantly reduced, achieving a reduction of 32.1% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the non-domestic elements.

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)		
	Regulated Building Regs 2013 (SAP 2012 Emission Factors)	Regulated Building Regs 2021 (SAP 10.1)	Unregulated (SAP 10.1 Emission Factors)
Baseline:	209.3	63.8	25.4
Be Lean: After energy demand reduction	134.2	43.3	21.1
Be Clean: After heat network	134.2	43.3	21.1
Be Green: After renewable energy	130.2	34.1	21.1

Table 3: Carbon dioxide emissions for non-domestic elements of the detailed application

	Regulated non-domestic carbon dioxide savings over Part L 2013 Baseline		Regulated non-domestic carbon dioxide savings over Part L 2021 Baseline	
	Tonnes CO_2 per annum	%	Tonnes CO_2 per annum	%
Be lean: Savings from energy demand reduction	166.0	79.3%	20.5	32.1%
Be clean: Savings from heat network	0.0	0.0%	0.0	0.0%
Be green: Savings from renewable energy	9.2	4.4%	9.2	14.4%
Cumulative on site savings	175.2	83.7%	29.7	46.5%

Table 4: Regulated carbon dioxide savings for non-domestic elements of the detailed application

Total Carbon Emissions and Savings

The table below details the overall carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the detailed application.

	Total regulated emissions (Tonnes CO_2/year)	CO_2 savings (Tonnes CO_2/year)	Percentage saving (%)
Part L 2021 baseline	368.4		
Be Lean	361.2	7.3	2.0%
Be Clean	361.2	0.0	0.0%
Be Green	146.2	215.1	58.4%
Cumulative on site savings		222.3	60.3%

Table 5: Total regulated carbon dioxide emissions and savings for the detailed application

The table above demonstrates that the detailed application as a whole achieves an on-site reduction of 60.3% in regulated carbon dioxide emissions over Part L 2021 (and around 75.4% over Part L 2013) considerably exceeding the emerging draft GNLP target of 19% reduction against Part L 2013.

1.3.3 Demand Reduction (Be Lean)

As detailed above, energy demand will be significantly reduced beyond Part L requirements, achieving an overall 2.0% reduction in carbon emissions over Part L 2021 (around 39.7% over Part L 2013) for the detailed application, through passive design and energy efficiency measures alone.

The reduction will be achieved by a combination of measures, which shall include the following;

- Compact building massing;
- Highly insulated building fabric;
- Airtight building fabric;
- Significantly reduced thermal bridging;
- Optimised size, shape, orientation and g-value of the glazing to provide the best balance between the following;-
    - Minimising summer solar gain (to reduce risk of overheating)
    - Maximising beneficial solar gain in winter (to reduce heating demand)
    - Minimising winter heat loss (to reduce heating demand)
    - Maximising natural daylight (to reduce lighting energy)
- Natural ventilation via openable windows;
- High efficiency mechanical ventilation systems for background ventilation;
- Reduced heat loss from heating and hot water systems;
- Low energy lighting;
- Controls systems to monitor and operate the plant and equipment as efficiently as possible; and
- Smart metering.

1.3.4 Heating Infrastructure (Be Clean)

Investigations have confirmed that there are no existing district heating networks in the vicinity of this site, as demonstrated on the below extract from the Greater Norwich Energy Infrastructure Study (2019). There were also no planned heat networks of significant scale identified within the study area.

With consideration of local air quality and the longer term net zero emissions targets, it is proposed to generate heat via electrical means rather than use fossil fuels.

Domestic hot water accounts for almost 62% of the regulated energy demand for the residential areas of the detailed application, so it is critical to provide a heating solution that maximises efficiency at the higher temperatures required for domestic hot water. It is therefore proposed to install a dedicated air source heat pump in each apartment that is specifically designed to operate at high temperatures to provide the domestic hot water for each dwelling.

The proposed heat pumps are the Dimplex Edel which use a refrigerant with an extremely low Global Warming Potential (GWP) of only 3 and when coupled with appropriate thermal storage, will achieve a very high overall seasonal efficiency of between 343 and 349% across the whole year (depending on the size of apartment).

Due to the energy demand reduction measures incorporated in the design, the space heating demand in the residential dwellings is very low, so it is proposed to provide local electric panel heaters.

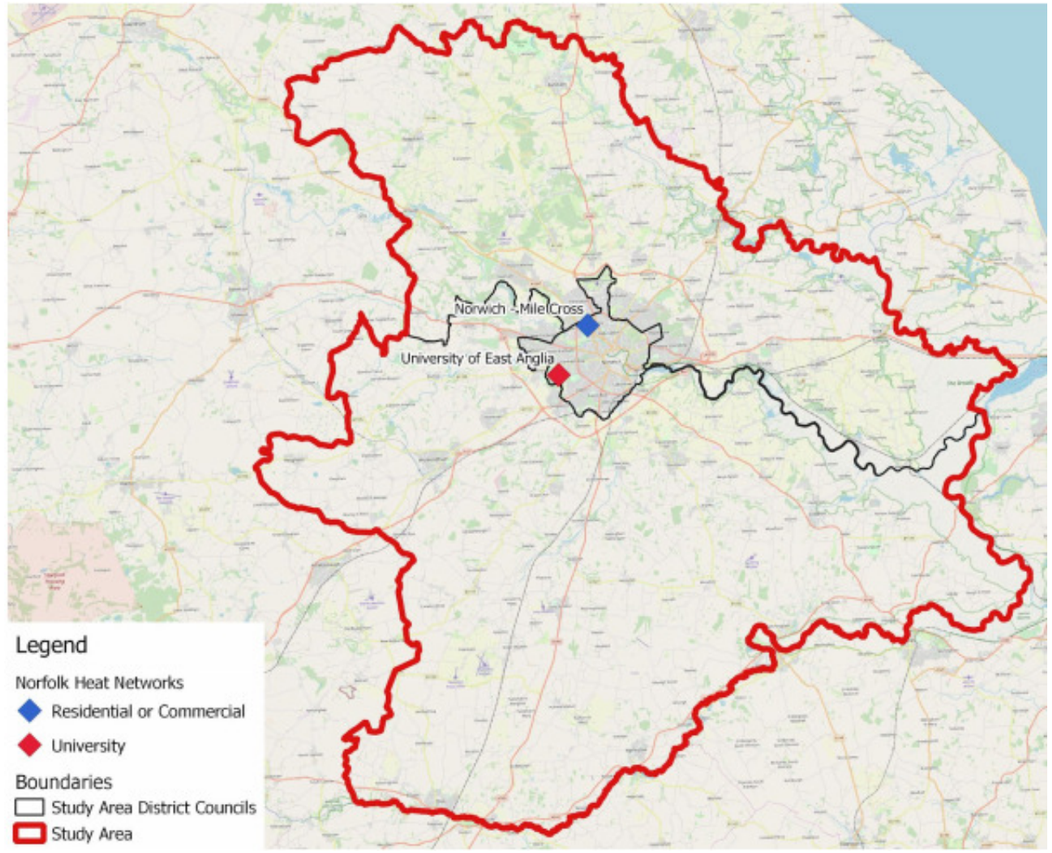


Figure 5: Existing heat networks within Greater Norwich (Greater Norwich Energy Infrastructure Study)

Space heating will be provided to the commercial areas by high efficiency air source heat pumps using Variable Refrigerant Volume/Flow (VRV/VRF) technology. Domestic hot water will be provided to the commercial areas by local electric heaters.

The carbon reductions generated by the heat pumps in the residential and the commercial will be included at the Be Green stage of the hierarchy.

1.3.5 Renewable Energy Systems (Be Green)

As stated above, air source heat pumps are appropriate as the main heat source for the residential and commercial elements of the scheme.

The hot water and VRV/VRF heat pumps are expected to provide a further 58.4% improvement over Part L 2021 (36.2% over Part L 2013) for the detailed application following the passive design/energy efficiency measures.

They are expected to provide 56% of the detailed application's energy demand, considerably exceeding the 10% target in the JCS for Broadland, Norwich and South Norfolk.

1.3.6 Unregulated Energy

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking and appliances), have been estimated using the BRE Domestic Energy Model (BREDEM) for the residential elements and using data from CIBSE Guide F and CIBSE TM50 for non-residential.

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

It is expected that the detailed application will provide a 15.6% reduction in unregulated carbon dioxide emissions over the baseline.

1.3.7 Overheating and Cooling

The detailed application has been assessed to reduce overheating and minimise the use of air conditioning.

Residential

The residential assessment includes dynamic thermal modelling on a sample of dwellings to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3 weather data.

The results of the dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

It is generally expected that the CIBSE compliance criteria are met for the DSY1 weather scenario. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

The assessment therefore demonstrates that the risk of overheating has been reduced as far as practical, with all available passive measures explored.

The proposed overheating mitigation measures are summarised below;-

- In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following;-
  - Using portable fans to increase airflow
  - Minimising internal heat gains
  - Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home.

Non-Residential

The non-residential assessment includes dynamic thermal modelling of the commercial space in the detailed application to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM52 guidance, using the current 2020s summer year (DSY 1).

The results of the dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria cannot be met in the non-residential space (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

It is therefore proposed to provide active cooling to the commercial areas.

1.4 Outline Application (Blocks E, EF, F, G, H, J)

1.4.1 Carbon Reduction Strategy

The energy strategy for the outline application follows the same energy hierarchy approach as detailed above for the detailed application.

The carbon emissions from the outline application area have been estimated using the SAP/SBEM calculation results from the detailed application. These have been increased pro-rata to reflect the maximum number of dwellings and maximum area of non-residential in the proposed outline development.

1.4.2 Carbon Reductions

Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential parts of the outline application.

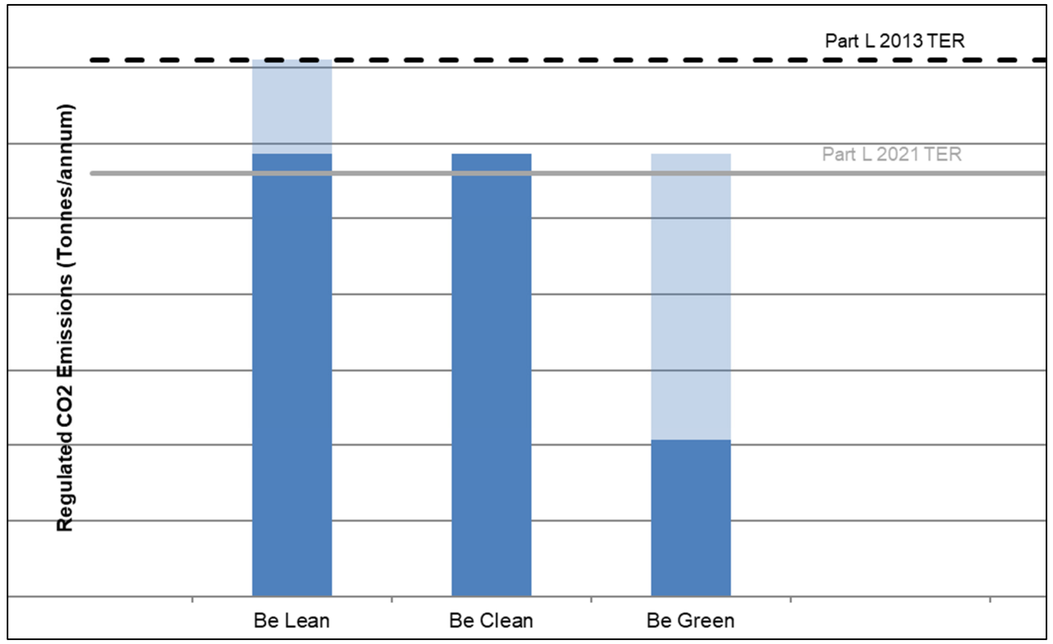


Figure 6: Domestic energy hierarchy and targets for the outline application

The graph demonstrates that the residential element of the outline application is expected to achieve an overall on-site reduction of 63.2% in regulated carbon dioxide emissions over Part L 2021 (around 70.9% over Part L 2013).

Energy demand in the residential areas will be significantly reduced, with an expected reduction of 17.5% in regulated carbon emissions over Part L 2013 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the domestic elements.

	Carbon dioxide emissions for domestic buildings (Tonnes CO_2 per annum)		
	Regulated Building Regs 2013 (SAP 2012 Emission Factors)	Regulated Building Regs 2021 (SAP 10.1)	Unregulated (SAP 10.1 Emission Factors)
Baseline:	736.0	581.9	188.0
Be Lean: After energy demand reduction	694.3	607.2	159.3
Be Clean: After heat network	694.3	607.2	159.3
Be Green: After renewable energy	816.2	213.9	159.3

Table 6: Estimated carbon dioxide emissions for domestic elements of the outline application

	Regulated domestic carbon dioxide savings over Part L 2013 Baseline		Regulated domestic carbon dioxide savings over Part L 2021 Baseline	
	Tonnes CO_2 per annum	%	Tonnes CO_2 per annum	%
Be lean: Savings from energy demand reduction	128.8	17.5%	-25.3	-4.3%
Be clean: Savings from heat network	0.0	0.0%	0.0	0.0%
Be green: Savings from renewable energy	393.3	53.4%	393.3	67.6%
Cumulative on site savings	522.1	70.9%	368.0	63.2%

Table 7: Estimated carbon dioxide savings for domestic elements of the outline application

Non-Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the non-residential parts of the outline application.

The graph demonstrates that the non-residential element of the outline application is expected to achieve an overall on-site reduction of 46.5% in regulated carbon dioxide emissions over Part L 2021 (83.7% over Part L 2013).

Energy demand in the non-residential areas will be significantly reduced, with an expected reduction of 32.1% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

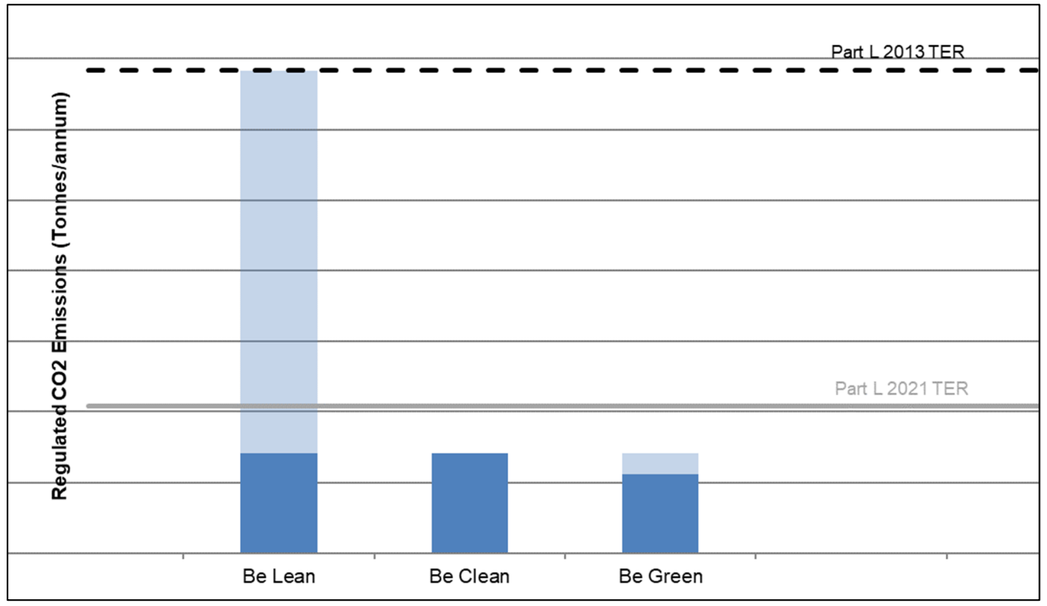


Figure 7: Non-domestic energy hierarchy and targets for the outline application

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the non-domestic elements.

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)		
	Regulated Building Regs 2013 (SAP 2012 Emission Factors)	Regulated Building Regs 2021 (SAP 10.1)	Unregulated (SAP 10.1 Emission Factors)
Baseline:	34.2	10.4	4.1
Be Lean: After energy demand reduction	21.9	7.1	3.5
Be Clean: After heat network	21.9	7.1	3.5
Be Green: After renewable energy	21.3	5.6	3.5

Table 8: Estimated carbon dioxide emissions for non-domestic elements of the outline application

	Regulated non-domestic carbon dioxide savings over Part L 2013 Baseline		Regulated non-domestic carbon dioxide savings over Part L 2021 Baseline	
	Tonnes CO_2 per annum	%	Tonnes CO_2 per annum	%
Be lean: Savings from energy demand reduction	27.1	79.3%	3.3	32.1%
Be clean: Savings from heat network	0.0	0.0%	0.0	0.0%
Be green: Savings from renewable energy	1.5	4.4%	1.5	14.4%
Cumulative on site savings	28.6	83.7%	4.8	46.5%

Table 9: Estimated regulated carbon dioxide savings for non-domestic elements of the outline application

Total Carbon Emissions and Savings

The table below details the overall carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the outline application.

	Total regulated emissions (Tonnes CO_2/year)	CO_2 savings (Tonnes CO_2/year)	Percentage saving (%)
Part L 2021 baseline	592.3		
Be Lean	614.2	-21.9	-3.7%
Be Clean	614.2	0.0	0.0%
Be Green	219.5	394.8	66.7%
Cumulative on site savings		372.8	62.9%

Table 10: Estimated total regulated carbon dioxide emissions and savings for the outline application

The table above demonstrates that the outline application as a whole is expected to achieve an on-site reduction of 62.9% in regulated carbon dioxide emissions over Part L 2021 (and around 71.5% over Part L 2013) considerably exceeding the emerging draft GNLP target of 19% reduction against Part L 2013.

1.4.3 Demand Reduction (Be Lean)

As detailed above, energy demand will be significantly reduced beyond Part L requirements, with an expected overall 20.2% reduction in carbon emissions over Part L 2013 for the outline application, through passive design and energy efficiency measures alone.

The reduction is expected to be achieved by a combination of measures as shown above for the detailed application.

1.4.4 Heating Infrastructure (Be Clean)

It is expected that the outline application will follow the same heating infrastructure strategy as proposed for the detailed application with generation of heat via electrical means rather than use fossil fuels.

It is expected that a dedicated air source heat pump will be installed in each apartment that is specifically designed to operate at high temperatures to provide the domestic hot water for each dwelling.

Due to the energy demand reduction measures incorporated in the design, the space heating demand in the residential dwellings is very low, so it is expected that local electric panel heaters will be provided.

It is expected that space heating will be provided to the commercial areas by high efficiency air source heat pumps using Variable Refrigerant Volume/Flow (VRV/VRF) technology, and domestic hot water by local electric heaters.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

1.4.5 Renewable Energy Systems (Be Green)

It is expected that the outline application will follow the same renewable energy strategy as proposed for the detailed application with air source heat pumps provided as the main heat source for the residential and commercial elements of the scheme.

The hot water and VRV/VRF heat pumps are expected to provide a further 66.7% improvement over Part L 2021 (51.3% over Part L 2013) for the outline application following the passive design/energy efficiency measures.

They are expected to provide over 50% of the outline application's energy requirements, considerably exceeding the 10% target in the JCS for Broadland, Norwich and South Norfolk.

1.4.6 Overheating and Cooling

A detailed assessment of the overheating risk will be carried out at a later date for the outline application areas and submitted with the Reserve Matters application.

1.5 Sustainability Strategy

The proposed strategy in relation to sustainable design and construction is detailed in Section 11, and addresses the key issues such as certification, water use, drainage, flood risk, pollution, air quality, noise and vibration, materials, waste, transport, management, health and wellbeing and accessibility.

2 Introduction

2.1 This Application

This Energy Assessment and Sustainability Strategy Report has been prepared by Meinhardt (UK) Ltd on behalf of Weston Homes (the Applicant) in support of a hybrid (part detailed/part outline) planning application submitted to Norwich City Council (NCC) for the comprehensive redevelopment of Anglia Square and various parcels of mostly open surrounding land (the Site) as shown within a red line on drawing '35301-ZZ-00-DR-A-01-0200'.

The Site is located in a highly accessible position within the northern part of Norwich City Centre and comprises a significant element of the Anglia Square/Magdalen Street/St Augustines Large District Centre, (the LDC). It is thus of strategic importance to the City, and accordingly has been identified for redevelopment for many years within various local planning policy documents, including the Northern City Centre Area Action Plan 2010, (NCCAAP), (now expired), the Joint Core Strategy for Broadland, Norwich and South Norfolk 2014, (JCS), and NCC's Anglia Square and Surrounding Area Policy Guidance Note 2017, (PGN). The Site forms the principal part of an allocation (GNLP 0506) in the emerging Greater Norwich Local Plan (GNLP).

This application follows a previous application on a somewhat smaller development parcel, (NCC Ref. 18/00330/F) made jointly by Weston Homes Plc as development partner and Columbia Threadneedle Investments, (CTI), the Site's owner, for a residential-led mixed use scheme consisting of up to 1250 dwellings with decked parking, and 11,000 sqm GEA flexible ground floor retail/commercial/non-residential institution floorspace, hotel, cinema, multi-storey public car park, place of worship, and associated public realm and highway works. This was subject to a Call-in by the Secretary of State (PINS Ref. APP/G2625/V/19/3225505) who refused planning permission on 12th November 2020, (the 'Call in Scheme').

In April 2021, following new negotiations with Site owner CTI, Weston Homes decided to explore the potential for securing planning permission for an alternative scheme via an extensive programme of public and stakeholder engagement, from the earliest concepts to a fully worked up application. The negotiations with CTI have secured a "Subject to Planning" contract to purchase the Site, (enlarged to include the southeastern part of Anglia Square fronting Magdalen Street and St Crispins Road), which has enabled a completely fresh approach to establishing a redevelopment scheme for Anglia Square. This has resulted in a different development brief for the scheme, being to create a replacement part of the larger LDC suited to the flexible needs of a wide range of retail, service, business and community uses, reflective of trends in town centre character, integrated with the introduction of homes across the Site, within a highly permeable layout, well connected to its surroundings.

The new development proposal seeks to comprehensively redevelop the Site to provide up to 8,000 sq m Net Internal Area, (NIA), flexible commercial and other non-residential floorspace and up to 1,100 new residential dwellings (the Proposed Development). These figures are maxima in view of the hybrid nature of the application. This proposes part of the scheme designed in full, to accommodate 6,062 sq m non-residential floorspace and 367 dwellings, with the remaining large part of the Site for later detailed design as a "Reserved Matters" application, up to those maxima figures.

2.2 This Energy Assessment and Sustainability Strategy

This Energy Assessment and Sustainability Strategy Report demonstrates to Norwich City Council how the scheme satisfies national, regional, and local planning guidance in relation to sustainability and climate change mitigation/adaption.

As this is a hybrid application, the report demonstrates the strategy for the detailed application based on a full assessment including appropriate modelling. The report also provides an overview of the expected strategy for the outline application area including estimates of the carbon reductions that are likely to be achieved.

2.3 Other Documents

This report should be read in conjunction with the other documents which form part of the hybrid planning application.

2.4 Project Team

Applicant / Client:	Weston Homes
Planning Consultant:	Weston Homes and PAL Planning
Architect:	Broadway Malyan
Acoustics Consultant:	SES
Air Quality:	Aether
Archaeology:	RPS Group
Commercial Strategy:	CPW Planning
Daylight and Sunlight Consultant:	GIA
Drainage Strategy:	EAS
Ecology:	Ecology Solutions
Environmental Impact Assessment:	Iceni
Fire Statement:	Marshall Fire
Flood Risk:	Royal Haskoning DHV
Health Impact Assessment:	Iceni
Heritage:	Iceni
Landscape:	Planit-IE Ltd
Socio-Economics:	Iceni
Transport:	Iceni

3 Scheme Overview

3.1 Site and Surroundings

The Main Site is primarily occupied by the shopping centre known as Anglia Square. The centre comprises a collection of buildings ranging from 1960 to late 1970s designed by Alan Cook and Partners, and currently includes;

- A public space, Anglia Square, which provides a valuable retail and social area.
- Variety of small-scale retail premises.
- A former cinema.
- A redundant car park.
- Vacant offices of Gildengate House (now with partial use as artists' spaces) and Sovereign House.
- To the west, surface car parks which serve the centre.
- A number of properties fronting Pitt Street to the west, including two 'locally listed' 2 storey Edwardian buildings.
- Surrey Chapel, a post WWII building, fronting St. Crispins Road.

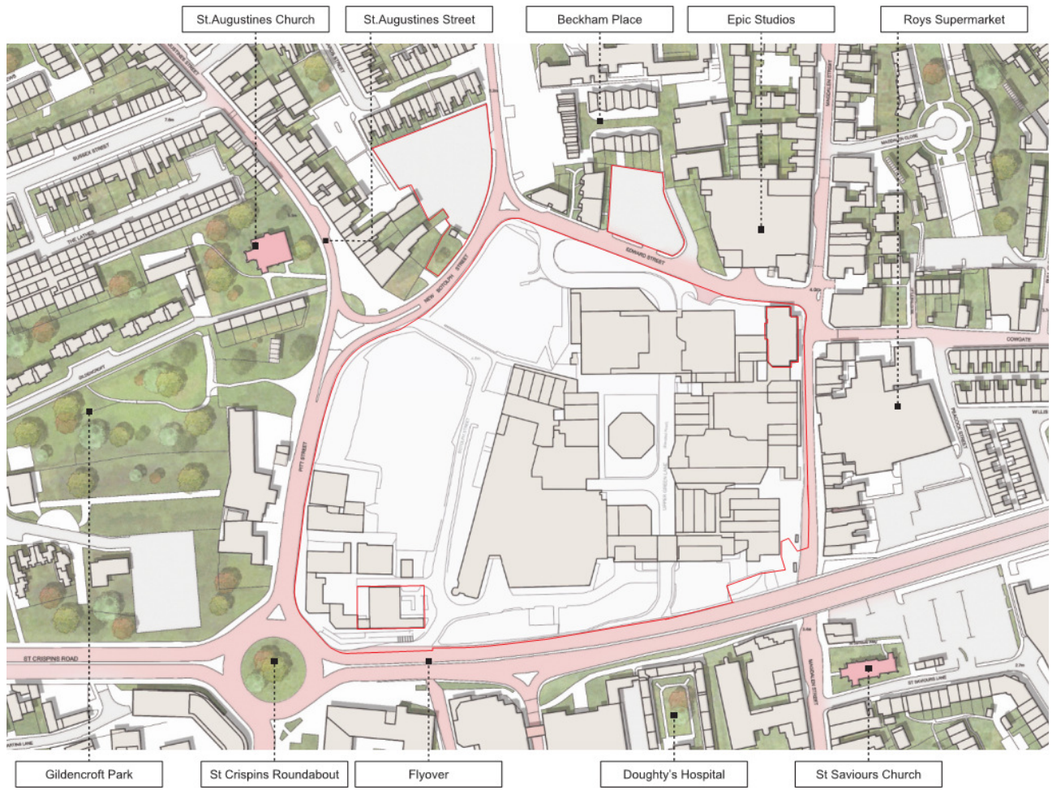


Figure 8: Plan view of the existing site

3.2 Proposed Development

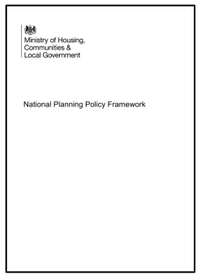
The new development proposal seeks to comprehensively redevelop the Site to provide up to 8,000 sq m Net Internal Area, (NIA), flexible commercial and other non-residential floorspace and up to 1,100 new residential dwellings (the Proposed Development). These figures are maxima in view of the hybrid nature of the application. This proposes part of the scheme designed in full, to accommodate 6,062 sq m non-residential floorspace and 367 dwellings, with the remaining large part of the Site for later detailed design as a "Reserved Matters" application, up to those maxima figures.

Figure 9: Illustrative aerial view of the proposed development

4 Planning Policy

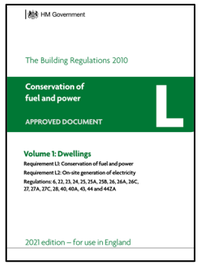
4.1 National

4.1.1 National Planning Policy Framework (2021)



The National Planning Policy Framework (NPPF) set out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

4.1.2 Building Regulations



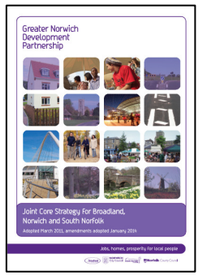
The Building Regulations set out the statutory standards that developments are to meet. Part L covers energy efficiency requirements.

An updated Building Regulations Part L was published in December 2021 that will deliver a 30% reduction in carbon emissions for domestic buildings and a 27% reduction for non-domestic, when introduced in June 2022.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

4.2 Local

4.2.1 Joint Core Strategy (2014)



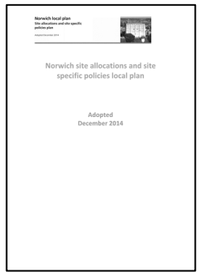
The JCS has been prepared by the three councils of Broadland, Norwich and South Norfolk, together with Norfolk County Council as the Greater Norwich Development Partnership (GNDP).

The JCS sets out the long term vision and objectives for the area, including strategic policies for steering and shaping development.

4.2.2 Norwich Development Management Policies Local Plan (2014)

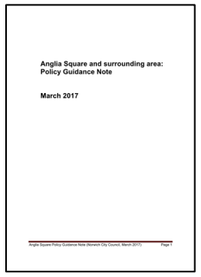
This document, the Development management policies local plan, contains a suite of detailed planning policies to help guide and manage change in Norwich between now and 2026. The plan builds on and supports the sustainable growth strategy for the wider area set out in the adopted Joint Core Strategy. It also closely follows national planning requirements for sustainable development and positive, community based planning.

4.2.3 Norwich Site Allocations and Site Specific Policies Local Plan (2014)



This document, the Site allocations and site specific policies local plan, identifies sites across the city to accommodate growth between now and 2026. These site allocations will help secure the supply of land for new homes and employment opportunities in Norwich. The site policies set out in the document will also guarantee our natural and historic environment is preserved and the needs of our communities are met.

4.2.4 Anglia Square and Surrounding Area Policy Guidance Note (2017)



This document sets out the broad principles of development for the Anglia Square site, identifies constraints, provides specific policy guidance on a range of issues relevant to the proposed development, and specifies the range of supporting documentation required in support of the planning application.

4.2.5 Emerging Greater Norwich Local Plan

The emerging Greater Norwich Local Plan (GNLP) which is being prepared by Broadland DC, South Norfolk Council, NCC and Norfolk County Council, (the Partnership), will supersede the Joint Core Strategy for Broadland, Norwich and South Norfolk (2014) (JCS) and Norwich Site Allocations and Site Specific Policies Local Plan (2014) (NSASSP) once adopted.

The GNLP Reg 19 version was submitted to the Secretary of State for examination on 30th July 2021.

5 Establishing Energy Demand and Emissions

5.1 Carbon Reduction Targets

5.1.1 National Planning Policy Framework (NPPF)

The NPPF recommends that plans should take a proactive approach to mitigating and adapting to climate change. New development should take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Plans should provide a positive strategy for the use and supply of renewable and low carbon energy and heat, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts).

5.1.2 Greenhouse Gas Emissions Policy

In June 2019 the UK Government made a commitment to bring all greenhouse gas emissions to net zero by 2050. This has been followed by further commitments in December 2020 and April 2021, to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

Norwich City Council have recently set a revised target of achieving net zero emissions across the city by 2045.

5.1.3 Building Regulations

An updated Building Regulations Part L was published in December 2021 that will deliver a 30% reduction in carbon emissions for domestic buildings and a 27% reduction for non-domestic, when introduced in June 2022.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

5.1.4 Joint Core Strategy (JCS) for Broadland, Norwich and South Norfolk

Development should include sources of decentralised and renewable or low-carbon energy providing at least 10% of the scheme's expected energy requirements.

Renewable energy generation schemes will be strongly promoted and encouraged as part of development proposals where reasonably practicable.

5.1.5 Emerging Draft Greater Norwich Local Plan (GNLP)

There is an emerging development plan, the Greater Norwich Local Plan (GNLP) which is being prepared by Broadland DC, South Norfolk Council, NCC and Norfolk County Council, (the Partnership), that will supersede the Joint Core Strategy for Broadland, Norwich and South Norfolk (2014) (JCS) and Norwich Site Allocations and Site Specific Policies Local Plan (2014) (NSASSP) once adopted. The GNLP Reg 19 version was submitted to the Secretary of State for examination on 30th July 2021.

The examination process is underway, for which hearing sessions took place during February and March 2022. As a result of the hearings, many policies, including the emerging allocation for the Site were subject to debate, addressing their soundness and the consequential need for amendment, alongside requests for additional information by the Inspectors. It is therefore considered likely the Council will prepare and consult upon Modifications or at least minor changes to both policy text and supporting text, relevant to this application. This process, and the publication of the Inspectors' report may extend beyond the determination of this application, and so final GNLP policy wording may not be available at that stage.

Paragraph 48 of the National Planning Policy Framework 2021 (NPPF) requires decision makers to give weight to relevant policies of emerging Local Plans according to the stage of preparation, the extent of unresolved objections, and the degree of consistency between emerging policies and the NPPF. In this instance, there are currently unresolved objections, in respect of some of which the Inspectors have requested additional information, and accordingly there are likely to be Modifications to some policies relevant to this application before they can be considered sound. On this basis, it is considered that in respect of those policies, the emerging development plan currently holds limited weight in decision making. In this context, those policies are not considered in detail.

The GNLP requires development to minimise energy demand through the design and orientation and maximise the use of sustainable energy, local energy networks and battery storage.

All new development should provide a 19% reduction against Part L of the 2013 Building Regulations.

5.2 Detailed Application

5.2.1 Residential

Building Regulations Part L1A SAP calculations have been undertaken by Stansted Environmental Services (SES) for a sample of 50 No. of the apartment and house types across the detailed application.

Elmhurst Energy's updated version of the Standard Assessment Procedure (SAP), Design SAP 10 Beta, has been used which has been released to reflect the confirmed updates to the Building Regulations which take effect later this year.

The final updated SAP methodology has not yet been released by the Ministry of Housing, Communities and Local Government, so Design SAP Beta provides the best indication currently available of the performance of the residential dwellings against the version of Building Regulations applicable when they are constructed.

SAP 10 Beta uses the SAP 10.1 methodology and carbon emission factors.

Performance against Part L 2013 has been estimated by applying the Part L 2013 (SAP2012) carbon emission factors to the SAP 10 Beta results.

A selection of the Compliance output sheets and DER worksheets are provided in Appendix A.1 for the 'Be Lean' stage of the hierarchy, and in Appendix A.2 for the 'Be Green' stage.

5.2.2 Non-Residential

Building Regulations Part L2A modelling has been undertaken, using IES dynamic thermal modelling software (SBEM) in line with the relevant National Calculation Methodology (NCM) guidance which reflects the requirements of Part L 2013.

The following new build non-residential areas have been modelled for the detailed application;-

- Block A Commercial
- Block A Residential Entrance
- Block D Community Space
- Block D Residential Entrance
- Block KL Commercial
- Block KL Residential Entrance
- Block M Commercial
- Block M Residential Entrance

There is currently no SBEM software available to demonstrate compliance with Part L 2021, so for the non-residential areas of the detailed application performance against Part L 2021 has been estimated by applying the SAP 10.1 carbon emission factors to the Part L 2013 SBEM results.

The BRUKL output sheets are provided in Appendix A.3 for the ‘Be Lean’ stage of the hierarchy, and in Appendix A.4 for the ‘Be Green’ stage.

5.3 Outline Application

5.3.1 Residential

The carbon emissions from the residential parts of the outline application have been estimated using the SAP calculation results from the detailed application.

These have been increased pro-rata to reflect the maximum number of dwellings in the proposed development.

5.3.2 Non-Residential

The carbon emissions from the non-residential parts of the outline application have been estimated using the SBEM calculation results from the detailed application.

These have been increased pro-rata to reflect the maximum non-residential area in the proposed development.

5.3.3 Carbon Factors

The assessment of the outline application uses SAP 10 carbon emission factors.

6 Demand Reduction (Be Lean)

6.1 Detailed Application

Energy demand will be significantly reduced beyond Part L requirements, achieving an overall 2.0% reduction in carbon emissions over Part L 2021 for the detailed application, through passive design and energy efficiency measures alone.

The table below details the breakdown of regulated energy demand by energy use, for each space type, at the 'Be Lean' stage of the hierarchy for the detailed application.

Space Type	Regulated Energy Demand (MWh/year)				
	Heating	Hot Water	Lighting	Auxiliary	Cooling
Residential	457.0	899.9	45.6	50.7	0.0
Non-residential	13.8	6.4	163.6	38.3	60.8
Total	470.8	906.3	209.2	89.0	60.8

Table 11: Breakdown of regulated energy demand at the Be Lean stage for the detailed application

The chart below details the breakdown of regulated energy demand by energy use, at the 'Be Lean' stage of the hierarchy for the detailed application.

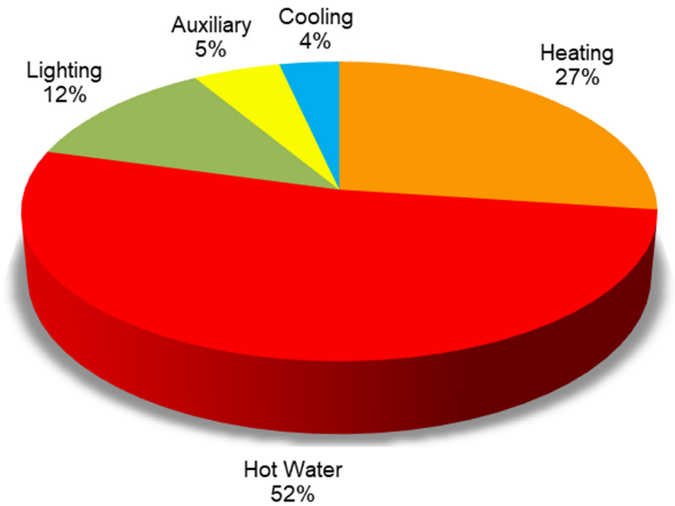


Figure 10: Breakdown of regulated energy demand at the Be Lean stage for the detailed application

The table below details the breakdown of regulated CO_2 emissions by energy use, for each space type, at the 'Be Lean' stage of the hierarchy for the detailed application.

Space Type	Regulated CO2 Emissions (kg CO2/year)				
	Heating	Hot Water	Lighting	Auxiliary	Cooling
Residential	102.6	202.1	6.2	6.9	0.0
Non-residential	8.1	3.1	22.2	5.2	4.7
Total	110.7	205.2	28.5	12.1	4.7

Table 12: Breakdown of regulated CO_2 emissions at the Be Lean stage for the detailed application

The chart below details the breakdown of CO_2 emissions by energy use, at the 'Be Lean' stage of the hierarchy.

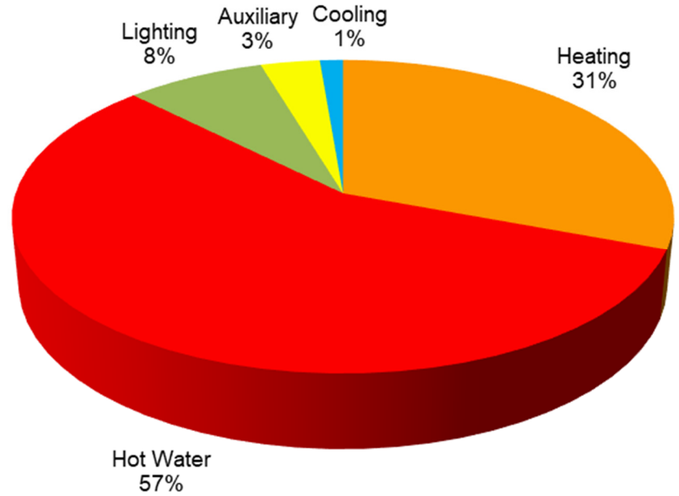


Figure 11: Breakdown of regulated CO_2 emissions at the Be Lean stage for the detailed application

The demand reduction will be achieved by a combination of the measures including those detailed below;-

6.1.1 Building Fabric Insulation

The thermal performance of the building fabric will be significantly improved over Part L 2021 minimum requirements as below;-

Residential Fabric Element	Limiting 'U' Value (W/m^2 K)	Proposed 'U' Value (W/m^2 K)
External Walls	0.26	0.14 to 0.22
Floor	0.18	0.13
Roof	0.16	0.14
Glazing	1.60	1.20

Table 13: Proposed residential fabric 'U' values for the detailed application

The residential party walls are proposed to have a 'U' value of 0.0 W/m² K based on a fully filled cavity with effective sealing at all exposed edges and in alignment with insulation layers in abutting elements.

Non-Residential Fabric Element	Limiting 'U' Value (W/m^2 K)	Proposed 'U' Value (W/m^2 K)
External Walls	0.26	0.22
Floor	0.18	0.13
Roof	0.18	0.14
Glazing	1.60	1.20

Table 14: Proposed non-residential fabric 'U' values for the detailed application

6.1.2 Cold Bridging

Cold bridging will be minimised to prevent the loss of heat and to prevent the development of cold spots, which can lead to mould. Suitable construction details will be developed to ensure insulation continuity and to meet the air tightness targets detailed below.

6.1.3 Air Tightness

The target air permeability has been set at 3 $m^3/(h\ m^2)$ at 50 Pa as compared to the Part L 2021 minimum requirement of 8 $m^3/(h\ m^2)$ to reduce heat loss in winter.

6.1.4 Natural Daylight

Natural daylight has been maximised wherever possible in the residential accommodation by arranging the living rooms and bedrooms as shallow spaces on the perimeter, by providing dual aspect glazing where possible, and by ensuring ceiling voids are as small as possible (particularly at the perimeter) to maintain the maximum floor to ceiling heights.

Increased floor to ceiling heights with full height glazing are generally provided to the ground floor commercial units and residential entrances.

6.1.5 Solar Gain

The size and g-value of the glazing has been optimised using the SAP calculations, SBEM calculations and the dynamic thermal modelling for the overheating assessment, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy.

This has resulted in the g-value of the glazing being set as detailed below;-.

Space type	Glazing g-value
Residential	0.50
Non-residential	0.35

Table 15: Glazing g-values for the detailed application

6.1.6 Shading

Balconies are provided to most of the proposed development which will provide a shading effect to the residential apartments to minimise peak solar gain.

6.1.7 Heating and Hot Water System Insulation

Heat losses from heating and hot water pipework will be reduced by minimising the length of pipe runs, and by providing a high level of insulation to all parts of the systems.

6.1.8 Heating Systems

In accordance with normal practice, at the Be Lean stage of the hierarchy we have assumed gas boilers with the standard efficiency of 93.5% for the residential and 91% for the non-residential will provide the heating and hot water to the development.

6.1.9 Cooling

Residential

Active mechanical cooling is not proposed for the residential apartments, with the use of natural ventilation via openable windows and increased mechanical ventilation proposed to prevent overheating in summer.

Non-Residential

For the commercial units active cooling via VRV/VRF heat pumps is proposed, which will achieve a nominal efficiency (EER) of 4.02 and a seasonal efficiency (SEER) of 6.1 in cooling mode.

6.1.10 Ventilation Systems

Residential

Ventilation to the residential apartments to remove moisture/pollutants in accordance with Building Regulations Part F will be via individual Mechanical Extract Ventilation (MEV) units. Each unit will achieve a Specific Fan Power of up to 0.15 W/(l/s) depending on the number of wet rooms. Fresh air will be provided to habitable rooms via trickle vents.

Non-Residential

It is expected that the commercial units will be provided with local commercial MVHR units that will achieve a Specific Fan Power of less than 1.4 W/(l/s) and a heat recovery efficiency of at least 82%.

6.1.11 Lighting

Energy efficient LED lighting will be used throughout the proposed development.

6.1.12 Smart Controls / Metering

It is expected that residential apartments will be provided with an individual, programmable, zoned, control system, together with smart energy meters.

This will allow the display of energy use within individual units, assisting occupants to understand the way in which they consume energy and how much it costs, and encouraging them to turn off non-essential equipment or run some equipment at a lower capacity during times of peak demand.

6.1.13 Appliances

Where appliances are provided by the developer they will be of an energy efficient type, which generally generate less heat and can help minimise the build-up of heat within the buildings. Where appliances are not provided by the developer, owners/tenants will be encouraged to supply energy efficient equipment.

6.2 Outline Application

Energy demand will be significantly reduced beyond Part L requirements, with an expected overall 20.2% reduction in carbon emissions over Part L 2013 for the outline application, through passive design and energy efficiency measures alone.

Detailed energy assessments will be carried out as part of the Reserved Matters application(s) to determine the most appropriate demand reduction measures.

The below sections outline the measures incorporated in this outline application, which should form the minimum standards expected to be achieved for all areas within the masterplan.

6.2.1 Building Fabric Insulation

The thermal performance of the building fabric should target at least the following;-

Fabric Element	Residential 'U' Values (W/m^2 K)	Non-Residential 'U' Values (W/m^2 K)
External Walls	0.14 to 0.22	0.22
Floor	0.13	0.13
Roof	0.14	0.14
Windows	1.20	1.20

Table 16: Proposed maximum fabric 'U' values for the outline application

6.2.2 Cold Bridging

Cold bridging should be minimised to prevent the loss of heat and to prevent the development of cold spots, which can lead to mould. Suitable construction details should be developed to ensure insulation continuity and to meet the air tightness targets detailed below.

6.2.3 Air Tightness

The target air permeability should be set at a maximum of 3 $m^3/(h\ m^2)$ at 50 Pa for the outline application.

6.2.4 Daylight and Solar Gain

The size and g-value of the glazing should be optimised using SAP calculations, SBEM calculations and dynamic overheating modelling, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy.

6.2.5 Heating Systems

In accordance with normal practice, at the Be Lean stage of the hierarchy gas boilers should be assumed to provide the heating and hot water for the outline application, with the standard efficiency of 93.5% for the residential and 91% for the non-residential.

6.2.6 Cooling

Residential

Active mechanical cooling is generally not expected to be proposed for the residential apartments, with the use of natural ventilation via openable windows and increased mechanical ventilation proposed to prevent overheating in summer.

Non-Residential

For the commercial units active cooling via VRV/VRF heat pumps are expected to be proposed, which should target a minimum nominal efficiency (EER) of 4.02 and a seasonal efficiency (SEER) of 6.1 in cooling mode.

6.2.7 Ventilation Systems

Residential

Ventilation to the residential apartments to remove moisture/pollutants in accordance with Building Regulations Part F is expected to be via individual Mechanical Extract Ventilation (MEV) units. Each unit should target a Specific Fan Power of up to 0.15 W/(l/s) depending on the number of wet rooms. Fresh air is expected to be provided to habitable rooms via trickle vents.

Non-Residential

It is expected that the commercial units will be provided with local commercial MVHR units that will target a Specific Fan Power of less than 1.4 W/(l/s) and a heat recovery efficiency of at least 82%.

6.2.8 Lighting

Energy efficient LED lighting should be used throughout the proposed development.

6.2.9 Smart Controls / Metering

It is expected that residential apartments will be provided with an individual, programmable, zoned, control system, together with smart energy meters.

6.2.10 Appliances

Where appliances are provided by the developer they should be of an energy efficient type, and where they are not provided by the developer, owners/tenants will be encouraged to supply energy efficient equipment.

7 Heating Infrastructure (Be Clean)

7.1 Detailed Application

Investigations have confirmed that there are no existing district heating networks in the vicinity of this site, as demonstrated on the below extract from the Greater Norwich Energy Infrastructure Study (2019). There were also no planned heat networks of significant scale identified within the study area.

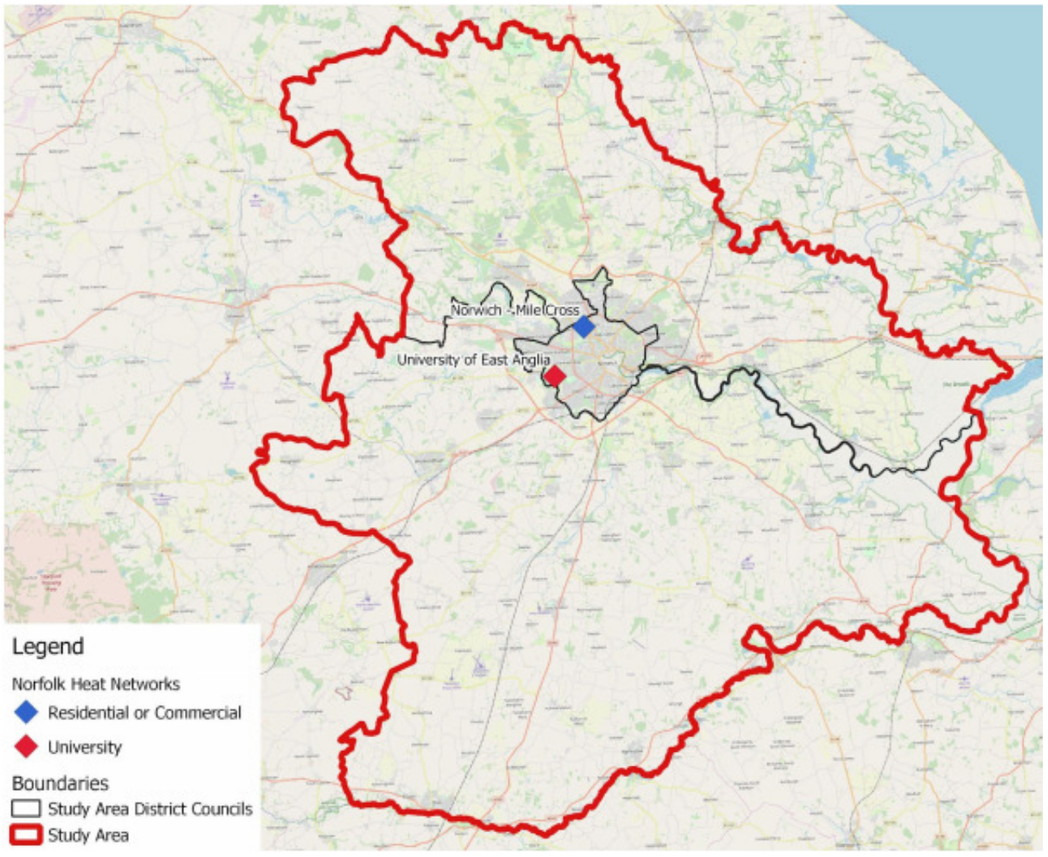


Figure 12: Existing heat networks within Greater Norwich (Greater Norwich Energy Infrastructure Study)

With consideration of local air quality and the longer term net zero emissions targets, it is proposed to generate heat via electrical means rather than use fossil fuels.

Domestic hot water accounts for almost 62% of the regulated energy demand for the residential areas of the detailed application, so it is critical to provide a heating solution that maximises efficiency at the higher temperatures required for domestic hot water. It is therefore proposed to install a dedicated air source heat pump in each apartment that is specifically designed to operate at high temperatures to provide the domestic hot water for each dwelling.

The proposed heat pumps are the Dimplex Edel which use a refrigerant with an extremely low Global Warming Potential (GWP) of only 3 and when coupled with appropriate thermal storage, will achieve a very high overall seasonal efficiency of between 343 and 349% across the whole year (depending on the size of apartment).

Due to the energy demand reduction measures incorporated in the design, the space heating demand in the residential dwellings is very low, so it is proposed to provide local electric panel heaters.

Space heating will be provided to the commercial areas by high efficiency air source heat pumps using Variable Refrigerant Volume/Flow (VRV/VRF) technology. Domestic hot water will be provided to the commercial areas by local electric heaters.

The carbon reductions generated by the heat pumps in the residential and the commercial will be included at the Be Green stage of the hierarchy.

7.2 Outline Application

It is expected that the outline application will follow the same heating infrastructure strategy as proposed for the detailed application with generation of heat via electrical means rather than use fossil fuels.

It is expected that a dedicated air source heat pump will be installed in each apartment that is specifically designed to operate at high temperatures to provide the domestic hot water for each dwelling.

Due to the energy demand reduction measures incorporated in the design, the space heating demand in the residential dwellings is very low, so it is expected that local electric panel heaters will be provided.

It is expected that space heating will be provided to the commercial areas by high efficiency air source heat pumps using Variable Refrigerant Volume/Flow (VRV/VRF) technology, and domestic hot water by local electric heaters.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

8 Renewable Energy (Be Green)

8.1 Detailed Application

Air source heat pumps are classified as a renewable technology, and as stated above, air source heat pumps are appropriate as the main heat source for the residential and commercial elements of the scheme.

The hot water and VRV/VRF heat pumps are expected to provide a saving of 215.1 Tonnes CO_2 per year, resulting in a further 58.4% improvement over Part L 2021 (36.2% over Part L 2013) for the detailed application following the passive design/energy efficiency measures.

They are expected to provide 56% of the detailed application's energy requirements, considerably exceeding the 10% target in the JCS for Broadland, Norwich and South Norfolk.

8.2 Outline Application

It is expected that the outline application will follow the same renewable energy strategy as proposed for the detailed application with air source heat pumps provided as the main heat source for the residential and commercial elements of the scheme.

The hot water and VRV/VRF heat pumps are expected to provide a further 66.7% improvement over Part L 2021 (51.3% over Part L 2013) for the outline application following the passive design/energy efficiency measures.

They are expected to provide over 50% of the outline application's energy requirements, considerably exceeding the 10% target in the JCS for Broadland, Norwich and South Norfolk.

9 Unregulated Energy

9.1 Detailed Application

This section outlines how non-regulated energy and carbon dioxide emissions will be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

9.1.1 Baseline

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking and appliances), have been estimated using the BRE Domestic Energy Model (BREDEM) for the residential elements and using data from CIBSE Guide F and CIBSE TM50 for non-residential.

The table below details the breakdown of baseline unregulated energy demand and associated CO_2 emissions for the detailed application.

Energy Use	Residential		Non-Residential	
	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)
Cooking (electric)	149,002	20,264		
Appliances/equipment	574,722	78,162	186,520	25,367
Total (Unregulated)	723,724	98,426	186,520	25,367

Table 17: Baseline unregulated energy demand and CO2 emissions for detailed application

9.1.2 Demand Reduction (Be Lean)

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

The table below details the breakdown of unregulated energy demand and associated CO_2 emissions following demand reduction for the detailed application.

Energy Use	Residential		Non-Residential	
	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)
Cooking (electric)	131,726	17,915		
Appliances/equipment	481,435	65,475	155,434	21,139
Total (Unregulated)	613,161	83,390	155,434	21,139

Table 18: Unregulated energy demand and CO2 emissions after demand reduction for detailed application

It is expected that the detailed application will provide a 15.6% reduction in unregulated carbon dioxide emissions over the baseline.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

9.1.2.1 Residential Cooking

The baseline energy demand and associated carbon dioxide emissions from BREDEM are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as ‘A’ rated electric ovens and ‘D’ rated cooker hood extract units.

More efficient appliances are easily available, and provision of ‘A+’ rated oven and a ‘C’ rated cooker hood extract units will be encouraged.

9.1.2.2 Residential Appliances/Equipment

The baseline energy demand and associated carbon dioxide emissions from BREDEM are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as ‘F’ rated fridge/freezers, ‘D’ rated washing machines, ‘E’ rated dishwashers and ‘G’ rated televisions.

More efficient appliances are easily available, and purchasers/tenants will be encouraged to reduce energy demand by providing an ‘E’ rated fridge/freezer, a ‘C’ rated washing machine, an ‘D’ rated dishwasher and an ‘F’ rated television.

Further reductions in unregulated energy can be achieved by owners/tenants of residential properties as detailed below. The potential savings are difficult to quantify as they are operational items. A reduction has not been included in this assessment, but owners/tenants will be encouraged to operate appliances as suggested.

Washing Machine and Dryer

Wash full loads rather than just a few items.

Use a temperature setting of 40°C or even 30°C where possible.

Reduce dryer use by using an outdoor line in summer and a drying rack in winter.

Use tumble dryer balls to reduce drying time.

Dishwasher

Fill the dishwasher before using.

Use the economy setting if available.

Kettle

Only boil the amount you need each time.

Oven

Limit the number of times the oven door is opened while cooking.

Hob

Use the smallest pot possible each time.

Use a lid.

Use stacked steamers.

General Appliances

Do not leave appliances on standby.

9.1.2.3 Non-residential Equipment/Small Power

Tenants will be encouraged to reduce energy demand and associated carbon dioxide emissions to achieve the CIBSE good practice benchmarks.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

Commercial Space

- Optimisation of refrigeration storage temperatures.
- Specification of refrigeration equipment to include (where possible) automatic defrost, self-closing doors, fan assistance (with auto shut-off and energy efficient fans), high performance insulation, and door open alarms.
- Energy efficient glass and dishwashers to be used.
- Energy efficient desktop PCs, laptops, screens etc to be used.
- Energy efficient sound systems to be used.
- Encourage staff to switch off equipment when not in use.
- Energy efficient TVs, white goods and other equipment to be used.

10 Overheating and Cooling

10.1 Detailed Application

The detailed application has been assessed to reduce overheating and minimise the use of air conditioning.

The assessment includes dynamic thermal modelling of both the domestic and non-domestic elements of the proposed development to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49, TM52 and TM59.

10.1.1 Overheating Risk Assessment Methodology

Domestic

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

a) For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Non-Domestic

The non-domestic overheating risk assessment has been made against the three criteria outlined in CIBSE TM52. A room or building that fails any two of the three criteria is classed as overheating.

- The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
- The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
- The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The Norwich weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years;-

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

10.1.2 Overheating Risk Reduction Measures

The assessment has considered the following measures to reduce the risk of overheating;-

Minimise internal heat generation through energy efficient design

Internal heat generation will be minimised by a combination of measures including the following;-

- Minimising cold bridging;
- Minimising heat loss from heating and hot water systems;
- Low energy lighting; and
- Energy efficient appliances.

Reduce the amount of heat entering a building in summer

The heat entering the building will be reduced by a combination of measures including the following;-

- Significantly improved fabric ‘U’ values;
- Improved air tightness;
- Optimisation of glazing g-value;
- Optimisation of glazing area; and
- External shading (including via balconies).

Manage the heat within the building through exposed thermal mass and high ceilings

Floor to floor heights have been maximised in the proposed development.

Mechanical ventilation

Ventilation to the residential apartments to remove moisture/pollutants in accordance with Building Regulations Part F will be via individual Mechanical Extract Ventilation (MEV) units, with fresh air provided to habitable rooms via trickle vents.

The units will have a boost facility to increase ventilation rates to assist in the prevention of overheating.

It is expected that the commercial units will be provided with local commercial MVHR units.

Active Cooling Systems

Active cooling is not proposed for the residential dwellings in the detailed application.

For the commercial units active cooling will be provided by high efficiency air source heat pumps using Variable Refrigerant Volume/Flow (VRV/VRF) technology.

10.1.3 Overheating Modelling Results

The results of the dynamic modelling overheating assessment are provided in Appendix A.5, and summarised below;-

Residential

The results of the dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

The assessment therefore demonstrates that the risk of overheating has been reduced as far as practical, with all available passive measures explored.

Non-Residential

The results of the dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria cannot be met in the non-residential space (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

It is therefore proposed to provide active cooling to the commercial areas.

10.1.4 Overheating Mitigation Measures

Domestic

The proposed overheating mitigation measures are summarised below;-

- In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following;-
    - Using portable fans to increase airflow
    - Minimising internal heat gains
    - Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home.

Non-Domestic

It is proposed to provide active cooling to the commercial areas.

10.2 Outline Application

A detailed assessment of the overheating risk will be carried out at a later date for the outline application areas and submitted with the Reserve Matters application.

11 Sustainability Strategy

11.1 Water

Water is becoming an increasingly scarce resource, with new development generating a growing demand. To meet increased demand new water sources and associated infrastructure need to be in place.

East Anglia is one of the UK's water stressed areas where demand is rapidly outgrowing supply. Freshwater consumption of the proposed development will be reduced through water efficiency.

In accordance with the optional requirement of Building Regulation Part G, in the domestic apartments the proposed development will aim to reduce average internal potable water consumption to 105 litres per person per day plus 5 litres per person per day for external use, which equates to approximately two thirds of the UK average.

This will be achieved through the provision of efficient water fittings throughout the development, including aerated shower heads and taps (also helping to reduce hot water demand), dual flush toilets, and low water consumption appliances where provided.

The Table below provides an indication of the flow rates expected for the residential fittings, with final specifications determined during the detailed design.

Fitting	Flow Rate
WC	6 / 3 litre dual flush
Bath	160 litres capacity to overflow
WHB Taps	4 litres/minute aerating tap
Shower	8 litres/minute
Kitchen Taps	5 litre/minute
Washing Machine	8.17 litres/kg
Dishwasher	1.25 litres/place setting

Table 19: Indicative residential water fittings

The proposed development will also aim to reduce potable water consumption in the retail and other non-residential space through the incorporation of water efficient fittings.

Domestic water supplies will be separately metered using smart meters to allow residents and the local water authority to easily monitor water consumption.

11.2 Flood Risk Assessment

Please refer to Royal Haskoning DHV's Flood Risk Assessment report for full details of the flood risk assessment carried out for the proposed development, which is summarised below.

The Environment Agency's Flood Map for Planning illustrates that the site is located entirely within Flood Zone 1 and therefore deemed to be at a low risk of fluvial and tidal flooding. The local geology and location in Source Protection Zone 2 suggests that groundwater may be relatively high. However, there is no evidence of groundwater flooding, and the existing site is almost entirely impermeable, which would prevent groundwater emergence at the site.

The Flood Risk from Surface Water mapping indicates that the risk of surface water flooding is medium/high. This is most likely due to the presence of the Dalymond/ Dalimond ditch, a "lost" river which is likely to have been incorporated into the public sewer networks. Due to the generalised methodology used for modelling surface water, it is likely that the risk is overestimated. The existing surface water model for Norwich City Centre has been updated, amended and re-run for several existing and proposed scenarios. This process has helped to determine the most vulnerable parts of the proposed development, and to quantify the risks to the development. This also helped to compare the existing and proposed risks offsite to determine whether there would be a significant increase in flows as a result of the proposed development.

The areas at highest surface water risk have been identified as the Edward Street service yard, basement car park in Block A, part of the ground floor of Block A, Block C, Part of Blocks K and L and the area south of Block J. A number of mitigation measures were discussed which included installing flood sensors and alarms in vulnerable areas, having a flood warning and evacuation system across the site, using flood resilient construction methods and tanking the low-lying areas of the site.

It is not possible to prevent offsite flows from entering the onsite drainage system, so separate alarms fitted to the attenuation tanks serving the pedestrian walkways/hardstandings are proposed. These would alert the site management who would then send out a warning to the residents and staff of the individual ground floor units.

The lowering of part of the pedestrian walkways has the benefit of directing runoff away from the proposed buildings while also routing surface water through the site, and maintaining the existing flow routes. It is acknowledged that the central sections of the pedestrian walkways may flood in places, but an evacuation route has been identified to guide people offsite to the west and southwest, away from the main overland flow paths.

An offsite impact study indicated the area where the proposed development would increase flood levels. All the areas identified would already have flooded in the existing scenario, however there was a section of the road in New Botolph Street which could experience an increase in flood depth as a result of the development. However, a sizeable area of Cowgate Street and Magdalen Street would experience a reduction in flood depth as a result of the development.

Areas where residential lobbies and utility plants are located were compared to the depth maps. Mitigation measures are proposed where possible.

A flood warning and evacuation strategy for the site has been outlined and it is expected that a more detailed flood warning strategy will be provided at a later design stage.

The development proposals comply with the guidance provided in the NPPF, and with the recommendations of Anglian Water and Norwich City Council, and that no reason exists to object to the proposals in terms of flood risk or drainage.

11.3 Surface Water Drainage

Please refer to EAS's Surface Water Drainage Strategy report for full details of the drainage strategy for the proposed development, which is summarised below.

The proposed surface water drainage strategy for the Hybrid Planning Application site has been based on sustainable principles with aim to provide a significant betterment to the existing situation. Currently the site does not benefit from any attenuation features and as such surface water run-off flows freely into the adopted sewer network, unrestricted and untreated.

The city centre site gives opportunities for "urban types" of Sustainable Drainage Systems (SuDS) features to be incorporated. These features provide water quality and biodiversity betterments and it is proposed that wherever possible, these features will form the wider SuDS Drainage Strategy. The proposals include green roofs, bioretention swales, bioretention tree-pits, lined permeable paving and geo-cellular attenuation devices. These will improve water quality, biodiversity and amenity.

An assessment was undertaken to determine the existing surface water run-off from the site and what flow rate would likely enter the adopted sewer network. The assessment was discussed with Anglian Water and it was agreed that the proposed site should achieve a reduction of run-off to the adopted network to a maximum of 242 l/s to manage all storms up to and including the 1:100yr + 40% Climate Change Event. This will be the equivalent of 43% of the existing 1:1yr surface water run-off rate, a significant reduction.

The Hybrid site layout precludes the option for separating drainage for Outline areas from Full-Planning areas. Open spaces will be utilised for locating attenuation devices and in some cases, these areas will serve both

Outline and Full-Planning development areas. Where possible, drainage Systems serve only Outline or only Full-Planning areas.

The development parcels have been split into 8no. drainage catchments. Each catchment has a restricted outfall to the adopted surface water sewer network and attenuation designed to accommodate a 1:100yr + Climate Change Storm Event. Suitable water treatment stages, in line with CIRIA SuDS Manual are proposed and will provide an improvement to the existing situation, where waters enter the adopted sewer network, untreated.

Due to the surface water flood risk within the city of Norwich, it is proposed that the attenuation tanks will have capacity sensors and alarms fitted within them which monitor how full they become during storm events. The attenuation tanks will likely collect run-off from both roof and hardstanding areas and it is not possible to prevent any exceedance surface water run-off flows from off-site from entering the proposed drainage systems. The alarm would trigger in the Anglia Square management office, and it would be the management's responsibility to distribute the warning to each of the ground floor and retail, commercial and leisure uses. This would allow them time to evacuate, safeguard and close their premises.

Maintenance of the attenuation features will remain the responsibility of the site owner or an appointed management company, and will not be offered for adoption. The Anglian Water sewers that pass through the site will remain the responsibility of Anglian Water

The proposed surface water drainage strategy, covering 8no catchments will significantly reduce surface water runoff, provide significant attenuation volumes and improve water quality, biodiversity and amenity.

11.4 Noise and Vibration

The Proposed Development requires demolition of a number of structures in close proximity to existing neighbouring residential receptors.

Mitigation and control measures will be required to ensure that noise is kept within acceptable limits during the demolition works. This will include the selection of plant, controlled working hours and a monitoring programme. Noise levels will however be in excess of existing baseline levels. On this basis, the impact on existing residents is considered to be moderate adverse but short term and of minor significance.

Construction works associated with the scheme are predicted to be within noise limits and good practice measures will be put in place throughout the construction works to ensure that this is the case. Noise levels will however be in excess of existing baseline levels, and controlled working hours for noisy activities and on Sundays and Bank Holidays, with on-going noise monitoring will be set out in the CEMP and agreed with NCC. The impact on existing residents is considered to be minor adverse but medium term and of minor significance.

Environmental noise is unlikely to place significant constraints on the proposed future land uses of the Site during the operational phase, provided appropriate mitigation measures are included via, for example, planning conditions controlling hours of operation and external music. The operational phase noise impacts will be negligible.

The Development is considered to be consistent with the requirements of legislation, national/regional/local planning policy and good practice guidance with regard to noise and vibration issues.

11.5 Air Quality

Please refer to Aether's Air Quality Assessment report for full details of the air quality assessment carried out for the proposed development, which is summarised below.

Two future scenarios have been modelled. The first (without policy applied) uses a conservative approach with regards to expected improvements to air quality has been taken in that no improvement in the pollutant background concentrations or road transport emission factors has been assumed between the base year (2019) and the future year (2034). The second future scenario (with policy applied) utilises the project improvements in pollutant background concentrations and road transport emission factors in 2034.

The ADMS-Roads dispersion model has been used to determine the impact of emissions from road traffic on sensitive receptors under two scenarios – without and with policy. Predicted concentrations have been compared with the air quality objectives. The results of the assessment indicate that annual mean nitrogen dioxide (NO_2) concentrations are above the objective in 2034 (with and without policy applied scenarios) at Block C and M at ground floor level. Therefore, the installation of mechanical ventilation is required at these locations and air should be taken from first floor level or above. At all other locations no mitigation is required.

Concentrations of particulate matter (PM_{10} and $PM_{2.5}$) are predicted to be below the annual and daily mean objectives.

11.6 Materials

11.6.1 Sustainable Materials

A sustainable procurement plan will be developed to ensure that sustainable materials are used in the proposed development. Elements including walls, roofing, floors, windows, kitchens, insulation, and landscaping materials, will be selected with a BRE Green Guide rating of A to C where possible.

100% of non-reclaimed timber for basic building and finishing elements will be FSC certified.

A specific review will be carried out to determine the opportunities to maximise use of recycled/secondary aggregates in non-structural elements.

Development partners and their contractors will be encouraged to ensure that the products, materials and services they procure are responsibly sourced.

Wherever possible, insulation materials will be used which have zero Ozone Depletion Potential (ODP) and a Global Warming Potential (GWP) of 5 or less.

11.6.2 Recycled Aggregates

Recycled aggregate will be considered for use within non-structural concrete elements within the landscaping scheme. Due to inconsistencies in recycled aggregate size and quality, they will not be accepted for the structural frames.

11.7 Waste

11.7.1 Construction Waste

Site waste will be managed on site through a Construction Management Plan which will emphasise the need to minimise waste leaving site and the reuse of materials on the site. Waste from the site will be managed via a certified waste contractor and will be monitored through best practice site management procedures.

The Plan will aim to divert waste from landfill, in accordance with the Table below, with as much waste as possible being re-used on site or recycled.

Type of Waste	Volume	Tonnage
Non-Demolition	85%	90%
Demolition	85%	95%
Excavation	95%	95%

Table 20: Diversion from Landfill Benchmarks

11.7.2 Operational Waste

Flexible and easily accessible space for segregating and storing waste for collection, recycling and reuse will be provided to promote recycling.

In the residential properties, separation will be provided for each of the three material streams (dry recyclables, residual waste and organic waste) through the provision of three separate containers in the kitchen area of each property.

For the commercial areas, internal recycling facilities will be provided as part of the fit out to encourage the segregation and recycling of waste during site operation.

The provision of information on the ability of occupants to recycle items is shown to strongly increase recycling uptake. Therefore, information on the waste bins provided, what can be placed in each bin, where larger items can be taken and when, will be provided to residents to inform their waste decisions during the operational phase of the development.

11.8 Ecology

Please refer to Ecology Solutions' Ecological Assessment report for full details of the ecology assessment carried out for the proposed development, which is summarised below.

It is considered that there is no overriding ecological constraint to the redevelopment of the site and by adhering to the mitigation measures set out in the report it is considered that the proposals would accord with all relevant legislation and planning policy. The proposed development will deliver net gain for biodiversity.

11.8.1 Statutory Sites

There are no statutory designations of nature conservation value within or immediately adjacent to the site. The closest such sites are St James' Pit SSSI (designated for geological reasons) and Mousehold Heath Local Nature Reserve (LNR), located approximately 0.9km east of the site. Owing to the distance and intervening habitat between the site and this statutory designation, as well as the nature of the development, it is considered unlikely that that the development of the site will have any direct, indirect or in combination adverse effect upon this designated site, be it during the construction or operational phase.

A series of European designations are in the wider area; these are considered further in the accompanying Shadow Habitats Regulations Assessment, but in summary it is considered that potential adverse effects arising from the proposed development will be avoided, both alone and in combination with other plans or projects.

11.8.2 Non-statutory Sites

There are no non-statutory sites within or immediately adjacent to the site. The closest non-statutory site is Train Wood County Wildlife Site (CWS), located approximately 0.3km west of the site, adjacent to the River Wensum. It is not considered that any significant effect will occur to non-statutory sites given the nature of the development project and intervening land use between the site and nearby non-statutory designations.

11.8.3 Habitats

The habitats within the site are in themselves of low intrinsic ecological interest. Their removal to facilitate the proposed development is of negligible significance. The exception to this are the trees, particularly those on the St Crispins Road frontage. They are of significant ecological interest in the context of the site and the immediate locality, given the lack of similar features in this area. It is understood that some of these will need to be removed to facilitate a new access point from St Crispins Road.

11.8.4 Biodiversity Net Gain

The site is currently of negligible overall interest, principally comprising buildings and hardstanding with very limited vegetation.

The proposed development will deliver a measurable Biodiversity Net Gain.

11.8.5 Invasive Species

No invasive species were observed on site, but Buddleia was identified within the site. While not listed on the Wildlife & Countryside Act, Buddleia is a non-native species. Although its control is not a legal requirement, reasonable measures should be taken to prevent the spread of this plant species. Where vegetation is to be removed, the material should be disposed of at an approved facility.

11.8.6 Bats

The buildings on site exhibit no evidence of roosting bats and their removal is not considered to be detrimental to any local bat population. Given the results of the activity survey and the negative results of the building inspections, there is no evidence that a roost is present, and work may proceed without a Natural England licence.

As an enhancement, it is recommended that bat boxes of varying designs be incorporated into the development. This would increase available roosting opportunities. Any external lighting on the proposed structures should also be minimal and designed to limit light spillage, to avoid disturbance to local bat populations. There should be no direct lighting on or near to any installed bat box. The landscape strategy will provide significantly increased opportunities for foraging bats through encouragement of invertebrates, relative to the existing situation.

11.8.7 Badgers

No evidence of Badger was recorded on site or immediately adjacent to the site. The site and surrounding area are wholly unsuitable for the species.

11.8.8 Hedgehogs

No evidence of Hedgehogs was recorded on site, and opportunities are currently negligible. Where fences are to be provided for new private gardens and public open spaces, they should be provided with Hedgehog Gateways to encourage colonisation and dispersal.

11.8.9 Birds

The habitats on-site offer limited foraging opportunities for birds with these opportunities concentrated on the amenity grassland area and among the mature trees. The trees within the site do offer suitable nesting opportunities for local bird species. Among the six bird species identified on site, Feral Pigeon were also found to be nesting in the buildings within the site during this time.

The proposals will involve the demolition of all buildings. It is recommended that a nesting bird survey of each building is undertaken prior to its demolition to ensure no nesting birds are present. Feral Pigeon were recorded within buildings on site and this species will often nest year-round; therefore, the demolition of the buildings may need to be undertaken using the Natural England General Licence (GL41). This licence allows the killing of specific bird species, and allows the damage, removal or destruction of their nests and eggs. It is noted that this licence can only be used to preserve public health and public safety with the terms and conditions of the licence be always adhered to.

Removal of any suitable nesting habitat should be undertaken outside of the bird nesting season (March to July inclusive) to avoid any potential offence. Should these timing constraints conflict with any timetabled works, works should commence only after a suitably qualified ecologist has undertaken checks to ensure no nesting birds are present, and any confirmed nests left in situ until the young have fledged.

The development would present opportunities to enhance the site for birds through native species planting and installation of additional bird boxes. The planting of berry / fruit-bearing species would provide enhanced foraging opportunities. New tree planting and mixed native hedging has been incorporated into the landscape

strategy and will provide further nesting and foraging opportunities to birds. It is recommended that new tree planting comprise native species or species of known value to birds.

11.8.10 Reptiles

No reptiles were observed on site or immediately adjacent to the site. The habitats present are wholly unsuitable for reptile species.

11.8.11 Amphibians (Great Crested Newts)

There is no suitable aquatic breeding habitat within the site. The habitats on site are unsuitable for amphibians in their terrestrial phase and their presence on site is considered to be highly unlikely.

11.8.12 Invertebrates

The landscape strategy will offer a variety of new opportunities for invertebrates, presenting a significant enhancement on the existing situation.

11.9 Landscape

Through developing the design and associated strategies a comprehensive and holistic landscape masterplan has been produced. The proposed Anglia Square will create a new community at Norwich-over-the-Water, creating homes for local people and offering a vast array of amenities for the wider community.

A place with vastly improved connectivity, increased safety and abundant biodiversity is the result of the design process. The rich history of Norwich has been respected, and the city's strong sense of identity has been harnessed.

A scheme of the highest quality is on offer at Anglia Square, and this is evident in the selection of materials within the landscape. The materials palette has been carefully considered and selected to respond to the context - be it the tree species, the hard surfacing materials, or the external furniture. As well as opening up areas of brownfield land for public use to benefit local people, nature will also benefit from the introduction of a number of greening initiatives, such as the introduction of over a hundred and fifty proposed trees.

Whilst the scheme at Anglia Square is aspirational and is looking to develop this area of Norwich to a higher standard, the design has also been considered so not to alienate the current users of the space, who use the shops daily and still have a strong connection with the area. A design that creates a dynamic retail and commercial environment as well as a new residential neighbourhood has been developed. The way people use the square at Anglia Square has been respected and has informed the design of the public spaces.

11.10 Transport

Please refer to Iceni's Transport Assessment report for full details of the transport assessment carried out for the proposed development, which is summarised below.

The site benefits from an excellent location both in terms of access to amenities / services, but also walking, cycling and public transport accessibility. The Proposed Development looks to further enhance these connections via local improvements both within the Site and in the immediate surrounding area. It is therefore considered that all users of the site have the opportunity to travel by non-car modes.

A highway safety assessment has been undertaken which has demonstrated that there is no underlying highway safety issues that will be exacerbated by the Proposed Development.

The Site is split into different zones, each of which have had access strategies carefully developed to ensure that vehicles can access and egress appropriately, but are also limited from travelling through the development wherever possible to further improve the pedestrian and cycle environment. Assessments in the form of visibility splays and swept path analysis have been undertaken to ensure the proposed vehicular access work from a technical perspective.

Adequate provision is included to ensure that delivery vehicles can successfully serve the site, with loading bays and turning areas provided at the necessary locations. A Delivery and Servicing Plan has been produced to provide further details on this.

The Proposed Development also provides a significant benefit with regard to decreasing vehicular movements by removing the existing public car parking located on the Site, which has been shown to be surplus to requirements. A limited number parking spaces have been proposed to serve the residential element of the Proposed Development (likely minimum of 0.41 total ratio), but this has been kept to a minimum given the sustainable location of the Site.

Cycle parking will also be provided to an adequate level to ensure that residents, staff and visitors will have sufficient space to store their bikes securely. The storage areas will be provided in accessible and convenient locations.

Given the proposed reduction in vehicular parking spaces within the Site, the associated vehicular trips are expected to decrease as a result of the Proposed Development and therefore the Site will generate less vehicle movements compared to the extant uses available. The multi-modal trip generation assessment has demonstrated that the majority of people travelling to and from the site will do so by sustainable travel modes. This will be further encouraged through the provision of Framework Travel Plans to support the development.

In conclusion, the proposed development at the site is compatible with, and supports, local and regional transport policies. It has been shown throughout this report that the proposals will not give rise to any adverse transport impacts. It is therefore considered that there is no highway related reason why the development proposal should not be granted planning permission.

11.11 Construction Environmental Management Plan (CEMP)

A framework Construction Environmental Management Plan (CEMP) has been developed to outline the overarching details and principles in order to minimise, manage and/or mitigate the environmental effects of the works associated with the construction phase of the development.

The aim of the Construction Environmental Management Plan (CEMP) is to set out the responsibilities with regards to compliance with legislation and to implement any mitigation measures. This CEMP details management measures to minimise environmental impact from the construction phase of the development.

The CEMP forms a framework within which the measures will be implemented throughout the project. This framework provides project-specific management measures and is a dynamic document which should be reviewed if activities or conditions onsite change that may influence management measures.

Appendix A.1 – SAP Calculations (Be Lean)

FullRefNo: P01 - Mid Floor End Flat - East - Be Lean

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 52 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating: Mains gas
Target Carbon Dioxide Emission Rate (TER) 14.31 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 14.46 kgCOâ,,/mÂ²
Fail
Excess emissions 1 = 0.15 kgCOâ,,/mÂ² (1.0%)

1b TPER and DPER
Target Primary Energy Rate (TPER) 81.1 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 81.1 kWh/mÂ²/yr
Fail
Excess energy = 5.0 kWh/mÂ²/yr (6.6%)

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.26)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.05 (max. 0.18)	0.05 (max. 0.70)	OK
Roof	(no roof)		
Windows		1.20 (max. 1.60)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor
- Mains gas
Data from manufacturer
- -

Efficiency: 88%
Minimum: 88% OK
Secondary heating system: None

---

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 2.66 kWh/day
Permitted by DBSCG 1.89
Fail
Primary pipework insulated: Yes
OK

---

6 Controls
Space heating controls: Programmer, room thermostat and TRVs
OK

Hot water controls: Cylinderstat
OK
Independent timer for DHW
OK

Boiler interlock Yes
OK

---

7 Low energy lights
Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK

---

8 Mechanical ventilation and Cooling
Continuous extract system
Specific fan power: 0.15
Maximum 0.7
OK
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Medium
OK
Based on:
Overshading: Average
Windows facing North: 2.28 mÂ², No overhang
Windows facing East: 8.51 mÂ², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---

10 Key features
External wall U-value 0.14 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K
Exposed floor U-value 0.10 W/mÂ²K
Air permeability 3.0 mÂ³/mÂ²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

---

1. Overall dwelling dimensions

Area (m2)	Storey height (m)	Volume (m3)
Ground floor		
52.2400 (1b)	x 2.7000 (2b)	= 141.0480 (1b) - (3b)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 52.2400 (4)
Dwelling volume
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 141.0480 (5)

---

2. Ventilation rate

---

m3 per hour

Number of open chimneys
0 * 80 = 0.0000 (6a)
Number of open flues
0 * 35 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire
0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler
0 * 20 = 0.0000 (6d)
Number of flues attached to other heater
0 * 35 = 0.0000 (6e)
Number of blocked chimneys
0 * 20 = 0.0000 (6f)
Number of open flues or <200 vertical ducts
0 * 20 = 0.0000 (6g)
Number of intermittent extract fans
0 * 10 = 0.0000 (7a)
Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) =
0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
2 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211

Jul	Aug	Sep	Oct	Nov	Dec	
3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Double Glazing (Uw = 1.20)								
10.7900			10.7900	1.1450	12.3550			(27)
Floor to commercial								
52.2400			52.2400	0.0500	2.6120			(28b)
RC Block	7.7900							
7.7900			7.7900	0.2700	2.1033	150.0000	1168.5000	(29a)
Bos Unipanel	31.4100					10.7900		
20.6200			20.6200	0.1400	2.8868	14.0000	288.6800	(29a)

Total net area of external elements Aum(A, m2)
91.4400 (31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 19.9571 (33)

Party Wall					
30.5600	0.0000	0.0000	70.0000	2139.2000	(32)
Solid Party Wall					
8.6400	0.0000	0.0000	110.0000	950.4000	(32)

Party Floor 1
52.2400 80.0000 4179.2000 (32d)
Party Ceilings 1
52.2400 80.0000 4179.2000 (32b)
Internal Wall
71.0100 9.0000 639.0900 (32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 13544.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
259.2701 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
3.6777 (36)
Total fabric heat loss
(33) + (36) = 23.6347 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun
(38)m	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729

Jul	Aug	Sep	Oct	Nov	Dec	
23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	(38)

Heat transfer coeff

	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077

46.9077	46.9077	46.9077	46.9077	46.9077	46.9077	(39)

Average = Sum(39)m / 12 =
46.9077 (39)

	Jan	Feb	Mar	Apr	May	Jun
HLP	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979

Jul	Aug	Sep	Oct	Nov	Dec	
0.8979	0.8979	0.8979	0.8979	0.8979	0.8979	(40)

HLP (average)
0.8979 (40)
Days in month

	31	28	31	30	31	30

31	31	30	31	30	31	(41)

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy
1.7562 (42)
Average daily hot water use (litres/day)
85.0799 (43)

	Jan	Feb	Mar	Apr	May	Jun
Daily hot water use	93.0207	90.5320	87.9849	83.9422	80.8659	77.4272

Jul	Aug	Sep	Oct	Nov	Dec	
77.0037	79.5585	82.2970	85.8444	89.5338	93.1508	(44)

Energy conte	137.9470	121.8525	126.9954	109.9419	105.9503	91.4299

84.2599	95.6464	96.0338	112.1641	122.8792	133.7812	(45)

Energy content (annual)
Total = Sum(45)m = 1338.8816 (45)
Distribution loss (46)m = 0.15 x (45)m

	20.6921	18.2779	19.0493	16.4913	15.8925	13.7145

12.6390	14.3470	14.4051	16.8246	18.4319	20.0672	(46)

Water storage loss:
Store volume
150.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day)
0.0191 (51)
Volume factor from Table 2a
0.9283 (52)
Temperature factor from Table 2b
0.5400 (53)
Enter (49) or (54) in (55)
1.4364 (55)
Total storage loss

	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918

44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(56)

If cylinder contains dedicated solar storage

	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918

44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(57)

Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120

23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

Total heat required for water heating calculated for each month

	205.7376	183.0827	194.7860	175.5457	173.7409	157.0337

152.0505	163.4370	161.6376	179.9547	188.4830	201.5717	(62)

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Solar input (sum of months) = Sum(63d)m = 0.0000 (63d)
Output from w/h

	205.7376	183.0827	194.7860	175.5457	173.7409	157.0337

152.0505	163.4370	161.6376	179.9547	188.4830	201.5717	(64)

Total per year (kWh/year) = Sum(64)m = 2137.0611 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by
instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

	100.0999	89.5001	96.4585	89.0387	89.4610	82.8835

82.2489	86.0349	84.4143	91.5270	93.3404	98.7147	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun
(66)m	87.8075	87.8075	87.8075	87.8075	87.8075	87.8075

Jul	Aug	Sep	Oct	Nov	Dec	
87.8075	87.8075	87.8075	87.8075	87.8075	87.8075	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	77.5051	85.8092	77.5051	80.0886	77.5051	80.0886

77.5051	77.5051	80.0886	77.5051	80.0886	77.5051	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	153.0483	154.6365	150.6344	142.1143	131.3593	121.2511

114.4982	112.9101	116.9122	125.4322	136.1872	146.2954	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	31.7808	31.7808	31.7808	31.7808	31.7808	31.7808

31.7808	31.7808	31.7808	31.7808	31.7808	31.7808	(69)

Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000

3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

```
                -70.2460   -70.2460   -70.2460   -70.2460   -70.2460   -70.2460   -
70.2460   -70.2460   -70.2460   -70.2460   -70.2460   -70.2460 (71)
Water heating gains (Table 5)
                134.5428   133.1847   129.6485   123.6649   120.2432   115.1159
110.5496   115.6383   117.2420   123.0202   129.6394   132.6811 (72)
Total internal gains
                417.4385   425.9727   410.1302   398.2101   381.4499   368.7979
354.8952   358.3957   366.5851   378.2998   398.2575   408.8239 (73)
```

```
-------------------------------------------------------------------------------
-----------------
6. Solar gains
-------------------------------------------------------------------------------
-----------------

[Jan]                                       Area         Solar flux
g                FF             Access              Gains
                                              m2           Table 6a      Specific
data      Specific data              factor                    W
                                                                  W/m2        or
Table 6b        or Table 6c           Table 6d
-------------------------------------------------------------------------------
-----------------
North                                     2.2800           10.6334
0.5000             0.7000             0.7700            5.8804 (74)
East                                      8.5100           19.6403
0.5000             0.7000             0.7700           40.5395 (76)
-------------------------------------------------------------------------------
-----------------
Solar gains     46.4199    90.5416   149.6978   221.1480   274.7536   283.1950
268.7987   228.1845   174.8549   107.4778    57.8022    38.2399 (83)
Total gains    463.8584   516.5143   559.8280   619.3581   656.2035   651.9929
623.6939   586.5803   541.4400   485.7776   456.0597   447.0638 (84)
```

```
-------------------------------------------------------------------------------
-----------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------
-----------------
Temperature during heating periods in the living area from Table 9, Th1 (C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun
Jul        Aug        Sep        Oct        Nov        Dec
tau             80.2065    80.2065    80.2065    80.2065    80.2065    80.2065
80.2065    80.2065    80.2065    80.2065    80.2065    80.2065
alpha            6.3471     6.3471     6.3471     6.3471     6.3471     6.3471
6.3471     6.3471     6.3471     6.3471     6.3471     6.3471
util living area
                 0.9850     0.9698     0.9324     0.8234     0.6472     0.4586
0.3307     0.3674     0.5884     0.8657     0.9665     0.9880 (86)

MIT             20.4032    20.5351    20.7109    20.8947    20.9789    20.9978
20.9998    20.9996    20.9907    20.8770    20.6138    20.3668 (87)
Th 2            20.1693    20.1693    20.1693    20.1693    20.1693    20.1693
20.1693    20.1693    20.1693    20.1693    20.1693    20.1693 (88)
util rest of house
                 0.9807     0.9615     0.9150     0.7870     0.5953     0.4000
0.2684     0.3013     0.5216     0.8275     0.9558     0.9844 (89)
```

```
MIT 2           19.6400    19.7678    19.9335    20.0939    20.1571    20.1684
20.1692    20.1692    20.1651    20.0835    19.8454    19.6044 (90)
Living area fraction
fLA = Living area / (4) =      0.5691 (91)
MIT             20.0744    20.2045    20.3759    20.5497    20.6248    20.6404
20.6419    20.6417    20.6349    20.5351    20.2827    20.0383 (92)
Temperature adjustment
0.0000
adjusted MIT    20.0744    20.2045    20.3759    20.5497    20.6248    20.6404
20.6419    20.6417    20.6349    20.5351    20.2827    20.0383 (93)
```

```
-------------------------------------------------------------------------------
-----------------
8. Space heating requirement
-------------------------------------------------------------------------------
-----------------

                Jan        Feb        Mar        Apr        May        Jun
Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9801     0.9619     0.9197     0.8043     0.6241     0.4333
0.3039     0.3390     0.5594     0.8453     0.9575     0.9838 (94)
Useful gains   454.6273   496.8340   514.8836   498.1615   409.5647   282.5328
189.5266   198.8325   302.8878   410.6384   436.6550   439.8028 (95)
Ext temp.        4.3000     4.9000     6.5000     8.9000    11.7000    14.6000
16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
               739.9383   717.8966   650.8865   546.4588   418.6416   283.3427
189.5955   198.9702   306.5384   466.0315   618.3705   742.9369 (97)
Month fracti     1.0000     1.0000     1.0000     1.0000     1.0000     0.0000
0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
                212.2714   148.5541   101.1862    34.7741     6.7532     0.0000
0.0000     0.0000     0.0000    41.2124   130.8352   225.5317 (98)
Space heating
901.1182 (98)
Space heating per m2
(98) / (4) =     17.2496 (99)
```

```
-------------------------------------------------------------------------------
-----------------
8c. Space cooling requirement
-------------------------------------------------------------------------------
-----------------
Not applicable
```

```
-------------------------------------------------------------------------------
-----------------
9a. Energy requirements - Individual heating systems, including micro-CHP
-------------------------------------------------------------------------------
-----------------
Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Efficiency of main space heating system 1 (in %)
88.0000 (206)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
```

Space heating requirement
1023.9980 (211)

	Jan	Feb	Mar	Apr	May	Jun
Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement						
	212.2714	148.5541	101.1862	34.7741	6.7532	0.0000
0.0000	0.0000	0.0000	41.2124	130.8352	225.5317 (98)	
Space heating efficiency (main heating system 1)						
	88.0000	88.0000	88.0000	88.0000	88.0000	0.0000
0.0000	0.0000	0.0000	88.0000	88.0000	88.0000 (210)	
Space heating fuel (main heating system)						
	241.2175	168.8114	114.9843	39.5160	7.6741	0.0000
0.0000	0.0000	0.0000	46.8323	148.6763	256.2861 (211)	
Water heating requirement						
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	

Water heating
Water heating requirement

205.7376	183.0827	194.7860	175.5457	173.7409	157.0337
152.0505	163.4370	161.6376	179.9547	188.4830	201.5717 (64)

Efficiency of water heater
88.0000 (216)

(217)m	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000
88.0000	88.0000	88.0000	88.0000	88.0000	88.0000 (217)	

Fuel for water heating, kWh/month

233.7927	208.0485	221.3478	199.4838	197.4328	178.4473
172.7846	185.7239	183.6791	204.4940	214.1852	229.0588 (219)

Water heating fuel used
2428.4786 (219)
Annual totals kWh/year
Space heating fuel - main system
1023.9980 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)
mechanical ventilation fans (SFP = 0.1950)
33.5553 (230a)
central heating pump
41.0000 (230c)
main heating flue fan
45.0000 (230e)
Total electricity for the above, kWh/year
119.5553 (231)
Electricity for lighting (calculated in Appendix L)
102.2027 (232)
Total delivered energy for all uses
3674.2346 (238)

Space heating - main system 1
1023.9980 0.2100 215.0396 (261)
Space heating - secondary
0.0000 0.0000 0.0000 (263)
Water heating (other fuel)
2428.4786 0.2100 509.9805 (264)
Space and water heating
725.0201 (265)
Pumps and fans
119.5553 0.1360 16.2595 (267)
Energy for lighting
102.2027 0.1360 13.8996 (268)
Total CO2, kg/year
755.1792 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
14.4600 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
14.4600 ZC1
Total Floor Area
TFA 52.2400
Assumed number of occupants
N 1.7562
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.5493 ZC2
CO2 emissions from cooking, equation (L16)
3.0848 ZC3
Total CO2 emissions
22.0940 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
22.0940 ZC8

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year

SAP X Input Data (Flat) 05/04/2022

FullRefNo: P21 - Mid Floor Mid Flat - Be Lean

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 52 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating: Mains gas
Target Carbon Dioxide Emission Rate (TER) 12.66 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 13.64 kgCOâ,,/mÂ²
Fail
Excess emissions 1 = 0.98 kgCOâ,,/mÂ² (7.7%)

1b TPER and DPER

Target Primary Energy Rate (TPER) 76.7 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 76.7 kWh/mÂ²/yr
Fail
Excess energy = 9.0 kWh/mÂ²/yr (13.3%)

---

2 Fabric U-values

Element	Average	Highest
External wall	0.22 (max. 0.26)	0.22 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	(no floor)	
Roof	(no roof)	
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability

Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK

---

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
- -

Efficiency: 88%
Minimum: 88%
OK

Secondary heating system: None

---

5 Cylinder insulation

Hot water storage Nominal cylinder loss: 2.66 kWh/day
Permitted by DBSCG 1.89
Fail
Primary pipework insulated: Yes
OK

---

6 Controls

Space heating controls: Programmer, room thermostat and TRVs
OK

Hot water controls: Cylinderstat
OK

Independent timer for DHW
OK

Boiler interlock Yes
OK

---

7 Low energy lights

Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK

---

8 Mechanical ventilation and Cooling

Continuous extract system
Specific fan power: 0.15
Maximum 0.7
OK
Not applicable

---

9 Summertime temperature

Overheating risk (Thames Valley): Medium
OK
Based on:
Overshading: Average
Windows facing East: 5.38 mÂ², No overhang
Windows facing South West: 4.87 mÂ², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/mÂ²K
Air permeability 3.0 mÂ³/mÂ²h

---
1. Overall dwelling dimensions

Area (m2)		Storey height (m)		Volume (m3)
Ground floor				
51.7700 (1b)	x	2.7000 (2b)	=	139.7790 (1b) - (3b)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
51.7700
(4)
Dwelling volume
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 139.7790 (5)

---
2. Ventilation rate

---

m3 per hour

Number of open chimneys
0 * 80 = 0.0000 (6a)
Number of open flues
0 * 35 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire
0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler
0 * 20 = 0.0000 (6d)
Number of flues attached to other heater
0 * 35 = 0.0000 (6e)
Number of blocked chimneys
0 * 20 = 0.0000 (6f)

Number of open flues or <200 vertical ducts
0 * 20 = 0.0000 (6g)
Number of intermittent extract fans
0 * 10 = 0.0000 (7a)
Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
2 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
Double Glazing (Uw = 1.20)			10.2500	1.1450	11.7366		(27)
Cavity Wall	38.4500	10.2500	28.2000	0.2200	6.2040	110.0000	3102.0000 (29a)

Total net area of external elements Aum(A, m2)
38.4500
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 17.9406 (33)

Party Wall	47.6100	0.0000	0.0000	70.0000	3332.7000 (32)
Party Floor 1	51.7700			40.0000	2070.8000 (32d)
Party Ceilings 1	51.7700			80.0000	4141.6000 (32b)
Internal Wall	58.7000			9.0000	528.3000 (32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 13175.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
254.4987 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
3.5015 (36)
Total fabric heat loss
(33) + (36) = 21.4421 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635 (38)
Heat transfer coeff	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056 (39)

Average = Sum(39)m / 12 =
44.5056 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597 (40)

HLP (average)
0.8597 (40)
Days in month

```
                    31         28         31         30         31
30         31         31         30         31         30         31
(41)



------------------------------------------------------------------------------
------------------------------
4. Water heating energy requirements (kWh/year)
------------------------------------------------------------------------------
------------------------------
Assumed occupancy
1.7423 (42)
Average daily hot water use (litres/day)
84.7095 (43)

                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
Daily hot water use
               92.6157    90.1379    87.6019    83.5767    80.5138
77.0901    76.6685    79.2122    81.9387    85.4706    89.1440
92.7452 (44)
Energy conte   137.3464   121.3220   126.4425   109.4632   105.4890
91.0318    83.8930    95.2300    95.6157   111.6758   122.3442
133.1987 (45)
Energy content (annual)
Total = Sum(45)m =   1333.0524 (45)
Distribution loss  (46)m = 0.15 x (45)m
               20.6020    18.1983    18.9664    16.4195    15.8234
13.6548    12.5840    14.2845    14.3424    16.7514    18.3516
19.9798 (46)
Water storage loss:
Store volume
150.0000 (47)
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)
0.0191 (51)
  Volume factor from Table 2a
0.9283 (52)
  Temperature factor from Table 2b
0.5400 (53)
Enter (49) or (54) in (55)
1.4364 (55)
Total storage loss
               44.5282    40.2190    44.5282    43.0918    44.5282
43.0918    44.5282    44.5282    43.0918    44.5282    43.0918
44.5282 (56)
If cylinder contains dedicated solar storage
               44.5282    40.2190    44.5282    43.0918    44.5282
43.0918    44.5282    44.5282    43.0918    44.5282    43.0918
44.5282 (57)
Primary loss    23.2624    21.0112    23.2624    22.5120    23.2624
22.5120    23.2624    23.2624    22.5120    23.2624    22.5120
23.2624 (59)
Total heat required for water heating calculated for each month
               205.1370   182.5522   194.2331   175.0670   173.2796
156.6356   151.6836   163.0206   161.2195   179.4664   187.9480
200.9893 (62)
Solar input      0.0000     0.0000     0.0000     0.0000     0.0000
0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0.0000 (63d)

Solar input (sum of months) = Sum(63d)m =      0.0000 (63d)
Output from w/h
               205.1370   182.5522   194.2331   175.0670   173.2796
156.6356   151.6836   163.0206   161.2195   179.4664   187.9480
200.9893 (64)

Total per year (kWh/year) = Sum(64)m =   2131.2320 (64)
Electric shower(s)
                0.0000     0.0000     0.0000     0.0000     0.0000
0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0.0000 (64a)
                                                          Total Energy used
by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month
               99.9002    89.3237    96.2746    88.8796    89.3076
82.7511    82.1269    85.8964    84.2752    91.3647    93.1625
98.5210 (65)



------------------------------------------------------------------------------
------------------------------
5. Internal gains (see Table 5 and 5a)
------------------------------------------------------------------------------
------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m          87.1143    87.1143    87.1143    87.1143    87.1143
87.1143    87.1143    87.1143    87.1143    87.1143    87.1143
87.1143 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see
Table 5
               77.2036    85.4754    77.2036    79.7771    77.2036
79.7771    77.2036    77.2036    79.7771    77.2036    79.7771
77.2036 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also
see Table 5
              151.8293   153.4048   149.4346   140.9824   130.3130
120.2853   113.5862   112.0107   115.9810   124.4331   135.1025
145.1302 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also
see Table 5
               31.7114    31.7114    31.7114    31.7114    31.7114
31.7114    31.7114    31.7114    31.7114    31.7114    31.7114
31.7114 (69)
Pumps, fans      3.0000     3.0000     3.0000     3.0000     3.0000
3.0000     3.0000     3.0000     3.0000     3.0000     3.0000
3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
```

-69.6914 -69.6914 -69.6914 -69.6914 -69.6914 -
69.6914 -69.6914 -69.6914 -69.6914 -69.6914 -69.6914 -
69.6914 (71)
Water heating gains (Table 5)
134.2744 132.9222 129.4014 123.4438 120.0371
114.9321 110.3856 115.4522 117.0490 122.8020 129.3924
132.4208 (72)
Total internal gains
415.4416 423.9367 408.1738 396.3376 379.6880
367.1288 353.3098 356.8008 364.9413 376.5730 396.4062
406.8888 (73)

---
6. Solar gains

[Jan] Area Solar flux
g FF Access Gains
m2 Table 6a
Specific data Specific data factor W
W/m2
or Table 6b or Table 6c Table 6d

East 5.3800 19.6403
0.5000 0.7000 0.7700 25.6290 (76)
Southwest 4.8700 36.7938
0.5000 0.7000 0.7700 43.4616 (79)

Solar gains 69.0905 124.1668 183.8589 245.9245 288.1545
290.6322 278.3777 246.8523 205.7065 141.3103 84.0132
58.2700 (83)
Total gains 484.5321 548.1035 592.0327 642.2621 667.8425
657.7610 631.6874 603.6531 570.6478 517.8834 480.4194
465.1589 (84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1
(C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
tau 82.2330 82.2330 82.2330 82.2330 82.2330 82.2330
82.2330 82.2330 82.2330 82.2330 82.2330 82.2330
82.2330

alpha 6.4822 6.4822 6.4822 6.4822 6.4822
6.4822 6.4822 6.4822 6.4822 6.4822 6.4822
6.4822
util living area
0.9773 0.9522 0.9006 0.7794 0.6089
0.4320 0.3099 0.3389 0.5336 0.8131 0.9489
0.9821 (86)

MIT 20.4911 20.6327 20.7884 20.9285 20.9863
20.9987 20.9999 20.9998 20.9951 20.9212 20.6929
20.4511 (87)
Th 2 20.2019 20.2019 20.2019 20.2019 20.2019
20.2019 20.2019 20.2019 20.2019 20.2019 20.2019
20.2019 (88)
util rest of house
0.9713 0.9405 0.8788 0.7417 0.5603
0.3786 0.2537 0.2803 0.4739 0.7707 0.9344
0.9771 (89)
MIT 2 19.7545 19.8896 20.0330 20.1516 20.1940
20.2014 20.2019 20.2018 20.1997 20.1487 19.9487
19.7157 (90)
Living area fraction
fLA = Living area / (4) = 0.5503 (91)
MIT 20.1598 20.2985 20.4487 20.5791 20.6300
20.6401 20.6410 20.6410 20.6374 20.5738 20.3582
20.1204 (92)
Temperature adjustment
0.0000
adjusted MIT 20.1598 20.2985 20.4487 20.5791 20.6300
20.6401 20.6410 20.6410 20.6374 20.5738 20.3582
20.1204 (93)

---
8. Space heating requirement

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Utilisation 0.9709 0.9421 0.8860 0.7600 0.5866
0.4080 0.2847 0.3126 0.5067 0.7913 0.9376
0.9765 (94)
Useful gains 470.4287 516.3489 524.5329 488.1386 391.7532
268.3380 179.8111 188.6773 289.1310 409.7836 450.4285
454.2485 (95)
Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000
14.6000 16.6000 16.4000 14.1000 10.6000 7.1000
4.2000 (96)
Heat loss rate W
705.8520 685.3208 620.7958 519.7872 397.4352
268.8198 179.8485 188.7466 290.9533 443.8911 590.0663
708.5476 (97)
Month fracti 1.0000 1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000 1.0000 1.0000
1.0000 (97a)

Space heating kWh
175.1549 113.5491 71.6196 22.7870 4.2274
0.0000 0.0000 0.0000 0.0000 25.3760 100.5392
189.1985 (98)
Space heating
702.4517 (98)
Space heating per m2
(98) / (4) = 13.5687 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Efficiency of main space heating system 1 (in %)
88.0000 (206)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
798.2406 (211)

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Space heating requirement
175.1549 113.5491 71.6196 22.7870 4.2274
0.0000 0.0000 0.0000 0.0000 25.3760 100.5392
189.1985 (98)
Space heating efficiency (main heating system 1)
88.0000 88.0000 88.0000 88.0000 88.0000
0.0000 0.0000 0.0000 0.0000 88.0000 88.0000
88.0000 (210)
Space heating fuel (main heating system)
199.0397 129.0331 81.3859 25.8943 4.8039
0.0000 0.0000 0.0000 0.0000 28.8363 114.2491
214.9983 (211)
Water heating requirement
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (215)

Water heating
Water heating requirement
205.1370 182.5522 194.2331 175.0670 173.2796
156.6356 151.6836 163.0206 161.2195 179.4664 187.9480
200.9893 (64)
Efficiency of water heater
88.0000 (216)
(217)m 88.0000 88.0000 88.0000 88.0000 88.0000
88.0000 88.0000 88.0000 88.0000 88.0000 88.0000
88.0000 (217)
Fuel for water heating, kWh/month
233.1102 207.4457 220.7194 198.9398 196.9087
177.9950 172.3678 185.2507 183.2039 203.9391 213.5773
228.3969 (219)
Water heating fuel used
2421.8545 (219)
Annual totals kWh/year
Space heating fuel - main system
798.2406 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)
mechanical ventilation fans (SFP = 0.1950)
33.2534 (230a)
central heating pump
41.0000 (230c)
main heating flue fan
45.0000 (230e)
Total electricity for the above, kWh/year
119.2534 (231)
Electricity for lighting (calculated in Appendix L)
101.9625 (232)
Total delivered energy for all uses
3441.3110 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1		
798.2406	0.2100	167.6305 (261)
Space heating - secondary		
0.0000	0.0000	0.0000 (263)
Water heating (other fuel)		
2421.8545	0.2100	508.5894 (264)
Space and water heating		
676.2200 (265)		
Pumps and fans		
119.2534	0.1360	16.2185 (267)

Energy for lighting
101.9625 0.1360 13.8669 (268)
Total CO2, kg/year
706.3053 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
13.6400 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
13.6400 ZC1
Total Floor Area
TFA 51.7700
Assumed number of occupants
N 1.7423
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.5540 ZC2
CO2 emissions from cooking, equation (L16)
3.1063 ZC3
Total CO2 emissions
21.3004 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
21.3004 ZC8

SAP X Input Data (Flat) 06/04/2022

FullRefNo: P27 - Mid Floor End Flat-South - Be Lean

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 71 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating: Mains gas
Target Carbon Dioxide Emission Rate (TER) 11.31 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 11.66 kgCOâ,,/mÂ²
Fail
Excess emissions 1 = 0.35 kgCOâ,,/mÂ² (3.1%)

1b TPER and DPER
Target Primary Energy Rate (TPER) 65.6 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 65.6 kWh/mÂ²/yr
Fail
Excess energy = 5.5 kWh/mÂ²/yr (9.2%)

---

2 Fabric U-values

Element	Average	Highest
External wall	0.18 (max. 0.26)	0.27 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	(no floor)	
Roof	(no roof)	
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
- -

Efficiency: 88%
Minimum: 88%
OK

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 2.66 kWh/day
Permitted by DBSCG 1.89
Fail
Primary pipework insulated: Yes
OK

---

6 Controls
Space heating controls: Programmer, room thermostat and TRVs
OK

Hot water controls: Cylinderstat
OK
Independent timer for DHW
OK
Boiler interlock Yes
OK

---

7 Low energy lights
Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK

---

8 Mechanical ventilation and Cooling
Continuous extract system
Specific fan power: 0.17
Maximum 0.7
OK
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Medium
OK
Based on:
Overshading: Average
Windows facing East: 7.24 mÂ², No overhang
Windows facing South East: 7.24 mÂ², No overhang
Windows facing South: 2.41 mÂ², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
External wall U-value 0.14 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K
Air permeability 3.0 mÂ³/mÂ²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

---
1. Overall dwelling dimensions

Area Storey height Volume

(m2) (m) (m3)
Ground floor
71.1800 (1b) x 2.7000 (2b) = 192.1860 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
71.1800
(4)
Dwelling volume
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 192.1860 (5)

---
2. Ventilation rate

---

m3 per hour

Number of open chimneys
0 * 80 = 0.0000 (6a)
Number of open flues
0 * 35 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire
0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler
0 * 20 = 0.0000 (6d)
Number of flues attached to other heater
0 * 35 = 0.0000 (6e)
Number of blocked chimneys
0 * 20 = 0.0000 (6f)
Number of open flues or <200 vertical ducts
0 * 20 = 0.0000 (6g)
Number of intermittent extract fans
0 * 10 = 0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
2 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---
3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
Double Glazing (Uw = 1.20)							
	16.8900	1.1450	19.3397				(27)
RC Block	8.3700						
	8.3700	0.2700	2.2599	150.0000	1255.5000		(29a)
Bos Unipanel	34.4100	16.8900					
	17.5200	0.1400	2.4528	14.0000	245.2800		(29a)

Total net area of external elements Aum(A, m2)
42.7800
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 24.0524 (33)

Party Wall					
39.9700	0.0000	0.0000	70.0000	2797.9000	(32)
Solid Party Wall					
10.8500	0.0000	0.0000	110.0000	1193.5000	(32)
Party Floor 1					
71.1800			80.0000	5694.4000	(32d)
Party Ceilings 1					
71.1800			80.0000	5694.4000	(32b)
Internal Wall					
115.9700			9.0000	1043.7300	(32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 17924.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
251.8223 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
4.6740 (36)
Total fabric heat loss
(33) + (36) = 28.7264 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107 (38)
Heat transfer coeff	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370 (39)

Average = Sum(39)m / 12 =
60.4370 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491 (40)

HLP (average)
0.8491 (40)

Days in month
31 28 31 30 31
30 31 31 30 31 30 31
(41)

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy
2.2744 (42)
Average daily hot water use (litres/day)
98.9257 (43)

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Daily hot water use
108.1588 105.2651 102.3035 97.6028 94.0259
90.0276 89.5352 92.5058 95.6899 99.8146 104.1044
108.3100 (44)
Energy conte 160.3963 141.6826 147.6625 127.8337 123.1925
106.3090 97.9722 111.2118 111.6622 130.4176 142.8764
155.5525 (45)
Energy content (annual)
Total = Sum(45)m = 1556.7694 (45)
Distribution loss (46)m = 0.15 x (45)m
24.0594 21.2524 22.1494 19.1751 18.4789
15.9464 14.6958 16.6818 16.7493 19.5626 21.4315
23.3329 (46)
Water storage loss:
Store volume
150.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day)
0.0191 (51)
Volume factor from Table 2a
0.9283 (52)
Temperature factor from Table 2b
0.5400 (53)
Enter (49) or (54) in (55)
1.4364 (55)
Total storage loss
44.5282 40.2190 44.5282 43.0918 44.5282
43.0918 44.5282 44.5282 43.0918 44.5282 43.0918
44.5282 (56)
If cylinder contains dedicated solar storage
44.5282 40.2190 44.5282 43.0918 44.5282
43.0918 44.5282 44.5282 43.0918 44.5282 43.0918
44.5282 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624
22.5120 23.2624 23.2624 22.5120 23.2624 22.5120
23.2624 (59)
Total heat required for water heating calculated for each month
228.1869 202.9128 215.4531 193.4375 190.9831
171.9128 165.7628 179.0024 177.2660 198.2082 208.4802
223.3431 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (63d)

Solar input (sum of months) = Sum(63d)m = 0.0000 (63d)
Output from w/h
228.1869 202.9128 215.4531 193.4375 190.9831
171.9128 165.7628 179.0024 177.2660 198.2082 208.4802
223.3431 (64)

Total per year (kWh/year) = Sum(64)m = 2354.9489 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (64a)
Total Energy used
by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month
107.5642 96.0936 103.3303 94.9877 95.1940
87.8308 86.8082 91.2104 89.6107 97.5963 99.9894
105.9537 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
(66)m 113.7214 113.7214 113.7214 113.7214 113.7214
113.7214 113.7214 113.7214 113.7214 113.7214 113.7214
113.7214 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see
Table 5
100.8948 111.7050 100.8948 104.2580 100.8948
104.2580 100.8948 100.8948 104.2580 100.8948 104.2580
100.8948 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also
see Table 5
200.0353 202.1110 196.8802 185.7445 171.6876
158.4761 149.6500 147.5743 152.8051 163.9408 177.9977
191.2092 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also
see Table 5
34.3721 34.3721 34.3721 34.3721 34.3721
34.3721 34.3721 34.3721 34.3721 34.3721 34.3721
34.3721 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000
3.0000 3.0000 3.0000 3.0000 3.0000 3.0000
3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)

-90.9771 -90.9771 -90.9771 -90.9771 -90.9771 -
90.9771 -90.9771 -90.9771 -90.9771 -90.9771 -90.9771 -
90.9771 (71)
Water heating gains (Table 5)
144.5756 142.9965 138.8847 131.9274 127.9489
121.9872 116.6777 122.5946 124.4593 131.1778 138.8742
142.4109 (72)
Total internal gains
505.6221 516.9289 496.7762 482.0463 460.6477
444.8377 427.3390 431.1801 441.6388 456.1299 481.2463
494.6313 (73)

---
6. Solar gains

[Jan] Area Solar flux
g FF Access Gains
m2 Table 6a
Specific data Specific data factor W
W/m2
or Table 6b or Table 6c Table 6d

East 7.2400 19.6403
0.5000 0.7000 0.7700 34.4895 (76)
Southeast 7.2400 36.7938
0.5000 0.7000 0.7700 64.6123 (77)
South 2.4100 46.7521
0.5000 0.7000 0.7700 27.3287 (78)

Solar gains 126.4305 222.2848 318.7114 413.0711 474.7354
475.3993 456.7197 410.8884 351.8379 249.9706 152.7888
107.2716 (83)
Total gains 632.0526 739.2137 815.4877 895.1174 935.3831
920.2370 884.0587 842.0686 793.4767 706.1006 634.0351
601.9030 (84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1
(C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec

tau 82.3847 82.3847 82.3847 82.3847 82.3847
82.3847 82.3847 82.3847 82.3847 82.3847 82.3847
82.3847
alpha 6.4923 6.4923 6.4923 6.4923 6.4923
6.4923 6.4923 6.4923 6.4923 6.4923 6.4923
6.4923
util living area
0.9815 0.9538 0.8956 0.7654 0.5919
0.4194 0.3007 0.3300 0.5217 0.8112 0.9551
0.9861 (86)

MIT 20.4604 20.6281 20.7974 20.9359 20.9883
20.9989 20.9999 20.9998 20.9958 20.9226 20.6746
20.4147 (87)
Th 2 20.2110 20.2110 20.2110 20.2110 20.2110
20.2110 20.2110 20.2110 20.2110 20.2110 20.2110
20.2110 (88)
util rest of house
0.9765 0.9425 0.8734 0.7276 0.5448
0.3681 0.2468 0.2735 0.4637 0.7692 0.9421
0.9822 (89)
MIT 2 19.7331 19.8938 20.0495 20.1661 20.2043
20.2105 20.2110 20.2110 20.2091 20.1586 19.9404
19.6886 (90)
Living area fraction
fLA = Living area / (4) = 0.4468 (91)
MIT 20.0581 20.2219 20.3836 20.5100 20.5546
20.5627 20.5634 20.5634 20.5605 20.5000 20.2684
20.0130 (92)
Temperature adjustment
0.0000
adjusted MIT 20.0581 20.2219 20.3836 20.5100 20.5546
20.5627 20.5634 20.5634 20.5605 20.5000 20.2684
20.0130 (93)

---
8. Space heating requirement

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Utilisation 0.9754 0.9427 0.8786 0.7423 0.5655
0.3911 0.2709 0.2987 0.4896 0.7853 0.9432
0.9810 (94)
Useful gains 616.4871 696.8430 716.4557 664.4622 528.9507
359.8714 239.5017 251.5529 388.4597 554.4909 598.0032
590.4698 (95)
Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000
14.6000 16.6000 16.4000 14.1000 10.6000 7.1000
4.2000 (96)
Heat loss rate W
952.3700 926.0079 839.0847 701.6756 535.1446
360.3703 239.5380 251.6222 390.4555 598.3244 795.8586
955.6921 (97)

Month fracti 1.0000 1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000 1.0000 1.0000
1.0000 (97a)
Space heating kWh
249.8969 153.9988 91.2360 26.7936 4.6083
0.0000 0.0000 0.0000 0.0000 32.6121 142.4559
271.7254 (98)
Space heating
973.3269 (98)
Space heating per m2
(98) / (4) = 13.6742 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Efficiency of main space heating system 1 (in %)
88.0000 (206)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
1106.0533 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	249.8969	153.9988	91.2360	26.7936	4.6083	0.0000	0.0000	0.0000	0.0000	32.6121	142.4559	271.7254 (98)
Space heating efficiency (main heating system 1)	88.0000	88.0000	88.0000	88.0000	88.0000	0.0000	0.0000	0.0000	0.0000	88.0000	88.0000	88.0000 (210)
Space heating fuel (main heating system)	283.9737	174.9986	103.6773	30.4473	5.2367	0.0000	0.0000	0.0000	0.0000	37.0592	161.8817	308.7788 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating
Water heating requirement
228.1869 202.9128 215.4531 193.4375 190.9831
171.9128 165.7628 179.0024 177.2660 198.2082 208.4802
223.3431 (64)
Efficiency of water heater
88.0000 (216)
(217)m 88.0000 88.0000 88.0000 88.0000 88.0000
88.0000 88.0000 88.0000 88.0000 88.0000 88.0000
88.0000 (217)
Fuel for water heating, kWh/month
259.3033 230.5827 244.8330 219.8153 217.0263
195.3555 188.3668 203.4118 201.4386 225.2365 236.9093
253.7990 (219)
Water heating fuel used
2676.0783 (219)
Annual totals kWh/year
Space heating fuel - main system
1106.0533 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.2210)
mechanical ventilation fans (SFP = 0.2210)
51.8172 (230a)
central heating pump
41.0000 (230c)
main heating flue fan
45.0000 (230e)
Total electricity for the above, kWh/year
137.8172 (231)
Electricity for lighting (calculated in Appendix L)
127.0206 (232)
Total delivered energy for all uses
4046.9693 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1		
1106.0533	0.2100	232.2712 (261)
Space heating - secondary		
0.0000	0.0000	0.0000 (263)
Water heating (other fuel)		
2676.0783	0.2100	561.9764 (264)
Space and water heating		
794.2476 (265)		
Pumps and fans		
137.8172	0.1360	18.7431 (267)

Energy for lighting
127.0206 0.1360 17.2748 (268)
Total CO2, kg/year
830.2656 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
11.6600 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
11.6600 ZC1
Total Floor Area
TFA 71.1800
Assumed number of occupants
N 2.2744
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.3638 ZC2
CO2 emissions from cooking, equation (L16)
2.4387 ZC3
Total CO2 emissions
18.4625 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
18.4625 ZC8

SAP X Input Data (Flat) 06/04/2022

FullRefNo: P46 - Top Floor Inner Flat - W - Be Lean

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 73 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating: Mains gas
Target Carbon Dioxide Emission Rate (TER) 10.36 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 10.47 kgCOâ,,/mÂ²
Fail
Excess emissions 1 = 0.11 kgCOâ,,/mÂ² (1.1%)

1b TPER and DPER
Target Primary Energy Rate (TPER) 59.3 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 59.3 kWh/mÂ²/yr
Fail
Excess energy = 3.4 kWh/mÂ²/yr (6.1%)

---

2 Fabric U-values

Element	Average	Highest
External wall	0.18 (max. 0.26)	0.27 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	(no floor)	
Roof	(no roof)	
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
- -

Efficiency: 88%
Minimum: 88%
OK

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 2.66 kWh/day
Permitted by DBSCG 1.89
Fail
Primary pipework insulated: Yes
OK

---

6 Controls
Space heating controls: Programmer, room thermostat and TRVs
OK

Hot water controls: Cylinderstat
OK
Independent timer for DHW
OK
Boiler interlock Yes
OK

---

7 Low energy lights
Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK

---

8 Mechanical ventilation and Cooling
Continuous extract system
Specific fan power: 0.17
Maximum 0.7
OK
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Slight
OK
Based on:
Overshading: Average
Windows facing East: 8.51 mÂ², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---

10 Key features

External wall U-value	0.14 W/mÂ²K
Party wall U-value	0.00 W/mÂ²K
Party wall U-value	0.00 W/mÂ²K
Air permeability	3.0 mÂ³/mÂ²h

---

1. Overall dwelling dimensions

Area (m2)		Storey height (m)		Volume (m3)
Ground floor				
73.2100 (1b)	x	2.7000 (2b)	=	197.6670 (1b) - (3b)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
73.2100
(4)
Dwelling volume
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 197.6670 (5)

---

2. Ventilation rate

m3 per hour

Number of open chimneys
0 * 80 = 0.0000 (6a)
Number of open flues
0 * 35 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire
0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler
0 * 20 = 0.0000 (6d)
Number of flues attached to other heater
0 * 35 = 0.0000 (6e)
Number of blocked chimneys
0 * 20 = 0.0000 (6f)
Number of open flues or <200 vertical ducts
0 * 20 = 0.0000 (6g)
Number of intermittent extract fans
0 * 10 = 0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
3 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1163 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
Double Glazing (Uw = 1.20)							
8.5100			8.5100	1.1450	9.7443		(27)
RC Block							
6.4800			6.4800	0.2700	1.7496	150.0000	972.0000 (29a)
Bos Unipanel							
15.9500			24.4600	0.1400	2.2330	14.0000	223.3000 (29a)

Total net area of external elements Aum(A, m2)
30.9400
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 13.7269 (33)

Party Wall				
42.3500	0.0000	0.0000	70.0000	2964.5000 (32)
Solid Party Wall				
31.1000	0.0000	0.0000	110.0000	3421.0000 (32)
Party Floor 1				
73.2100			80.0000	5856.8000 (32d)
Party Ceilings 1				
73.2100			80.0000	5856.8000 (32b)
Internal Wall				
121.0100			9.0000	1089.0900 (32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 20383.4900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
278.4249 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
3.0927 (36)
Total fabric heat loss
(33) + (36) = 16.8195 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151 (38)
Heat transfer coeff	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346 (39)

Average = Sum(39)m / 12 =
49.4346 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752 (40)

HLP (average)
0.6752 (40)
Days in month

```
                    31          28          31          30          31
30          31          31          30          31          30          31
(41)



------------------------------------------------------------------------
------------------------------
4. Water heating energy requirements (kWh/year)
------------------------------------------------------------------------
------------------------------
Assumed occupancy
2.3215 (42)
Average daily hot water use (litres/day)
100.1824 (43)

                 Jan         Feb         Mar         Apr         May
Jun         Jul         Aug         Sep         Oct         Nov         Dec
Daily hot water use
               109.5327    106.6023    103.6030     98.8427     95.2203
91.1712     90.6726     93.6809     96.9055    101.0825    105.4269
109.6859 (44)
Energy conte    162.4338    143.4824    149.5383    129.4576    124.7574
107.6595     99.2168    112.6245    113.0806    132.0743    144.6914
157.5285 (45)
Energy content (annual)
Total = Sum(45)m =    1576.5450 (45)
Distribution loss  (46)m = 0.15 x (45)m
                24.3651     21.5224     22.4307     19.4186     18.7136
16.1489     14.8825     16.8937     16.9621     19.8111     21.7037
23.6293 (46)
Water storage loss:
Store volume
150.0000 (47)
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)
0.0191 (51)
  Volume factor from Table 2a
0.9283 (52)
  Temperature factor from Table 2b
0.5400 (53)
Enter (49) or (54) in (55)
1.4364 (55)
Total storage loss
               44.5282     40.2190     44.5282     43.0918     44.5282
43.0918     44.5282     44.5282     43.0918     44.5282     43.0918
44.5282 (56)
If cylinder contains dedicated solar storage
               44.5282     40.2190     44.5282     43.0918     44.5282
43.0918     44.5282     44.5282     43.0918     44.5282     43.0918
44.5282 (57)
Primary loss    23.2624     21.0112     23.2624     22.5120     23.2624
22.5120     23.2624     23.2624     22.5120     23.2624     22.5120
23.2624 (59)
Total heat required for water heating calculated for each month
              230.2244    204.7126    217.3288    195.0614    192.5480
173.2633    167.0074    180.4151    178.6844    199.8649    210.2952
225.3191 (62)
Solar input      0.0000      0.0000      0.0000      0.0000      0.0000
0.0000      0.0000      0.0000      0.0000      0.0000      0.0000
0.0000 (63d)

Solar input (sum of months) = Sum(63d)m =      0.0000 (63d)
Output from w/h
              230.2244    204.7126    217.3288    195.0614    192.5480
173.2633    167.0074    180.4151    178.6844    199.8649    210.2952
225.3191 (64)

Total per year (kWh/year) = Sum(64)m =   2374.7246 (64)
Electric shower(s)
                0.0000      0.0000      0.0000      0.0000      0.0000
0.0000      0.0000      0.0000      0.0000      0.0000      0.0000
0.0000 (64a)
                                                          Total Energy used
by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month
              108.2417     96.6921    103.9539     95.5277     95.7143
88.2798     87.2220     91.6801     90.0823     98.1472    100.5929
106.6107 (65)



------------------------------------------------------------------------
------------------------------
5. Internal gains (see Table 5 and 5a)
------------------------------------------------------------------------
------------------------------
Metabolic gains (Table 5), Watts
                 Jan         Feb         Mar         Apr         May
Jun         Jul         Aug         Sep         Oct         Nov         Dec
(66)m          116.0734    116.0734    116.0734    116.0734    116.0734
116.0734    116.0734    116.0734    116.0734    116.0734    116.0734
116.0734 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see
Table 5
               115.3930    127.7565    115.3930    119.2394    115.3930
119.2394    115.3930    115.3930    119.2394    115.3930    119.2394
115.3930 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also
see Table 5
               204.6701    206.7940    201.4420    190.0482    175.6656
162.1480    153.1174    150.9936    156.3456    167.7393    182.1219
195.6395 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also
see Table 5
                34.6073     34.6073     34.6073     34.6073     34.6073
34.6073     34.6073     34.6073     34.6073     34.6073     34.6073
34.6073 (69)
Pumps, fans      3.0000      3.0000      3.0000      3.0000      3.0000
3.0000      3.0000      3.0000      3.0000      3.0000      3.0000
3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
               -92.8587    -92.8587    -92.8587    -92.8587    -92.8587   -
92.8587    -92.8587    -92.8587    -92.8587    -92.8587    -92.8587   -
92.8587 (71)
Water heating gains (Table 5)
```

```
              145.4862   143.8870   139.7230   132.6773   128.6483
122.6109   117.2339   123.2260   125.1144   131.9182   139.7124
143.2939 (72)
Total internal gains
              526.3713   539.2595   517.3800   502.7869   480.5289
464.8203   446.5663   450.4345   461.5214   475.8726   501.8957
515.1485 (73)



-------------------------------------------------------------------------
-----------------------------
6. Solar gains
-------------------------------------------------------------------------
-----------------------------

[Jan]                                    Area         Solar flux
g                FF            Access              Gains
                                           m2           Table 6a
Specific data      Specific data            factor                  W
                                                              W/m2
or Table 6b        or Table 6c          Table 6d
-------------------------------------------------------------------------
-----------------------------
East                                      8.5100           19.6403
0.5000             0.7000            0.7700           40.5395 (76)
-------------------------------------------------------------------------
-----------------------------

Solar gains     40.5395    79.3038   130.6021   190.4754   233.4347
238.9620   227.5015   195.4205   151.8956    94.1007    50.5480
33.3377 (83)
Total gains    566.9108   618.5633   647.9821   693.2623   713.9636
703.7822   674.0679   645.8550   613.4170   569.9732   552.4437
548.4862 (84)



-------------------------------------------------------------------------
-----------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------
-----------------------------
Temperature during heating periods in the living area from Table 9, Th1
(C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            114.5368   114.5368   114.5368   114.5368   114.5368
114.5368   114.5368   114.5368   114.5368   114.5368   114.5368
114.5368
alpha            8.6358     8.6358     8.6358     8.6358     8.6358
8.6358     8.6358     8.6358     8.6358     8.6358     8.6358
8.6358
util living area
                 0.9875     0.9723     0.9354     0.8192     0.6387
0.4493     0.3227     0.3521     0.5545     0.8444     0.9661
0.9904 (86)
```

```
MIT              20.6602    20.7514    20.8585    20.9613    20.9953
20.9998    21.0000    21.0000    20.9988    20.9580    20.8038
20.6327 (87)
Th 2             20.3628    20.3628    20.3628    20.3628    20.3628
20.3628    20.3628    20.3628    20.3628    20.3628    20.3628
20.3628 (88)
util rest of house
                  0.9838     0.9648     0.9195     0.7868     0.5969
0.4047     0.2759     0.3033     0.5040     0.8081     0.9556
0.9875 (89)
MIT 2            20.0606    20.1484    20.2483    20.3357    20.3601
20.3627    20.3627    20.3627    20.3622    20.3346    20.1995
20.0337 (90)
Living area fraction
fLA = Living area / (4) =      0.3868 (91)
MIT              20.2926    20.3817    20.4844    20.5777    20.6058
20.6091    20.6093    20.6092    20.6085    20.5758    20.4333
20.2654 (92)
Temperature adjustment
0.0000
adjusted MIT     20.2926    20.3817    20.4844    20.5777    20.6058
20.6091    20.6093    20.6092    20.6085    20.5758    20.4333
20.2654 (93)



-------------------------------------------------------------------------
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8. Space heating requirement
-------------------------------------------------------------------------
-----------------------------

                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9833     0.9650     0.9228     0.7981     0.6130
0.4219     0.2940     0.3222     0.5236     0.8208     0.9569
0.9870 (94)
Useful gains   557.4513   596.9157   597.9379   553.3013   437.6348
296.9585   198.1923   208.0745   321.1605   467.8371   528.6367
541.3440 (95)
Ext temp.        4.3000     4.9000     6.5000     8.9000    11.7000
14.6000    16.6000    16.4000    14.1000    10.6000     7.1000
4.2000 (96)
Heat loss rate W
               790.5859   765.3302   691.3121   577.2828   440.2540
297.0584   198.1959   208.0825   321.7431   493.1481   659.1241
794.1877 (97)
Month fracti     1.0000     1.0000     1.0000     1.0000     1.0000
0.0000     0.0000     0.0000     0.0000     1.0000     1.0000
1.0000 (97a)
Space heating kWh
               173.4522   113.1746    69.4704    17.2666     1.9487
0.0000     0.0000     0.0000     0.0000    18.8314    93.9509
188.1157 (98)
Space heating
676.2105 (98)
Space heating per m2
(98) / (4) =      9.2366 (99)
```


8c. Space cooling requirement

Not applicable

9a. Energy requirements – Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Efficiency of main space heating system 1 (in %)
88.0000 (206)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
768.4211 (211)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement											
173.4522	113.1746	69.4704	17.2666	1.9487	0.0000	0.0000	0.0000	0.0000	18.8314	93.9509	188.1157 (98)
Space heating efficiency (main heating system 1)											
88.0000	88.0000	88.0000	88.0000	88.0000	0.0000	0.0000	0.0000	0.0000	88.0000	88.0000	88.0000 (210)
Space heating fuel (main heating system)											
197.1048	128.6075	78.9437	19.6212	2.2144	0.0000	0.0000	0.0000	0.0000	21.3993	106.7624	213.7678 (211)
Water heating requirement											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating
Water heating requirement

230.2244	204.7126	217.3288	195.0614	192.5480	173.2633	167.0074	180.4151	178.6844	199.8649	210.2952	225.3191 (64)

Efficiency of water heater

88.0000 (216)											
(217)m	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000 (217)

Fuel for water heating, kWh/month

	261.6187	232.6280	246.9646	221.6606	218.8046	196.8901	189.7811	205.0172	203.0505	227.1192	238.9718 256.0444 (219)

Water heating fuel used
2698.5506 (219)
Annual totals kWh/year
Space heating fuel – main system
768.4211 (211)
Space heating fuel – secondary
0.0000 (215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.2210)
mechanical ventilation fans (SFP = 0.2210)
53.2950 (230a)
central heating pump
41.0000 (230c)
main heating flue fan
45.0000 (230e)
Total electricity for the above, kWh/year
139.2950 (231)
Electricity for lighting (calculated in Appendix L)
144.7458 (232)
Total delivered energy for all uses
3751.0125 (238)

12a. Carbon dioxide emissions – Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating – main system 1		
768.4211	0.2100	161.3684 (261)
Space heating – secondary		
0.0000	0.0000	0.0000 (263)
Water heating (other fuel)		
2698.5506	0.2100	566.6956 (264)
Space and water heating		
728.0641 (265)		
Pumps and fans		
139.2950	0.1360	18.9441 (267)
Energy for lighting		
144.7458	0.1360	19.6854 (268)
Total CO2, kg/year		
766.6936 (272)		
Dwelling Carbon Dioxide Emission Rate (DER)		
10.4700 (273)		

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
10.4700 ZC1

Total Floor Area
TFA 73.2100
Assumed number of occupants
N 2.3215
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.3411 ZC2
CO2 emissions from cooking, equation (L16)
2.3865 ZC3
Total CO2 emissions
17.1976 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity
generation
0.0000 ZC7
Net CO2 emissions
17.1976 ZC8

SAP X Input Data (Flat) 06/04/2022

FullRefNo: P49 - Top Floor Mid Flat - West - Be Lean

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Top-floor flat, total floor area 52 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating: Mains gas
Target Carbon Dioxide Emission Rate (TER) 14.35 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 14.59 kgCOâ,,/mÂ²
Fail
Excess emissions 1 = 0.24 kgCOâ,,/mÂ² (1.7%)

1b TPER and DPER
Target Primary Energy Rate (TPER) 81.8 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 81.8 kWh/mÂ²/yr
Fail
Excess energy = 4.2 kWh/mÂ²/yr (5.4%)

---

2 Fabric U-values

Element	Average	Highest
External wall	0.17 (max. 0.26)	0.27 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	(no floor)	
Roof	0.14 (max. 0.16)	0.14 (max. 0.35)
OK		
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
- -

Efficiency: 88%
Minimum: 88%
OK

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 2.66 kWh/day
Permitted by DBSCG 1.89
Fail
Primary pipework insulated: Yes
OK

---

6 Controls
Space heating controls: Programmer, room thermostat and TRVs
OK

Hot water controls: Cylinderstat
OK

Independent timer for DHW
OK

Boiler interlock Yes
OK

---

7 Low energy lights
Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK

---

8 Mechanical ventilation and Cooling
Continuous extract system
Specific fan power: 0.15
Maximum 0.7
OK
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Slight
OK
Based on:
Overshading: Average
Windows facing West: 8.51 mÂ², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
External wall U-value 0.14 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K
Air permeability 3.0 mÂ³/mÂ²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

---
1. Overall dwelling dimensions

Area Storey height Volume

(m2) (m) (m3)
Ground floor
52.2400 (1b) x 2.7000 (2b) = 141.0480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
52.2400
(4)
Dwelling volume
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 141.0480 (5)

---
2. Ventilation rate

---

m3 per hour

Number of open chimneys
0 * 80 = 0.0000 (6a)
Number of open flues
0 * 35 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire
0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler
0 * 20 = 0.0000 (6d)
Number of flues attached to other heater
0 * 35 = 0.0000 (6e)
Number of blocked chimneys
0 * 20 = 0.0000 (6f)
Number of open flues or <200 vertical ducts
0 * 20 = 0.0000 (6g)
Number of intermittent extract fans
0 * 10 = 0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
3 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1163 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	Openings m2	A x K kJ/K	
Double Glazing (Uw = 1.20)							
	8.5100	1.1450	9.7443				(27)
RC Block					2.1600		
	2.1600	0.2700	0.5832	150.0000		324.0000	(29a)
Bos Unipanel					15.8800		
	7.3700	0.1400	1.0318	14.0000		103.1800	(29a)
Flat Roof					52.2400		
	52.2400	0.1400	7.3136	9.0000		470.1600	(30)

Total net area of external elements Aum(A, m2)
70.2800
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 18.6729 (33)

Party Wall					
	47.3000	0.0000	0.0000	70.0000	3311.0000 (32)
Solid Party Wall					
	12.9600	0.0000	0.0000	110.0000	1425.6000 (32)
Party Floor 1					
	52.2400			80.0000	4179.2000 (32d)
Party Ceilings 1					
	52.2400			80.0000	4179.2000 (32b)
Internal Wall					
	71.0100			9.0000	639.0900 (32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 14631.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
280.0810 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
5.1415 (36)
Total fabric heat loss
(33) + (36) = 23.8144 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729 (38)

Heat transfer coeff

	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873 (39)

Average = Sum(39)m / 12 =
47.0873 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014 (40)

HLP (average)
0.9014 (40)

Days in month
31 28 31 30 31
30 31 31 30 31 30 31
(41)

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy
1.7562 (42)
Average daily hot water use (litres/day)
85.0799 (43)

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Daily hot water use
93.0207 90.5320 87.9849 83.9422 80.8659
77.4272 77.0037 79.5585 82.2970 85.8444 89.5338
93.1508 (44)
Energy conte 137.9470 121.8525 126.9954 109.9419 105.9503
91.4299 84.2599 95.6464 96.0338 112.1641 122.8792
133.7812 (45)
Energy content (annual)
Total = Sum(45)m = 1338.8816 (45)
Distribution loss (46)m = 0.15 x (45)m
20.6921 18.2779 19.0493 16.4913 15.8925
13.7145 12.6390 14.3470 14.4051 16.8246 18.4319
20.0672 (46)
Water storage loss:
Store volume
150.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day)
0.0191 (51)
Volume factor from Table 2a
0.9283 (52)
Temperature factor from Table 2b
0.5400 (53)
Enter (49) or (54) in (55)
1.4364 (55)
Total storage loss
44.5282 40.2190 44.5282 43.0918 44.5282
43.0918 44.5282 44.5282 43.0918 44.5282 43.0918
44.5282 (56)
If cylinder contains dedicated solar storage
44.5282 40.2190 44.5282 43.0918 44.5282
43.0918 44.5282 44.5282 43.0918 44.5282 43.0918
44.5282 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624
22.5120 23.2624 23.2624 22.5120 23.2624 22.5120
23.2624 (59)
Total heat required for water heating calculated for each month
205.7376 183.0827 194.7860 175.5457 173.7409
157.0337 152.0505 163.4370 161.6376 179.9547 188.4830
201.5717 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (63d)

Solar input (sum of months) = Sum(63d)m = 0.0000 (63d)
Output from w/h
205.7376 183.0827 194.7860 175.5457 173.7409
157.0337 152.0505 163.4370 161.6376 179.9547 188.4830
201.5717 (64)

Total per year (kWh/year) = Sum(64)m = 2137.0611 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (64a)
Total Energy used
by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month
100.0999 89.5001 96.4585 89.0387 89.4610
82.8835 82.2489 86.0349 84.4143 91.5270 93.3404
98.7147 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
(66)m 87.8075 87.8075 87.8075 87.8075 87.8075
87.8075 87.8075 87.8075 87.8075 87.8075 87.8075
87.8075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see
Table 5
80.2543 88.8530 80.2543 82.9294 80.2543
82.9294 80.2543 80.2543 82.9294 80.2543 82.9294
80.2543 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also
see Table 5
153.0483 154.6365 150.6344 142.1143 131.3593
121.2511 114.4982 112.9101 116.9122 125.4322 136.1872
146.2954 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also
see Table 5
31.7808 31.7808 31.7808 31.7808 31.7808
31.7808 31.7808 31.7808 31.7808 31.7808 31.7808
31.7808 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000
3.0000 3.0000 3.0000 3.0000 3.0000 3.0000
3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)

-70.2460 -70.2460 -70.2460 -70.2460 -70.2460 -
70.2460 -70.2460 -70.2460 -70.2460 -70.2460 -70.2460 -
70.2460 (71)
Water heating gains (Table 5)
134.5428 133.1847 129.6485 123.6649 120.2432
115.1159 110.5496 115.6383 117.2420 123.0202 129.6394
132.6811 (72)
Total internal gains
420.1877 429.0164 412.8794 401.0509 384.1991
371.6388 357.6444 361.1449 369.4259 381.0490 401.0984
411.5731 (73)

---

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a				
Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W/m2				
West		8.5100	19.6403	0.5000	0.7000	0.7700	40.5395 (80)
Solar gains	40.5395	79.3038	130.6021	190.4754	233.4347	238.9620	227.5015	195.4205	151.8956	94.1007	50.5480	33.3377 (83)
Total gains	460.7272	508.3203	543.4815	591.5263	617.6338	610.6007	585.1459	556.5654	521.3216	475.1497	451.6463	444.9108 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139
alpha	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543

util living area
0.9886 0.9768 0.9473 0.8541 0.6873
0.4914 0.3539 0.3888 0.6133 0.8838 0.9732
0.9909 (86)

MIT	20.4334	20.5521	20.7125	20.8895	20.9770	20.9978	20.9998	20.9996	20.9912	20.8805	20.6319	20.4003 (87)
Th 2	20.1663	20.1663	20.1663	20.1663	20.1663	20.1663	20.1663	20.1663	20.1663	20.1663	20.1663	20.1663 (88)

util rest of house
0.9850 0.9697 0.9320 0.8191 0.6332
0.4284 0.2869 0.3185 0.5436 0.8466 0.9637
0.9880 (89)

MIT 2	19.6641	19.7795	19.9318	20.0876	20.1533	20.1655	20.1663	20.1662	20.1625	20.0839	19.8581	19.6316 (90)

Living area fraction
fLA = Living area / (4) = 0.5691 (91)

MIT	20.1019	20.2192	20.3761	20.5440	20.6221	20.6391	20.6406	20.6405	20.6341	20.5372	20.2985	20.0691 (92)

Temperature adjustment
0.0000

adjusted MIT	20.1019	20.2192	20.3761	20.5440	20.6221	20.6391	20.6406	20.6405	20.6341	20.5372	20.2985	20.0691 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9847	0.9703	0.9362	0.8357	0.6632	0.4643	0.3250	0.3585	0.5832	0.8643	0.9655	0.9876 (94)
Useful gains	453.6673	493.2007	508.8206	494.3348	409.6387	283.4937	190.1979	199.5486	304.0325	410.6535	436.0423	439.3874 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	744.0695	721.3380	653.3861	548.2825	420.1171	284.3671	190.2629	199.6746	307.6733	467.9176	621.4801	747.2328 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	216.0593	153.3083	107.5567	38.8423	7.7959	0.0000	0.0000	0.0000	0.0000	42.6045	133.5152	229.0370 (98)

Space heating
928.7192 (98)
Space heating per m2
(98) / (4) =   17.7779 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Efficiency of main space heating system 1 (in %)
88.0000 (206)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
1055.3627 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	216.0593	153.3083	107.5567	38.8423	7.7959	0.0000	0.0000	0.0000	0.0000	42.6045	133.5152	
229.0370 (98)												
Space heating efficiency (main heating system 1)	88.0000	88.0000	88.0000	88.0000	88.0000	0.0000	0.0000	0.0000	0.0000	88.0000	88.0000	
88.0000 (210)												
Space heating fuel (main heating system)	245.5219	174.2139	122.2235	44.1390	8.8590	0.0000	0.0000	0.0000	0.0000	48.4142	151.7218	
260.2693 (211)												
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (215)												

Water heating
Water heating requirement

	205.7376	183.0827	194.7860	175.5457	173.7409	157.0337	152.0505	163.4370	161.6376	179.9547	188.4830	
201.5717 (64)												

Efficiency of water heater
88.0000 (216)

(217)m	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	
88.0000 (217)												

Fuel for water heating, kWh/month

	233.7927	208.0485	221.3478	199.4838	197.4328	178.4473	172.7846	185.7239	183.6791	204.4940	214.1852	
229.0588 (219)												

Water heating fuel used
2428.4786 (219)
Annual totals kWh/year
Space heating fuel - main system
1055.3627 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
    (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)
   mechanical ventilation fans (SFP =   0.1950)
33.5553 (230a)
   central heating pump
41.0000 (230c)
   main heating flue fan
45.0000 (230e)
Total electricity for the above, kWh/year
119.5553 (231)
Electricity for lighting (calculated in Appendix L)
105.8279 (232)
Total delivered energy for all uses
3709.2245 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1		
1055.3627	0.2100	221.6262 (261)
Space heating - secondary		
0.0000	0.0000	0.0000 (263)
Water heating (other fuel)		
2428.4786	0.2100	509.9805 (264)
Space and water heating		
731.6067 (265)		
Pumps and fans		
119.5553	0.1360	16.2595 (267)
Energy for lighting		
105.8279	0.1360	14.3926 (268)

Total CO2, kg/year
762.2588 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
14.5900 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
14.5900 ZC1
Total Floor Area
TFA 52.2400
Assumed number of occupants
N 1.7562
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.5493 ZC2
CO2 emissions from cooking, equation (L16)
3.0848 ZC3
Total CO2 emissions
22.2240 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
22.2240 ZC8

Appendix A.2 - SAP Calculations (Be Green)

SAP X Input Data (Flat) 05/04/2022

FullRefNo: P01 - Mid Floor End Flat - East - Be Green

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 52 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:	Electricity
Target Carbon Dioxide Emission Rate (TER)	14.31 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER)	4.59 kgCOâ,,/mÂ²

OK

1b TPER and DPER

Target Primary Energy Rate (TPER)	50.7 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER)	50.7 kWh/mÂ²/yr

OK

---

2 Fabric U-values

Element	Average	Highest
External wall	0.18 (max. 0.26)	0.27 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	0.05 (max. 0.18)	0.05 (max. 0.70)
OK		
Roof	(no roof)	
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)
Maximum	8.0

OK

---

4 Heating efficiency

Main heating system 1:	Room heaters - Electric
	Data from manufacturer
	- -
Main heating system 2:	Heat pump with warm air distribution - Electric
	Dimplex EDL200UK-630
	Efficiency: 0.0% SEDBUK2009
	Minimum: 280.0%
Secondary heating system:	None

---

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.61 kWh/day
	Permitted by DBSCG 2.24

OK

---

6 Controls

Space heating controls 1:	Programmer and appliance thermostats
	OK
Hot water controls:	No cylinder

---

7 Low energy lights

Minimum efficacy of all light fittings:	66 lm/W
Minimum	60 lm/W

OK

---

8 Mechanical ventilation and Cooling

Continuous extract system

Specific fan power:	0.15
Maximum	0.7

OK

Not applicable

---

9 Summertime temperature

Overheating risk (Thames Valley):	Slight

OK

Based on:

Overshading:	Average
Windows facing North:	2.28 mÂ², No overhang
Windows facing East:	8.51 mÂ², No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

---

10 Key features

External wall U-value	0.14 W/mÂ²K
Party wall U-value	0.00 W/mÂ²K
Party wall U-value	0.00 W/mÂ²K
Exposed floor U-value	0.10 W/mÂ²K
Air permeability	3.0 mÂ³/mÂ²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

---

1. Overall dwelling dimensions

Area	Storey height	Volume
(m2)	(m)	(m3)
Ground floor		
52.2400 (1b) x	2.7000 (2b) =	141.0480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		
52.2400		
(4)		
Dwelling volume		
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		141.0480 (5)

---

2. Ventilation rate

m3 per hour

Number of open chimneys	
0 * 80 =	0.0000 (6a)
Number of open flues	
0 * 35 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	
0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	
0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	
0 * 35 =	0.0000 (6e)
Number of blocked chimneys	
0 * 20 =	0.0000 (6f)
Number of open flues or <200 vertical ducts	
0 * 20 =	0.0000 (6g)
Number of intermittent extract fans	
0 * 10 =	0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
2 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Double Glazing (Uw = 1.20)	10.7900	1.1450	12.3550				(27)
Floor to commercial	52.2400	0.0500	2.6120				(28b)
RC Block	7.7900		7.7900	0.2700	2.1033	150.0000	1168.5000 (29a)
Bos Unipanel	31.4100	10.7900	20.6200	0.1400	2.8868	14.0000	288.6800 (29a)

Total net area of external elements Aum(A, m2)
91.4400
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 19.9571 (33)

Party Wall	30.5600	0.0000	0.0000	70.0000	2139.2000 (32)
Solid Party Wall	8.6400	0.0000	0.0000	110.0000	950.4000 (32)
Party Floor 1	52.2400			80.0000	4179.2000 (32d)
Party Ceilings 1	52.2400			80.0000	4179.2000 (32b)
Internal Wall	71.0100			9.0000	639.0900 (32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 13544.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
259.2701 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
3.6777 (36)
Total fabric heat loss
(33) + (36) = 23.6347 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729 (38)
Heat transfer coeff	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077	46.9077 (39)

Average = Sum(39)m / 12 =
46.9077 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979	0.8979 (40)

HLP (average)
0.8979 (40)
Days in month
31 28 31 30 31
30 31 31 30 31 30 31
(41)

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy
1.7562 (42)
Average daily hot water use (litres/day)
89.5578 (43)

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Daily hot water use
97.9165 95.2969 92.6157 88.3602 85.1220
81.5023 81.0566 83.7458 86.6285 90.3625 94.2461
98.0535 (44)
Energy conte 145.2074 128.2658 133.6794 115.7283 111.5266
96.2420 88.6946 100.6804 101.0882 118.0675 129.3466
140.8223 (45)
Energy content (annual)
Total = Sum(45)m = 1409.3491 (45)
Distribution loss (46)m = 0.15 x (45)m
21.7811 19.2399 20.0519 17.3592 16.7290
14.4363 13.3042 15.1021 15.1632 17.7101 19.4020
21.1233 (46)
Water storage loss:
Store volume
201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):
1.6100 (48)
Temperature factor from Table 2b
0.5400 (49)
Enter (49) or (54) in (55)
0.8694 (55)
Total storage loss
26.9514 24.3432 26.9514 26.0820 26.9514
26.0820 26.9514 26.9514 26.0820 26.9514 26.0820
26.9514 (56)
If cylinder contains dedicated solar storage
26.9514 24.3432 26.9514 26.0820 26.9514
26.0820 26.9514 26.9514 26.0820 26.9514 26.0820
26.9514 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (59)
Total heat required for water heating calculated for each month
172.1588 152.6090 160.6308 141.8103 138.4780
122.3240 115.6460 127.6318 127.1702 145.0189 155.4286
167.7737 (62)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (63d)

Solar input (sum of months) = Sum(63d)m = 0.0000 (63d)
Output from w/h
172.1588 152.6090 160.6308 141.8103 138.4780
122.3240 115.6460 127.6318 127.1702 145.0189 155.4286
167.7737 (64)

Total per year (kWh/year) = Sum(64)m = 1726.6801 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (64a)
Total Energy used
by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month
48.2815 42.6484 44.4484 38.4797 37.0826
32.0005 29.4910 33.4762 33.6118 39.2574 43.0077
46.8234 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
(66)m 87.8075 87.8075 87.8075 87.8075 87.8075
87.8075 87.8075 87.8075 87.8075 87.8075 87.8075
87.8075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see
Table 5
77.5051 85.8092 77.5051 80.0886 77.5051
80.0886 77.5051 77.5051 80.0886 77.5051 80.0886
77.5051 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also
see Table 5
153.0483 154.6365 150.6344 142.1143 131.3593
121.2511 114.4982 112.9101 116.9122 125.4322 136.1872
146.2954 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also
see Table 5
31.7808 31.7808 31.7808 31.7808 31.7808
31.7808 31.7808 31.7808 31.7808 31.7808 31.7808
31.7808 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-70.2460 -70.2460 -70.2460 -70.2460 -70.2460 -
70.2460 -70.2460 -70.2460 -70.2460 -70.2460 -70.2460 -
70.2460 (71)
Water heating gains (Table 5)

```
                64.8944    63.4648    59.7425    53.4440    49.8422
44.4451    39.6384    44.9950    46.6831    52.7654    59.7330
62.9347 (72)
Total internal gains
                344.7901   353.2528   337.2242   324.9892   308.0489
295.1271   280.9840   284.7524   293.0261   305.0450   325.3511
336.0775 (73)



-------------------------------------------------------------------------
-----------------------------
6. Solar gains
-------------------------------------------------------------------------
-----------------------------

[Jan]                                       Area         Solar flux
g                 FF             Access              Gains
                                              m2           Table 6a
Specific data      Specific data             factor                   W
                                                                  W/m2
or Table 6b        or Table 6c           Table 6d
-------------------------------------------------------------------------
-----------------------------
North                                      2.2800           10.6334
0.5000             0.7000             0.7700            5.8804 (74)
East                                       8.5100           19.6403
0.5000             0.7000             0.7700           40.5395 (76)
-------------------------------------------------------------------------
-----------------------------

Solar gains     46.4199    90.5416   149.6978   221.1480   274.7536
283.1950   268.7987   228.1845   174.8549   107.4778    57.8022
38.2399 (83)
Total gains    391.2100   443.7944   486.9220   546.1372   582.8025
578.3221   549.7827   512.9369   467.8810   412.5227   383.1533
374.3174 (84)



-------------------------------------------------------------------------
-----------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------
-----------------------------
Temperature during heating periods in the living area from Table 9, Th1
(C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau             80.2065    80.2065    80.2065    80.2065    80.2065
80.2065    80.2065    80.2065    80.2065    80.2065    80.2065
80.2065
alpha            6.3471     6.3471     6.3471     6.3471     6.3471
6.3471     6.3471     6.3471     6.3471     6.3471     6.3471
6.3471
util living area
                  0.9939     0.9856     0.9627     0.8799     0.7145
0.5152     0.3749     0.4197     0.6697     0.9248     0.9856
0.9953 (86)

MIT             20.2787    20.4190    20.6136    20.8409    20.9638
20.9959    20.9995    20.9991    20.9812    20.8056    20.4984
20.2404 (87)
Th 2            20.1693    20.1693    20.1693    20.1693    20.1693
20.1693    20.1693    20.1693    20.1693    20.1693    20.1693
20.1693 (88)
util rest of house
                  0.9919     0.9812     0.9517     0.8494     0.6614
0.4501     0.3044     0.3444     0.5980     0.8975     0.9804
0.9938 (89)
MIT 2           19.2152    19.4174    19.6932    19.9960    20.1376
20.1668    20.1691    20.1689    20.1562    19.9587    19.5336
19.1596 (90)
Living area fraction
fLA = Living area / (4) =      0.5691 (91)
MIT             19.8204    19.9874    20.2170    20.4768    20.6078
20.6386    20.6417    20.6413    20.6257    20.4407    20.0827
19.7747 (92)
Temperature adjustment
0.0000
adjusted MIT    19.8204    19.9874    20.2170    20.4768    20.6078
20.6386    20.6417    20.6413    20.6257    20.4407    20.0827
19.7747 (93)

-------------------------------------------------------------------------
-----------------------------
8. Space heating requirement
-------------------------------------------------------------------------
-----------------------------

                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9909     0.9801     0.9524     0.8614     0.6901
0.4871     0.3446     0.3873     0.6382     0.9073     0.9797
0.9930 (94)
Useful gains   387.6606   434.9493   463.7361   470.4561   402.1736
281.6914   189.4423   198.6530   298.6093   374.2976   375.3913
371.6799 (95)
Ext temp.        4.3000     4.9000     6.5000     8.9000    11.7000
14.6000    16.6000    16.4000    14.1000    10.6000     7.1000
4.2000 (96)
Heat loss rate W
                728.0269   707.7158   643.4312   543.0423   417.8439
283.2570   189.5867   198.9517   306.1041   461.6038   608.9862
730.5741 (97)
Month fracti     1.0000     1.0000     1.0000     1.0000     1.0000
0.0000     0.0000     0.0000     0.0000     1.0000     1.0000
1.0000 (97a)
Space heating kWh
                253.2326   183.2991   133.6931    52.2621    11.6587
0.0000     0.0000     0.0000     0.0000    64.9558   168.1883
267.0173 (98)
```

Space heating
1134.3070 (98)
Space heating per m2
(98) / (4) = 21.7134 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Fraction of main heating from main system 2
0.0000 (203)
Fraction of total heating from main system 1
1.0000 (204)
Fraction of total heating from main system 2
0.0000 (205)
Efficiency of main space heating system 1 (in %)
100.0000 (206)
Efficiency of main space heating system 2 (in %)
0.0000 (207)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
1134.3070 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	253.2326	183.2991	133.6931	52.2621	11.6587	0.0000	0.0000	0.0000	0.0000	64.9558	168.1883	267.0173 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	253.2326	183.2991	133.6931	52.2621	11.6587	0.0000	0.0000	0.0000	0.0000	64.9558	168.1883	267.0173 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Space heating fuel used, main system 2
0.0000 (213)

Water heating
Water heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water heating requirement	172.1588	152.6090	160.6308	141.8103	138.4780	122.3240	115.6460	127.6318	127.1702	145.0189	155.4286	167.7737 (64)
Efficiency of water heater	349.4100 (216)											
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (217)
Fuel for water heating, kWh/month	49.2713	43.6762	45.9720	40.5857	39.6320	35.0087	33.0975	36.5278	36.3957	41.5039	44.4831	48.0163 (219)

Water heating fuel used
494.1702 (219)
Annual totals kWh/year
Space heating fuel - main system
1134.3070 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
    (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)
   mechanical ventilation fans (SFP = 0.1950)
33.5553 (230a)
Total electricity for the above, kWh/year
33.5553 (231)
Electricity for lighting (calculated in Appendix L)
102.2027 (232)
Total delivered energy for all uses
1764.2352 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1		
1134.3070	0.1360	154.2657 (261)

Space heating - main system 2
0.0000 0.1360 0.0000 (262)
Space heating - secondary
0.0000 0.0000 0.0000 (263)
Water heating (other fuel)
494.1702 0.1360 67.2071 (264)
Space and water heating
221.4729 (265)
Pumps and fans
33.5553 0.1360 4.5635 (267)
Energy for lighting
102.2027 0.1360 13.8996 (268)
Total CO2, kg/year
239.9360 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
4.5900 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
4.5900 ZC1
Total Floor Area
TFA 52.2400
Assumed number of occupants
N 1.7562
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.5493 ZC2
CO2 emissions from cooking, equation (L16)
3.0848 ZC3
Total CO2 emissions
12.2240 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
12.2240 ZC8

SAP X Input Data (Flat) 05/04/2022

FullRefNo: P21 - Mid Floor Mid Flat - Be Green

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Mid-floor flat, total floor area 52 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating: Electricity
Target Carbon Dioxide Emission Rate (TER) 12.66 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 4.04 kgCOâ,,/mÂ²
OK

1b TPER and DPER
Target Primary Energy Rate (TPER) 44.6 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 44.6 kWh/mÂ²/yr
OK
---
2 Fabric U-values

Element	Average	Highest
External wall	0.22 (max. 0.26)	0.22 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	(no floor)	
Roof	(no roof)	
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK
---
4 Heating efficiency
Main heating system 1: Room heaters - Electric
Data from manufacturer
- -
Main heating system 2: Heat pump with warm air distribution - Electric
Dimplex EDL200UK-630

Efficiency: 0.0% SEDBUK2009
Minimum: 280.0%

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG 2.24
OK
---
6 Controls
Space heating controls 1: Programmer and appliance thermostats
OK

Hot water controls: No cylinder

---
7 Low energy lights
Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK
---
8 Mechanical ventilation and Cooling
Continuous extract system
Specific fan power: 0.15
Maximum 0.7
OK
Not applicable
---
9 Summertime temperature
Overheating risk (Thames Valley): Medium
OK
Based on:
Overshading: Average
Windows facing East: 5.38 mÂ², No overhang
Windows facing South West: 4.87 mÂ², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None
---
10 Key features
Party wall U-value 0.00 W/mÂ²K
Air permeability 3.0 mÂ³/mÂ²h

1. Overall dwelling dimensions

Area (m2)	Storey height (m)	Volume (m3)
Ground floor		
51.7700 (1b)	x 2.7000 (2b)	= 139.7790 (1b) - (3b)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
51.7700
(4)
Dwelling volume
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 139.7790 (5)

2. Ventilation rate

m3 per hour

Number of open chimneys
0 * 80 = 0.0000 (6a)
Number of open flues
0 * 35 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire
0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler
0 * 20 = 0.0000 (6d)
Number of flues attached to other heater
0 * 35 = 0.0000 (6e)
Number of blocked chimneys
0 * 20 = 0.0000 (6f)
Number of open flues or <200 vertical ducts
0 * 20 = 0.0000 (6g)
Number of intermittent extract fans
0 * 10 = 0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
2 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
Double Glazing (Uw = 1.20)							
10.2500	1.1450	11.7366					(27)
Cavity Wall	38.4500	10.2500	28.2000	0.2200	6.2040	110.0000	3102.0000 (29a)
Total net area of external elements Aum(A, m2)							
38.4500							(31)
Fabric heat loss, W/K = Sum (A x U)							
(26)...(30) + (32) =	17.9406						(33)
Party Wall							
47.6100	0.0000	0.0000	70.0000	3332.7000			(32)
Party Floor 1							
51.7700	40.0000	2070.8000					(32d)
Party Ceilings 1							
51.7700	80.0000	4141.6000					(32b)
Internal Wall							
58.7000	9.0000	528.3000					(32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 13175.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
254.4987 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
3.5015 (36)
Total fabric heat loss
(33) + (36) = 21.4421 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635	23.0635 (38)
Heat transfer coeff	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056	44.5056 (39)

Average = Sum(39)m / 12 =
44.5056 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597	0.8597 (40)

HLP (average)
0.8597 (40)
Days in month

	31	28	31	30	31	30	31	31	30	31	30	31 (41)

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy
1.7423 (42)
Average daily hot water use (litres/day)
89.1679 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.4902	94.8820	92.2125	87.9755	84.7514	81.1474	80.7037	83.3812	86.2513	89.9691	93.8358	97.6266 (44)
Energy conte	144.5752	127.7073	133.0974	115.2245	111.0411	95.8230	88.3085	100.2421	100.6481	117.5535	128.7834	140.2092 (45)

Energy content (annual)
Total = Sum(45)m =   1403.2131 (45)
Distribution loss (46)m = 0.15 x (45)m

	21.6863	19.1561	19.9646	17.2837	16.6562	14.3734	13.2463	15.0363	15.0972	17.6330	19.3175	21.0314 (46)

Water storage loss:
Store volume
201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):
1.6100 (48)
  Temperature factor from Table 2b
0.5400 (49)
Enter (49) or (54) in (55)
0.8694 (55)
Total storage loss

	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)

If cylinder contains dedicated solar storage

	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Total heat required for water heating calculated for each month

	171.5266	152.0505	160.0488	141.3065	137.9925	121.9050	115.2599	127.1935	126.7301	144.5049	154.8654	167.1606 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Solar input (sum of months) = Sum(63d)m =   0.0000 (63d)
Output from w/h

	171.5266	152.0505	160.0488	141.3065	137.9925	121.9050	115.2599	127.1935	126.7301	144.5049	154.8654	167.1606 (64)

Total per year (kWh/year) = Sum(64)m =   1720.5441 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month

	48.0712	42.4627	44.2549	38.3121	36.9212	31.8611	29.3626	33.3305	33.4655	39.0865	42.8205	46.6195 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	87.1143	87.1143	87.1143	87.1143	87.1143	87.1143	87.1143	87.1143	87.1143	87.1143	87.1143	87.1143 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	77.2036	85.4754	77.2036	79.7771	77.2036	79.7771	77.2036	77.2036	79.7771	77.2036	79.7771	77.2036 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	151.8293	153.4048	149.4346	140.9824	130.3130	120.2853	113.5862	112.0107	115.9810	124.4331	135.1025	145.1302 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	31.7114	31.7114	31.7114	31.7114	31.7114	31.7114	31.7114	31.7114	31.7114	31.7114	31.7114	31.7114 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914	-69.6914 (71)

Water heating gains (Table 5)

	64.6119	63.1885	59.4824	53.2113	49.6252	44.2516	39.4658	44.7991	46.4798	52.5357	59.4729	62.6607 (72)

Total internal gains

342.7791 351.2031 335.2548 323.1050 306.2762
293.4483 279.3900 283.1477 291.3722 303.3067 323.4867
334.1288 (73)

---

6. Solar gains

[Jan] Area Solar flux
g FF Access Gains
m2 Table 6a
Specific data Specific data factor W
W/m2
or Table 6b or Table 6c Table 6d

East 5.3800 19.6403
0.5000 0.7000 0.7700 25.6290 (76)
Southwest 4.8700 36.7938
0.5000 0.7000 0.7700 43.4616 (79)

Solar gains 69.0905 124.1668 183.8589 245.9245 288.1545
290.6322 278.3777 246.8523 205.7065 141.3103 84.0132
58.2700 (83)
Total gains 411.8696 475.3698 519.1137 569.0295 594.4306
584.0805 557.7676 530.0000 497.0787 444.6170 407.5000
392.3988 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1
(C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
tau 82.2330 82.2330 82.2330 82.2330 82.2330 82.2330
82.2330 82.2330 82.2330 82.2330 82.2330 82.2330
82.2330
alpha 6.4822 6.4822 6.4822 6.4822 6.4822
6.4822 6.4822 6.4822 6.4822 6.4822 6.4822
6.4822
util living area
0.9902 0.9753 0.9406 0.8413 0.6746
0.4853 0.3508 0.3858 0.6071 0.8831 0.9762
0.9927 (86)
MIT 20.3670 20.5228 20.7037 20.8872 20.9757
20.9974 20.9997 20.9995 20.9900 20.8675 20.5833
20.3241 (87)
Th 2 20.2019 20.2019 20.2019 20.2019 20.2019
20.2019 20.2019 20.2019 20.2019 20.2019 20.2019
20.2019 (88)
util rest of house
0.9873 0.9685 0.9252 0.8074 0.6237
0.4259 0.2873 0.3191 0.5414 0.8486 0.9683
0.9905 (89)
MIT 2 19.3697 19.5921 19.8439 20.0816 20.1809
20.2003 20.2018 20.2017 20.1951 20.0636 19.6809
19.3078 (90)
Living area fraction
fLA = Living area / (4) = 0.5503 (91)
MIT 19.9186 20.1043 20.3171 20.5249 20.6183
20.6390 20.6409 20.6408 20.6325 20.5060 20.1775
19.8671 (92)
Temperature adjustment
0.0000
adjusted MIT 19.9186 20.1043 20.3171 20.5249 20.6183
20.6390 20.6409 20.6408 20.6325 20.5060 20.1775
19.8671 (93)

---

8. Space heating requirement

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Utilisation 0.9860 0.9675 0.9277 0.8218 0.6507
0.4585 0.3223 0.3558 0.5772 0.8627 0.9680
0.9893 (94)
Useful gains 406.1122 459.9330 481.5629 467.6179 386.8001
267.8171 179.7643 188.5866 286.9345 383.5524 394.4749
388.2116 (95)
Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000
14.6000 16.6000 16.4000 14.1000 10.6000 7.1000
4.2000 (96)
Heat loss rate W
695.1141 676.6754 614.9371 517.3743 396.9128
268.7673 179.8437 188.7373 290.7337 440.8727 582.0210
697.2731 (97)
Month fracti 1.0000 1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000 1.0000 1.0000
1.0000 (97a)
Space heating kWh
215.0174 145.6509 99.2305 35.8246 7.5239
0.0000 0.0000 0.0000 0.0000 42.6463 135.0332
229.9417 (98)
Space heating
910.8684 (98)
Space heating per m2
(98) / (4) = 17.5945 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Fraction of main heating from main system 2
0.0000 (203)
Fraction of total heating from main system 1
1.0000 (204)
Fraction of total heating from main system 2
0.0000 (205)
Efficiency of main space heating system 1 (in %)
100.0000 (206)
Efficiency of main space heating system 2 (in %)
0.0000 (207)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
910.8684 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	215.0174	145.6509	99.2305	35.8246	7.5239	0.0000	0.0000	0.0000	0.0000	42.6463	135.0332	229.9417 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	215.0174	145.6509	99.2305	35.8246	7.5239	0.0000	0.0000	0.0000	0.0000	42.6463	135.0332	229.9417 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

Water heating requirement

Water heating requirement	171.5266	152.0505	160.0488	141.3065	137.9925	121.9050	115.2599	127.1935	126.7301	144.5049	154.8654	167.1606 (64)
Efficiency of water heater												349.4100 (216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (217)
Fuel for water heating, kWh/month	49.0903	43.5164	45.8054	40.4414	39.4930	34.8888	32.9870	36.4024	36.2697	41.3568	44.3220	47.8408 (219)
Water heating fuel used												492.4141 (219)

Annual totals kWh/year
Space heating fuel - main system
910.8684 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)
mechanical ventilation fans (SFP = 0.1950)
33.2534 (230a)
Total electricity for the above, kWh/year
33.2534 (231)
Electricity for lighting (calculated in Appendix L)
101.9625 (232)
Total delivered energy for all uses
1538.4984 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1		
910.8684	0.1360	123.8781 (261)
Space heating - main system 2		
0.0000	0.1360	0.0000 (262)
Space heating - secondary		
0.0000	0.0000	0.0000 (263)
Water heating (other fuel)		
492.4141	0.1360	66.9683 (264)

Space and water heating
190.8464 (265)
Pumps and fans
33.2534 0.1360 4.5225 (267)
Energy for lighting
101.9625 0.1360 13.8669 (268)
Total CO2, kg/year
209.2358 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
4.0400 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
4.0400 ZC1
Total Floor Area
TFA 51.7700
Assumed number of occupants
N 1.7423
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.5540 ZC2
CO2 emissions from cooking, equation (L16)
3.1063 ZC3
Total CO2 emissions
11.7004 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
11.7004 ZC8

SAP X Input Data (Flat) 06/04/2022

FullRefNo: P27 - Mid Floor End Flat-South - Be Green

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 71 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating: Electricity
Target Carbon Dioxide Emission Rate (TER) 11.31 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 3.64 kgCOâ,,/mÂ²
OK

1b TPER and DPER
Target Primary Energy Rate (TPER) 40.2 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 40.2 kWh/mÂ²/yr
OK

---

2 Fabric U-values

Element	Average	Highest
External wall	0.18 (max. 0.26)	0.27 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	(no floor)	
Roof	(no roof)	
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK

---

4 Heating efficiency
Main heating system 1: Room heaters - Electric
Data from manufacturer
- -

Main heating system 2: Heat pump with warm air distribution - Electric
Dimplex EDL200UK-630

Efficiency: 0.0% SEDBUK2009
Minimum: 280.0%

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG 2.24
OK

---

6 Controls
Space heating controls 1: Programmer and appliance thermostats
OK

Hot water controls: No cylinder

---

7 Low energy lights
Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK

---

8 Mechanical ventilation and Cooling
Continuous extract system
Specific fan power: 0.17
Maximum 0.7
OK
Not applicable

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9 Summertime temperature
Overheating risk (Thames Valley): Medium
OK
Based on:
Overshading: Average
Windows facing East: 7.24 mÂ², No overhang
Windows facing South East: 7.24 mÂ², No overhang
Windows facing South: 2.41 mÂ², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---

10 Key features
External wall U-value 0.14 W/mÂ²K

Party wall U-value	0.00 W/mÂ²K
Party wall U-value	0.00 W/mÂ²K
Air permeability	3.0 mÂ³/mÂ²h

---

1. Overall dwelling dimensions

Area	Storey height	Volume
(m2)	(m)	(m3)
Ground floor		
71.1800 (1b) x	2.7000 (2b) =	192.1860 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		
71.1800		
(4)		
Dwelling volume		
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		192.1860 (5)

2. Ventilation rate

m3 per hour

Number of open chimneys	
0 * 80 =	0.0000 (6a)
Number of open flues	
0 * 35 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	
0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	
0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	
0 * 35 =	0.0000 (6e)
Number of blocked chimneys	
0 * 20 =	0.0000 (6f)
Number of open flues or <200 vertical ducts	
0 * 20 =	0.0000 (6g)
Number of intermittent extract fans	
0 * 10 =	0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
2 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---
3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
Double Glazing (Uw = 1.20)							
	16.8900	1.1450	19.3397				(27)
RC Block	8.3700						
	8.3700	0.2700	2.2599	150.0000	1255.5000		(29a)
Bos Unipanel	34.4100	16.8900					
	17.5200	0.1400	2.4528	14.0000	245.2800		(29a)

Total net area of external elements Aum(A, m2)
42.7800
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 24.0524 (33)

Party Wall					
39.9700	0.0000	0.0000	70.0000	2797.9000	(32)
Solid Party Wall					
10.8500	0.0000	0.0000	110.0000	1193.5000	(32)
Party Floor 1					
71.1800			80.0000	5694.4000	(32d)
Party Ceilings 1					
71.1800			80.0000	5694.4000	(32b)
Internal Wall					
115.9700			9.0000	1043.7300	(32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 17924.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
251.8223 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
4.6740 (36)
Total fabric heat loss
(33) + (36) = 28.7264 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107	31.7107 (38)
Heat transfer coeff	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370	60.4370 (39)

Average = Sum(39)m / 12 =
60.4370 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491	0.8491 (40)

HLP (average)
0.8491 (40)

Days in month
31 28 31 30 31
30 31 31 30 31 30 31
(41)

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy
2.2744 (42)
Average daily hot water use (litres/day)
104.1323 (43)

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Daily hot water use
113.8513 110.8054 107.6879 102.7398 98.9746
94.7658 94.2476 97.3745 100.7263 105.0680 109.5836
114.0106 (44)
Energy conte 168.8382 149.1396 155.4342 134.5618 129.6763
111.9043 103.1287 117.0650 117.5391 137.2817 150.3962
163.7395 (45)
Energy content (annual)
Total = Sum(45)m = 1638.7046 (45)
Distribution loss (46)m = 0.15 x (45)m
25.3257 22.3709 23.3151 20.1843 19.4515
16.7856 15.4693 17.5598 17.6309 20.5922 22.5594
24.5609 (46)
Water storage loss:
Store volume
201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):
1.6100 (48)
Temperature factor from Table 2b
0.5400 (49)
Enter (49) or (54) in (55)
0.8694 (55)
Total storage loss
26.9514 24.3432 26.9514 26.0820 26.9514
26.0820 26.9514 26.9514 26.0820 26.9514 26.0820
26.9514 (56)
If cylinder contains dedicated solar storage
26.9514 24.3432 26.9514 26.0820 26.9514
26.0820 26.9514 26.9514 26.0820 26.9514 26.0820
26.9514 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (59)
Total heat required for water heating calculated for each month
195.7896 173.4828 182.3856 160.6438 156.6277
137.9863 130.0801 144.0164 143.6211 164.2331 176.4782
190.6909 (62)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (63d)

Solar input (sum of months) = Sum(63d)m = 0.0000 (63d)
Output from w/h
195.7896 173.4828 182.3856 160.6438 156.6277
137.9863 130.0801 144.0164 143.6211 164.2331 176.4782
190.6909 (64)

Total per year (kWh/year) = Sum(64)m = 1956.0356 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (64a)
Total Energy used
by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month
56.1387 49.5889 51.6819 44.7418 43.1174
37.2082 34.2903 38.9241 39.0818 45.6462 50.0067
54.4434 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
(66)m 113.7214 113.7214 113.7214 113.7214 113.7214
113.7214 113.7214 113.7214 113.7214 113.7214 113.7214
113.7214 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see
Table 5
100.8948 111.7050 100.8948 104.2580 100.8948
104.2580 100.8948 100.8948 104.2580 100.8948 104.2580
100.8948 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also
see Table 5
200.0353 202.1110 196.8802 185.7445 171.6876
158.4761 149.6500 147.5743 152.8051 163.9408 177.9977
191.2092 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also
see Table 5
34.3721 34.3721 34.3721 34.3721 34.3721
34.3721 34.3721 34.3721 34.3721 34.3721 34.3721
34.3721 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-90.9771 -90.9771 -90.9771 -90.9771 -90.9771 -
90.9771 -90.9771 -90.9771 -90.9771 -90.9771 -90.9771 -
90.9771 (71)
Water heating gains (Table 5)

```
                75.4553    73.7930    69.4649    62.1414    57.9535
51.6780    46.0891    52.3174    54.2802    61.3524    69.4538
73.1766 (72)
Total internal gains
                433.5018   444.7254   424.3564   409.2603   387.6523
371.5285   353.7503   357.9029   368.4597   383.3044   408.8259
422.3970 (73)



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6. Solar gains
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[Jan]                                    Area         Solar flux
g                 FF             Access              Gains
                                           m2           Table 6a
Specific data      Specific data             factor                    W
                                                                  W/m2
or Table 6b        or Table 6c           Table 6d
------------------------------------------------------------------------
------------------------------
East                                      7.2400           19.6403
0.5000             0.7000             0.7700           34.4895 (76)
Southeast                                 7.2400           36.7938
0.5000             0.7000             0.7700           64.6123 (77)
South                                     2.4100           46.7521
0.5000             0.7000             0.7700           27.3287 (78)
------------------------------------------------------------------------
------------------------------

Solar gains    126.4305   222.2848   318.7114   413.0711   474.7354
475.3993   456.7197   410.8884   351.8379   249.9706   152.7888
107.2716 (83)
Total gains    559.9323   667.0102   743.0678   822.3314   862.3877
846.9278   810.4701   768.7913   720.2976   633.2751   561.6147
529.6687 (84)



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7. Mean internal temperature (heating season)
------------------------------------------------------------------------
------------------------------
Temperature during heating periods in the living area from Table 9, Th1
(C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau             82.3847    82.3847    82.3847    82.3847    82.3847
82.3847    82.3847    82.3847    82.3847    82.3847    82.3847
82.3847
alpha            6.4923     6.4923     6.4923     6.4923     6.4923
6.4923     6.4923     6.4923     6.4923     6.4923     6.4923
6.4923
util living area
                 0.9902     0.9712     0.9265     0.8107     0.6371
0.4552     0.3280     0.3613     0.5718     0.8633     0.9745
0.9929 (86)

MIT              20.3689    20.5487    20.7394    20.9103    20.9824
20.9982    20.9998    20.9997    20.9929    20.8864    20.5938
20.3210 (87)
Th 2             20.2110    20.2110    20.2110    20.2110    20.2110
20.2110    20.2110    20.2110    20.2110    20.2110    20.2110
20.2110 (88)
util rest of house
                 0.9873     0.9635     0.9088     0.7749     0.5879
0.3998     0.2692     0.2995     0.5095     0.8263     0.9663
0.9909 (89)
MIT 2            19.3803    19.6366    19.8994    20.1168    20.1960
20.2099    20.2109    20.2109    20.2062    20.0940    19.7035
19.3111 (90)
Living area fraction
fLA = Living area / (4) =      0.4468 (91)
MIT              19.8219    20.0441    20.2747    20.4713    20.5473
20.5621    20.5634    20.5633    20.5576    20.4480    20.1013
19.7623 (92)
Temperature adjustment
0.0000
adjusted MIT     19.8219    20.0441    20.2747    20.4713    20.5473
20.5621    20.5634    20.5633    20.5576    20.4480    20.1013
19.7623 (93)



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8. Space heating requirement
------------------------------------------------------------------------
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                Jan        Feb        Mar        Apr        May
Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9856     0.9616     0.9104     0.7872     0.6091
0.4245     0.2955     0.3271     0.5371     0.8382     0.9649
0.9894 (94)
Useful gains   551.8461   641.4278   676.4807   647.3601   525.3215
359.5233   239.4730   251.4957   386.9002   530.8050   541.9202
524.0290 (95)
Ext temp.        4.3000     4.9000     6.5000     8.9000    11.7000
14.6000    16.6000    16.4000    14.1000    10.6000     7.1000
4.2000 (96)
Heat loss rate W
                938.1003   915.2644   832.4995   699.3355   534.7059
360.3308   239.5347   251.6157   390.2808   595.1850   785.7574
940.5369 (97)
Month fracti     1.0000     1.0000     1.0000     1.0000     1.0000
0.0000     0.0000     0.0000     0.0000     1.0000     1.0000
1.0000 (97a)
Space heating kWh
                287.3731   184.0182   116.0779    37.4223     6.9820
0.0000     0.0000     0.0000     0.0000    47.8987   175.5628
309.8819 (98)
```

Space heating
1165.2169 (98)
Space heating per m2
(98) / (4) =   16.3700 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Fraction of main heating from main system 2
0.0000 (203)
Fraction of total heating from main system 1
1.0000 (204)
Fraction of total heating from main system 2
0.0000 (205)
Efficiency of main space heating system 1 (in %)
100.0000 (206)
Efficiency of main space heating system 2 (in %)
0.0000 (207)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
1165.2169 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	287.3731	184.0182	116.0779	37.4223	6.9820	0.0000	0.0000	0.0000	0.0000	47.8987	175.5628	
309.8819 (98)												
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	
100.0000 (210)												
Space heating fuel (main heating system)	287.3731	184.0182	116.0779	37.4223	6.9820	0.0000	0.0000	0.0000	0.0000	47.8987	175.5628	
309.8819 (211)												
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (212)												
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (213)												
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (215)												
Space heating fuel used, main system 2												
0.0000 (213)												

Water heating
Water heating requirement

	195.7896	173.4828	182.3856	160.6438	156.6277	137.9863	130.0801	144.0164	143.6211	164.2331	176.4782	
190.6909 (64)												
Efficiency of water heater												
348.1648 (216)												
(217)m	348.1648	348.1648	348.1648	348.1648	348.1648	348.1648	348.1648	348.1648	348.1648	348.1648	348.1648	
348.1648 (217)												
Fuel for water heating, kWh/month	56.2348	49.8278	52.3849	46.1402	44.9867	39.6325	37.3616	41.3644	41.2509	47.1711	50.6881	
54.7703 (219)												
Water heating fuel used												
561.8132 (219)												

Annual totals kWh/year
Space heating fuel - main system
1165.2169 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
    (MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.2210)
   mechanical ventilation fans (SFP =   0.2210)
51.8172 (230a)
Total electricity for the above, kWh/year
51.8172 (231)
Electricity for lighting (calculated in Appendix L)
127.0206 (232)
Total delivered energy for all uses
1905.8679 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1		
1165.2169	0.1360	158.4695 (261)

Space heating - main system 2
0.0000 0.1360 0.0000 (262)
Space heating - secondary
0.0000 0.0000 0.0000 (263)
Water heating (other fuel)
561.8132 0.1360 76.4066 (264)
Space and water heating
234.8761 (265)
Pumps and fans
51.8172 0.1360 7.0471 (267)
Energy for lighting
127.0206 0.1360 17.2748 (268)
Total CO2, kg/year
259.1980 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
3.6400 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
3.6400 ZC1
Total Floor Area
TFA 71.1800
Assumed number of occupants
N 2.2744
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.3638 ZC2
CO2 emissions from cooking, equation (L16)
2.4387 ZC3
Total CO2 emissions
10.4425 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
10.4425 ZC8

SAP X Input Data (Flat) 06/04/2022

FullRefNo: P46 - Mid Floor Inner Flat - W - Be Green

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 73 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating: Electricity
Target Carbon Dioxide Emission Rate (TER) 10.36 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER) 3.09 kgCOâ,,/mÂ²
OK

1b TPER and DPER
Target Primary Energy Rate (TPER) 34.1 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER) 34.1 kWh/mÂ²/yr
OK

---

2 Fabric U-values

Element	Average	Highest
External wall	0.18 (max. 0.26)	0.27 (max. 0.70) OK
Party wall	0.00 (max. 0.20)	- OK
Floor	(no floor)	
Roof	(no roof)	
Windows		1.20 (max. 1.60) OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 8.0
OK

---

4 Heating efficiency
Main heating system 1: Room heaters - Electric
Data from manufacturer
- -

Main heating system 2: Heat pump with warm air distribution - Electric
Dimplex EDL200UK-630

Efficiency: 0.0% SEDBUK2009
Minimum: 280.0%

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG 2.24
OK

---

6 Controls
Space heating controls 1: Programmer and appliance thermostats OK

Hot water controls: No cylinder

---

7 Low energy lights
Minimum efficacy of all light fittings: 66 lm/W
Minimum 60 lm/W
OK

---

8 Mechanical ventilation and Cooling
Continuous extract system
Specific fan power: 0.17
Maximum 0.7
OK
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Slight
OK
Based on:
Overshading: Average
Windows facing East: 8.51 mÂ², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---

10 Key features
External wall U-value 0.14 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K
Party wall U-value 0.00 W/mÂ²K

Air permeability 3.0 mÂ³/mÂ²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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1. Overall dwelling dimensions

Area (m2)		Storey height (m)		Volume (m3)
Ground floor				
73.2100 (1b)	x	2.7000 (2b)	=	197.6670 (1b) - (3b)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)
73.2100
(4)
Dwelling volume
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 197.6670 (5)

---

2. Ventilation rate

m3 per hour

Number of open chimneys
0 * 80 = 0.0000 (6a)
Number of open flues
0 * 35 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire
0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler
0 * 20 = 0.0000 (6d)
Number of flues attached to other heater
0 * 35 = 0.0000 (6e)
Number of blocked chimneys
0 * 20 = 0.0000 (6f)
Number of open flues or <200 vertical ducts
0 * 20 = 0.0000 (6g)
Number of intermittent extract fans
0 * 10 = 0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
3 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1163 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
Double Glazing (Uw = 1.20)							
8.5100			8.5100	1.1450	9.7443		(27)
RC Block							
6.4800			6.4800	0.2700	1.7496	150.0000	972.0000 (29a)
Bos Unipanel							
15.9500			24.4600	0.1400	2.2330	14.0000	223.3000 (29a)

Total net area of external elements Aum(A, m2)
30.9400
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 13.7269 (33)

Party Wall				
42.3500	0.0000	0.0000	70.0000	2964.5000 (32)
Solid Party Wall				
31.1000	0.0000	0.0000	110.0000	3421.0000 (32)
Party Floor 1				
73.2100			80.0000	5856.8000 (32d)
Party Ceilings 1				
73.2100			80.0000	5856.8000 (32b)
Internal Wall				
121.0100			9.0000	1089.0900 (32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 20383.4900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
278.4249 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
3.0927 (36)
Total fabric heat loss
(33) + (36) = 16.8195 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151	32.6151 (38)
Heat transfer coeff	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346	49.4346 (39)

Average = Sum(39)m / 12 =
49.4346 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752	0.6752 (40)

HLP (average)
0.6752 (40)
Days in month

31 28 31 30 31
30 31 31 30 31 30 31
(41)

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy
2.3215 (42)
Average daily hot water use (litres/day)
105.4551 (43)

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Daily hot water use
115.2976 112.2129 109.0558 104.0449 100.2319
95.9697 95.4448 98.6115 102.0058 106.4027 110.9757
115.4588 (44)
Energy conte 170.9830 151.0341 157.4087 136.2711 131.3236
113.3258 104.4387 118.5521 119.0322 139.0255 152.3067
165.8195 (45)
Energy content (annual)
Total = Sum(45)m = 1659.5211 (45)
Distribution loss (46)m = 0.15 x (45)m
25.6474 22.6551 23.6113 20.4407 19.6985
16.9989 15.6658 17.7828 17.8548 20.8538 22.8460
24.8729 (46)
Water storage loss:
Store volume
201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):
1.6100 (48)
Temperature factor from Table 2b
0.5400 (49)
Enter (49) or (54) in (55)
0.8694 (55)
Total storage loss
26.9514 24.3432 26.9514 26.0820 26.9514
26.0820 26.9514 26.9514 26.0820 26.9514 26.0820
26.9514 (56)
If cylinder contains dedicated solar storage
26.9514 24.3432 26.9514 26.0820 26.9514
26.0820 26.9514 26.9514 26.0820 26.9514 26.0820
26.9514 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (59)
Total heat required for water heating calculated for each month
197.9344 175.3773 184.3601 162.3531 158.2750
139.4078 131.3901 145.5035 145.1142 165.9769 178.3887
192.7709 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (63d)

Solar input (sum of months) = Sum(63d)m = 0.0000 (63d)
Output from w/h
197.9344 175.3773 184.3601 162.3531 158.2750
139.4078 131.3901 145.5035 145.1142 165.9769 178.3887
192.7709 (64)

Total per year (kWh/year) = Sum(64)m = 1976.8521 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (64a)
Total Energy used
by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month
56.8518 50.2188 52.3384 45.3101 43.6651
37.6808 34.7259 39.4186 39.5782 46.2260 50.6420
55.1350 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
(66)m 116.0734 116.0734 116.0734 116.0734 116.0734
116.0734 116.0734 116.0734 116.0734 116.0734 116.0734
116.0734 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see
Table 5
115.3930 127.7565 115.3930 119.2394 115.3930
119.2394 115.3930 115.3930 119.2394 115.3930 119.2394
115.3930 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also
see Table 5
204.6701 206.7940 201.4420 190.0482 175.6656
162.1480 153.1174 150.9936 156.3456 167.7393 182.1219
195.6395 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also
see Table 5
34.6073 34.6073 34.6073 34.6073 34.6073
34.6073 34.6073 34.6073 34.6073 34.6073 34.6073
34.6073 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-92.8587 -92.8587 -92.8587 -92.8587 -92.8587 -
92.8587 -92.8587 -92.8587 -92.8587 -92.8587 -92.8587 -
92.8587 (71)
Water heating gains (Table 5)
76.4138 74.7304 70.3473 62.9308 58.6897
52.3345 46.6746 52.9820 54.9698 62.1317 70.3361
74.1061 (72)

Total internal gains
454.2989 467.1029 445.0042 430.0404 407.5702
391.5439 373.0070 377.1905 388.3767 403.0860 429.5194
442.9607 (73)

---

6. Solar gains

[Jan] Area Solar flux
g FF Access Gains
m2 Table 6a
Specific data Specific data factor W
W/m2
or Table 6b or Table 6c Table 6d

East 8.5100 19.6403
0.5000 0.7000 0.7700 40.5395 (76)

Solar gains 40.5395 79.3038 130.6021 190.4754 233.4347
238.9620 227.5015 195.4205 151.8956 94.1007 50.5480
33.3377 (83)
Total gains 494.8383 546.4067 575.6063 620.5157 641.0050
630.5059 600.5085 572.6110 540.2724 497.1867 480.0674
476.2984 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1
(C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
tau 114.5368 114.5368 114.5368 114.5368 114.5368 114.5368
114.5368 114.5368 114.5368 114.5368 114.5368 114.5368
114.5368
alpha 8.6358 8.6358 8.6358 8.6358 8.6358
8.6358 8.6358 8.6358 8.6358 8.6358 8.6358
8.6358
util living area
0.9951 0.9875 0.9663 0.8790 0.7052
0.5011 0.3622 0.3970 0.6269 0.9106 0.9859
0.9965 (86)

MIT 20.5741 20.6723 20.7947 20.9326 20.9902
20.9995 21.0000 20.9999 20.9969 20.9215 20.7266
20.5450 (87)
Th 2 20.3628 20.3628 20.3628 20.3628 20.3628
20.3628 20.3628 20.3628 20.3628 20.3628 20.3628
20.3628 (88)
util rest of house
0.9936 0.9837 0.9564 0.8511 0.6611
0.4516 0.3097 0.3421 0.5710 0.8824 0.9809
0.9953 (89)
MIT 2 19.7965 19.9378 20.1103 20.2906 20.3544
20.3624 20.3627 20.3627 20.3607 20.2805 20.0168
19.7543 (90)
Living area fraction
fLA = Living area / (4) = 0.3868 (91)
MIT 20.0973 20.2220 20.3751 20.5390 20.6003
20.6089 20.6092 20.6092 20.6068 20.5285 20.2914
20.0602 (92)
Temperature adjustment
0.0000
adjusted MIT 20.0973 20.2220 20.3751 20.5390 20.6003
20.6089 20.6092 20.6092 20.6068 20.5285 20.2914
20.0602 (93)

---

8. Space heating requirement

Jan Feb Mar Apr May
Jun Jul Aug Sep Oct Nov Dec
Utilisation 0.9928 0.9827 0.9566 0.8593 0.6778
0.4707 0.3300 0.3634 0.5926 0.8903 0.9802
0.9947 (94)
Useful gains 491.2693 536.9271 550.6282 533.2026 434.4865
296.8096 198.1861 208.0601 320.1748 442.6664 470.5787
473.7515 (95)
Ext temp. 4.3000 4.9000 6.5000 8.9000 11.7000
14.6000 16.6000 16.4000 14.1000 10.6000 7.1000
4.2000 (96)
Heat loss rate W
780.9343 757.4346 685.9087 575.3683 439.9850
297.0461 198.1954 208.0813 321.6625 490.8111 652.1118
784.0424 (97)
Month fracti 1.0000 1.0000 1.0000 1.0000 1.0000
0.0000 0.0000 0.0000 0.0000 1.0000 1.0000
1.0000 (97a)
Space heating kWh
215.5107 148.1810 100.6486 30.3593 4.0909
0.0000 0.0000 0.0000 0.0000 35.8196 130.7038
230.8564 (98)
Space heating
896.1704 (98)
Space heating per m2
(98) / (4) = 12.2411 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Fraction of main heating from main system 2
0.0000 (203)
Fraction of total heating from main system 1
1.0000 (204)
Fraction of total heating from main system 2
0.0000 (205)
Efficiency of main space heating system 1 (in %)
100.0000 (206)
Efficiency of main space heating system 2 (in %)
0.0000 (207)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
896.1704 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	215.5107	148.1810	100.6486	30.3593	4.0909	0.0000	0.0000	0.0000	0.0000	35.8196	130.7038	230.8564 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	215.5107	148.1810	100.6486	30.3593	4.0909	0.0000	0.0000	0.0000	0.0000	35.8196	130.7038	230.8564 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

Water heating requirement

	197.9344	175.3773	184.3601	162.3531	158.2750	139.4078	131.3901	145.5035	145.1142	165.9769	178.3887	192.7709 (64)
Efficiency of water heater												
347.7459 (216)												
(217)m	347.7459	347.7459	347.7459	347.7459	347.7459	347.7459	347.7459	347.7459	347.7459	347.7459	347.7459	347.7459 (217)
Fuel for water heating, kWh/month	56.9193	50.4326	53.0157	46.6873	45.5146	40.0890	37.7834	41.8419	41.7300	47.7294	51.2986	55.4344 (219)
Water heating fuel used												
568.4761 (219)												

Annual totals kWh/year
Space heating fuel - main system
896.1704 (211)
Space heating fuel - secondary
0.0000 (215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.2210)
mechanical ventilation fans (SFP = 0.2210)
53.2950 (230a)
Total electricity for the above, kWh/year
53.2950 (231)
Electricity for lighting (calculated in Appendix L)
144.7458 (232)
Total delivered energy for all uses
1662.6873 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1		
896.1704	0.1360	121.8792 (261)
Space heating - main system 2		
0.0000	0.1360	0.0000 (262)
Space heating - secondary		
0.0000	0.0000	0.0000 (263)
Water heating (other fuel)		
568.4761	0.1360	77.3127 (264)

Space and water heating
199.1919 (265)
Pumps and fans
53.2950 0.1360 7.2481 (267)
Energy for lighting
144.7458 0.1360 19.6854 (268)
Total CO2, kg/year
226.1255 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
3.0900 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
3.0900 ZC1
Total Floor Area
TFA 73.2100
Assumed number of occupants
N 2.3215
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.3411 ZC2
CO2 emissions from cooking, equation (L16)
2.3865 ZC3
Total CO2 emissions
9.8176 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
9.8176 ZC8

SAP X Input Data (Flat) 06/04/2022

FullRefNo: P49 - Top Floor Mid Flat - West - Be Green

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Top-floor flat, total floor area 52 mÂ²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:	Electricity
Target Carbon Dioxide Emission Rate (TER)	14.35 kgCOâ,,/mÂ²
Dwelling Carbon Dioxide Emission Rate (DER)	4.71 kgCOâ,,/mÂ²

OK

1b TPER and DPER

Target Primary Energy Rate (TPER)	52.0 kWh/mÂ²/yr
Dwelling Fabric Energy Efficiency (DPER)	52.0 kWh/mÂ²/yr

OK

---

2 Fabric U-values

Element	Average	Highest
External wall	0.17 (max. 0.26)	0.27 (max. 0.70)
OK		
Party wall	0.00 (max. 0.20)	-
OK		
Floor	(no floor)	
Roof	0.14 (max. 0.16)	0.14 (max. 0.35)
OK		
Windows		1.20 (max. 1.60)
OK		

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)
Maximum	8.0

OK

---

4 Heating efficiency

Main heating system 1:	Room heaters - Electric
	Data from manufacturer
	- -
Main heating system 2:	Heat pump with warm air distribution - Electric
	Dimplex EDL200UK-630
	Efficiency: 0.0% SEDBUK2009
	Minimum: 280.0%
Secondary heating system:	None

---

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.61 kWh/day
	Permitted by DBSCG 2.24

OK

---

6 Controls

Space heating controls 1:	Programmer and appliance thermostats
	OK
Hot water controls:	No cylinder

---

7 Low energy lights

Minimum efficacy of all light fittings:	66 lm/W
Minimum	60 lm/W

OK

---

8 Mechanical ventilation and Cooling

Continuous extract system

Specific fan power:	0.15
Maximum	0.7

OK

Not applicable

---

9 Summertime temperature

Overheating risk (Thames Valley):	Slight

OK

Based on:

Overshading:	Average
Windows facing West:	8.51 mÂ², No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

---

10 Key features

External wall U-value	0.14 W/mÂ²K

Party wall U-value	0.00 W/mÂ²K
Party wall U-value	0.00 W/mÂ²K
Air permeability	3.0 mÂ³/mÂ²h

---

1. Overall dwelling dimensions

Area	Storey height	Volume
(m2)	(m)	(m3)
Ground floor		
52.2400 (1b) x	2.7000 (2b) =	141.0480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		
52.2400		
(4)		
Dwelling volume		
(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		141.0480 (5)

2. Ventilation rate

m3 per hour

Number of open chimneys	
0 * 80 =	0.0000 (6a)
Number of open flues	
0 * 35 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	
0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	
0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	
0 * 35 =	0.0000 (6e)
Number of blocked chimneys	
0 * 20 =	0.0000 (6f)
Number of open flues or <200 vertical ducts	
0 * 20 =	0.0000 (6g)
Number of intermittent extract fans	
0 * 10 =	0.0000 (7a)

Number of passive vents
0 * 10 = 0.0000 (7b)
Number of flueless gas fires
0 * 40 = 0.0000 (7c)

Air changes per hour
Infiltration due to chimneys, flues and fans =
(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
0.0000 / (5) = 0.0000 (8)
Pressure test
Yes
Measured/design AP50
3.0000
Infiltration rate
0.1500 (18)
Number of sides sheltered
3 (19)

Shelter factor
(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor
(21) = (18) x (20) = 0.1163 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366 (22b)

Mechanical extract ventilation - centralised
If mechanical ventilation:
0.5000 (23a)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	Openings m2	A x K kJ/K	
Double Glazing (Uw = 1.20)							
	8.5100	1.1450	9.7443				(27)
RC Block					2.1600		
	2.1600	0.2700	0.5832	150.0000		324.0000	(29a)
Bos Unipanel					15.8800		
	7.3700	0.1400	1.0318	14.0000		103.1800	(29a)
Flat Roof					52.2400		
	52.2400	0.1400	7.3136	9.0000		470.1600	(30)

Total net area of external elements Aum(A, m2)
70.2800
(31)
Fabric heat loss, W/K = Sum (A x U)
(26)...(30) + (32) = 18.6729 (33)

Party Wall					
	47.3000	0.0000	0.0000	70.0000	3311.0000 (32)
Solid Party Wall					
	12.9600	0.0000	0.0000	110.0000	1425.6000 (32)
Party Floor 1					
	52.2400			80.0000	4179.2000 (32d)
Party Ceilings 1					
	52.2400			80.0000	4179.2000 (32b)
Internal Wall					
	71.0100			9.0000	639.0900 (32c)

Heat capacity Cm = Sum(A x k)
(28)...(30) + (32) + (32a)...(32e) = 14631.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
280.0810 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
5.1415 (36)
Total fabric heat loss
(33) + (36) = 23.8144 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729	23.2729 (38)

Heat transfer coeff

	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873	47.0873 (39)

Average = Sum(39)m / 12 =
47.0873 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014	0.9014 (40)

HLP (average)
0.9014 (40)

Days in month
31 28 31 30 31
30 31 31 30 31 30 31
(41)

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy
1.7562 (42)
Average daily hot water use (litres/day)
89.5578 (43)

	Jan	Feb	Mar	Apr	May
Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use					
	97.9165	95.2969	92.6157	88.3602	85.1220
81.5023	81.0566	83.7458	86.6285	90.3625	94.2461	
98.0535 (44)					
Energy conte	145.2074	128.2658	133.6794	115.7283	111.5266
96.2420	88.6946	100.6804	101.0882	118.0675	129.3466	
140.8223 (45)					

Energy content (annual)
Total = Sum(45)m = 1409.3491 (45)
Distribution loss (46)m = 0.15 x (45)m

	21.7811	19.2399	20.0519	17.3592	16.7290
14.4363	13.3042	15.1021	15.1632	17.7101	19.4020	
21.1233 (46)					

Water storage loss:
Store volume
201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):
1.6100 (48)
Temperature factor from Table 2b
0.5400 (49)
Enter (49) or (54) in (55)
0.8694 (55)
Total storage loss

	26.9514	24.3432	26.9514	26.0820	26.9514
26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	
26.9514 (56)					

If cylinder contains dedicated solar storage

	26.9514	24.3432	26.9514	26.0820	26.9514
26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	
26.9514 (57)					

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (59)					

Total heat required for water heating calculated for each month

	172.1588	152.6090	160.6308	141.8103	138.4780
122.3240	115.6460	127.6318	127.1702	145.0189	155.4286	
167.7737 (62)					

Solar input	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (63d)					

Solar input (sum of months) = Sum(63d)m = 0.0000 (63d)
Output from w/h

	172.1588	152.6090	160.6308	141.8103	138.4780
122.3240	115.6460	127.6318	127.1702	145.0189	155.4286	
167.7737 (64)					

Total per year (kWh/year) = Sum(64)m = 1726.6801 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (64a)					

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
0.0000 (64a)
Heat gains from water heating, kWh/month

	48.2815	42.6484	44.4484	38.4797	37.0826
32.0005	29.4910	33.4762	33.6118	39.2574	43.0077	
46.8234 (65)					

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May
Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	87.8075	87.8075	87.8075	87.8075	87.8075
87.8075	87.8075	87.8075	87.8075	87.8075	87.8075	
87.8075 (66)					

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	80.2543	88.8530	80.2543	82.9294	80.2543
82.9294	80.2543	80.2543	82.9294	80.2543	82.9294	
80.2543 (67)					

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	153.0483	154.6365	150.6344	142.1143	131.3593
121.2511	114.4982	112.9101	116.9122	125.4322	136.1872	
146.2954 (68)					

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	31.7808	31.7808	31.7808	31.7808	31.7808
31.7808	31.7808	31.7808	31.7808	31.7808	31.7808	
31.7808 (69)					

Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (70)					

Losses e.g. evaporation (negative values) (Table 5)

	-70.2460	-70.2460	-70.2460	-70.2460	-70.2460
-70.2460	-70.2460	-70.2460	-70.2460	-70.2460	-70.2460	
-70.2460 (71)					

Water heating gains (Table 5)

```
               64.8944    63.4648    59.7425    53.4440    49.8422
44.4451    39.6384    44.9950    46.6831    52.7654    59.7330
62.9347 (72)
Total internal gains
              347.5393   356.2966   339.9734   327.8300   310.7981
297.9679   283.7332   287.5016   295.8670   307.7942   328.1919
338.8267 (73)
```

---

6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains
			m2	Table 6a				
Specific data	Specific data		factor	W/m2				
or Table 6b	or Table 6c		Table 6d					
West			8.5100	19.6403	0.5000	0.7000	0.7700	40.5395 (80)

Solar gains	40.5395	79.3038	130.6021	190.4754	233.4347	238.9620	227.5015	195.4205	151.8956	94.1007	50.5480	33.3377 (83)
Total gains	388.0788	435.6004	470.5755	518.3054	544.2328	536.9299	511.2347	482.9220	447.7626	401.8948	378.7399	372.1644 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)
21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139	86.3139
alpha	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543	6.7543
util living area	0.9957	0.9898	0.9734	0.9084	0.7602	0.5562	0.4047	0.4474	0.7007	0.9398	0.9894	0.9967 (86)

```
MIT             20.3151    20.4401    20.6152    20.8306    20.9586
20.9954    20.9995    20.9991    20.9809    20.8082    20.5209
20.2806 (87)
Th 2            20.1663    20.1663    20.1663    20.1663    20.1663
20.1663    20.1663    20.1663    20.1663    20.1663    20.1663
20.1663 (88)
util rest of house
                 0.9942     0.9863     0.9644     0.8809     0.7062
0.4862     0.3284     0.3670     0.6265     0.9150     0.9851
0.9956 (89)
MIT 2           19.2602    19.4410    19.6906    19.9810    20.1305
20.1637    20.1662    20.1660    20.1535    19.9589    19.5590
19.2100 (90)
Living area fraction
fLA = Living area / (4) =      0.5691 (91)
MIT             19.8606    20.0096    20.2168    20.4645    20.6017
20.6370    20.6404    20.6401    20.6244    20.4422    20.1064
19.8193 (92)
Temperature adjustment
0.0000
adjusted MIT    19.8606    20.0096    20.2168    20.4645    20.6017
20.6370    20.6404    20.6401    20.6244    20.4422    20.1064
19.8193 (93)
```

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9935	0.9856	0.9650	0.8915	0.7352	0.5260	0.3719	0.4128	0.6682	0.9241	0.9848	0.9950 (94)
Useful gains	385.5654	429.3155	454.1181	462.0685	400.1361	282.4293	190.1030	199.3551	299.2128	371.4107	372.9753	370.3085 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	732.7047	711.4700	645.8855	544.5398	419.1589	284.2659	190.2536	199.6558	307.2156	463.4439	612.4365	735.4700 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	258.2716	189.6078	142.6749	59.3793	14.1530	0.0000	0.0000	0.0000	0.0000	68.4728	172.4121	271.6801 (98)

```
Space heating
1176.6515 (98)
Space heating per m2
(98) / (4) =     22.5240 (99)
```


8c. Space cooling requirement

Not applicable

9a. Energy requirements – Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)
0.0000 (201)
Fraction of space heat from main system(s)
1.0000 (202)
Fraction of main heating from main system 2
0.0000 (203)
Fraction of total heating from main system 1
1.0000 (204)
Fraction of total heating from main system 2
0.0000 (205)
Efficiency of main space heating system 1 (in %)
100.0000 (206)
Efficiency of main space heating system 2 (in %)
0.0000 (207)
Efficiency of secondary/supplementary heating system, %
0.0000 (208)
Space heating requirement
1176.6515 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	258.2716	189.6078	142.6749	59.3793	14.1530	0.0000	0.0000	0.0000	0.0000	68.4728	172.4121	
271.6801 (98)												
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	
100.0000 (210)												
Space heating fuel (main heating system)	258.2716	189.6078	142.6749	59.3793	14.1530	0.0000	0.0000	0.0000	0.0000	68.4728	172.4121	
271.6801 (211)												
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (212)												
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (213)												

Water heating requirement

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
0.0000 (215)												

Space heating fuel used, main system 2
0.0000 (213)

Water heating
Water heating requirement

	172.1588	152.6090	160.6308	141.8103	138.4780	122.3240	115.6460	127.6318	127.1702	145.0189	155.4286	
167.7737 (64)												
Efficiency of water heater												
349.4100 (216)												
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	
349.4100 (217)												
Fuel for water heating, kWh/month												
	49.2713	43.6762	45.9720	40.5857	39.6320	35.0087	33.0975	36.5278	36.3957	41.5039	44.4831	
48.0163 (219)												

Water heating fuel used
494.1702 (219)
Annual totals kWh/year
Space heating fuel – main system
1176.6515 (211)
Space heating fuel – secondary
0.0000 (215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.1950)
mechanical ventilation fans (SFP = 0.1950)
33.5553 (230a)
Total electricity for the above, kWh/year
33.5553 (231)
Electricity for lighting (calculated in Appendix L)
105.8279 (232)
Total delivered energy for all uses
1810.2050 (238)

12a. Carbon dioxide emissions – Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year
Space heating – main system 1		
1176.6515	0.1360	160.0246 (261)
Space heating – main system 2		
0.0000	0.1360	0.0000 (262)
Space heating – secondary		
0.0000	0.0000	0.0000 (263)

Water heating (other fuel)
494.1702 0.1360 67.2071 (264)
Space and water heating
227.2318 (265)
Pumps and fans
33.5553 0.1360 4.5635 (267)
Energy for lighting
105.8279 0.1360 14.3926 (268)
Total CO2, kg/year
246.1879 (272)
Dwelling Carbon Dioxide Emission Rate (DER)
4.7100 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES
DER
4.7100 ZC1
Total Floor Area
TFA 52.2400
Assumed number of occupants
N 1.7562
CO2 emission factor in Table 12 for electricity displaced from grid
EF 0.1360
CO2 emissions from appliances, equation (L14)
4.5493 ZC2
CO2 emissions from cooking, equation (L16)
3.0848 ZC3
Total CO2 emissions
12.3440 ZC4
Residual CO2 emissions offset from biofuel CHP
0.0000 ZC5
Additional allowable electricity generation, kWh/mÂ²/year
0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation
0.0000 ZC7
Net CO2 emissions
12.3440 ZC8

Appendix A.3 – BRUKL Reports (Be Lean)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Anglia Square Block A - Be Lean - Commerical

As designed

Date: Mon Apr 04 12:34:00 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	38.9
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	38.9
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	18.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000002:Surf[3]
Floor	0.25	0.13	0.13	BL000002:Surf[0]
Roof	0.25	0.14	0.14	BL000002:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000002:Surf[2]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	CM000000:Surf[3]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.82
Standard value	0.91*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial A	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial E	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial D	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial B	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial C	-	-	-	1.4	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Commercial A	NO
Commercial E	NO
Commercial D	NO
Commercial B	NO
Commercial C	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Commercial A	-	100	60	876

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Commercial E	-	100	60	781
Commercial D	-	100	60	7523
Commercial B	-	100	60	2689
Commercial C	-	100	60	1114

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial A	NO (-40.2%)	NO
Commercial E	NO (-22.6%)	NO
Commercial D	NO (-23.9%)	NO
Commercial B	YES (+4.7%)	NO
Commercial C	YES (+9.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1420.4	1420.4
External area [m^2]	1046.3	1046.3
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	386.88	489.33
Average U-value [W/m^2K]	0.37	0.47
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	2.5	1.22
Cooling	4.69	11.94
Auxiliary	6.24	3.06
Lighting	22.62	60.64
Hot water	2.05	1.86
Equipment*	20.26	20.26
TOTAL**	**38.09**	**78.72**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	84.92	166.68
Primary energy* [kWh/m^2]	108.53	230.16
Total emissions [kg/m^2]	18.4	38.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	8	76.9	2.5	4.7	6.2	0.89	4.56	0.91	6.1
	Notional	3.8	162.9	1.2	11.9	3.1	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000002:Surf[3]
Floor	0.2	0.13	BL000002:Surf[0]
Roof	0.15	0.14	BL000002:Surf[1]
Windows, roof windows, and rooflights	1.5	1.2	BL000002:Surf[2]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	CM000000:Surf[3]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Anglia Square Block A - Be Lean - Resi Entrances

As designed

Date: Mon Apr 04 12:31:47 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	8
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	8
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	4.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	RS000001:Surf[0]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	RS000001:Surf[2]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	RS000001:Surf[5]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.82
Standard value	0.91*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Enrtrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Residential Entrance	NO
Residential Enrtrance	NO
Residential Entrance	NO
Residential Entrance	NO
Residential Entrance	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Residential Entrance	-	100	-	190

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Residential Enrtrance	-	100	-	129
Residential Entrance	-	100	-	101
Residential Entrance	-	100	-	25
Residential Entrance	-	100	-	134

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance	NO (-24.5%)	NO
Residential Enrtrance	NO (-3.4%)	NO
Residential Entrance	YES (+31.1%)	NO
Residential Entrance	NO (-4.7%)	NO
Residential Entrance	YES (+1.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	315.1	315.1
External area [m^2]	125.3	125.3
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	93.71	116.35
Average U-value [W/m^2K]	0.75	0.93
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	2.92	7.87
Cooling	3.24	0.72
Auxiliary	1.34	0.53
Lighting	3.74	11.14
Hot water	0	0
Equipment*	13.13	13.13
TOTAL**	**11.22**	**20.26**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	62.48	34.19
Primary energy* [kWh/m^2]	29.06	46.69
Total emissions [kg/m^2]	4.9	8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	9.4	53.1	2.9	3.2	1.3	0.89	4.56	0.91	6.1
	Notional	24.4	9.8	7.9	0.7	0.5	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	RS000001:Surf[0]
Floor	0.2	-	UNKNOWN
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	RS000001:Surf[2]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	RS000001:Surf[5]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block D - Be Lean - Community

As designed

Date: Tue Apr 05 12:52:24 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	14.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	14.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	11.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	VL000001:Surf[12]
Floor	0.25	0.13	0.13	VL000001:Surf[27]
Roof	0.25	0.14	0.14	VL000001:Surf[28]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	VL000001:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	FL000002:Surf[53]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$ $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.91
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
Village Hall	-	-	-	1.4	-	-	-	-	-	-	N/A
Community Hub 1	-	-	-	1.4	-	-	-	-	-	-	N/A
Community Hub	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Village Hall	-	100	-	738
Community Hub 1	-	100	-	652
Community Hub	-	100	-	2117

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Village Hall	NO (-18.9%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Community Hub 1	N/A	N/A
Community Hub	YES (+21%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	773.8	773.8
External area [m^2]	1077.1	1077.1
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	463.12	446.26
Average U-value [W/m^2K]	0.43	0.41
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
100	**D1 Non-residential Institutions: Community/Day Centre**
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	12.72	15.38
Cooling	2.65	2.76
Auxiliary	7.39	2.95
Lighting	4.57	15.02
Hot water	5.32	4.84
Equipment*	4.72	4.72
TOTAL**	**32.66**	**40.95**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	84.41	85.36
Primary energy* [kWh/m^2]	66.9	86.72
Total emissions [kg/m^2]	11.5	14.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	40.9	43.5	12.7	2.7	7.4	0.89	4.56	0.91	6.1
Notional	47.7	37.6	15.4	2.8	2.9	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	VL000001:Surf[12]
Floor	0.2	0.13	VL000001:Surf[27]
Roof	0.15	0.14	VL000001:Surf[28]
Windows, roof windows, and rooflights	1.5	1.2	VL000001:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	FL000002:Surf[53]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block D - Be Lean - Resi Entrances

As designed

Date: Tue Apr 05 12:51:11 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	38
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	38
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	21.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000002:Surf[2]
Floor	0.25	0.13	0.13	BL000002:Surf[3]
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000001:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	BL000002:Surf[0]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.91
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Residential Entrance	-	100	-	21
Residential Entrance	-	100	-	40

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance	NO (-36.9%)	NO
Residential Entrance	YES (+81%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	16.6	16.6
External area [m^2]	53.6	53.6
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	30.53	34.3
Average U-value [W/m^2K]	0.57	0.64
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	51.16	125.81
Cooling	14.28	0.03
Auxiliary	1.34	0.53
Lighting	4.58	20.85
Hot water	0	0
Equipment*	13.14	13.14
TOTAL**	**71.35**	**147.21**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	398.72	390.8
Primary energy* [kWh/m^2]	124.41	217.56
Total emissions [kg/m^2]	21.5	38

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	164.4	234.3	51.2	14.3	1.3	0.89	4.56	0.91	6.1
	Notional	390.5	0.3	125.8	0	0.5	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000002:Surf[2]
Floor	0.2	0.13	BL000002:Surf[3]
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	BL000001:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	BL000002:Surf[0]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block K L - Be Lean - Commercial

As designed

Date: Tue Apr 05 17:50:52 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	37.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	37.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	27.6
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL00000A:Surf[1]
Floor	0.25	0.13	0.13	BL00000A:Surf[0]
Roof	0.25	0.14	0.14	CM000009:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL00000A:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	CM000005:Surf[13]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$ $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.82
Standard value	0.91*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial GF c	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF f	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF g	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF i	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF h	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial L GF	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF d	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF e	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF b	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF a	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 a	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 b	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 c	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 d	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 e	-	-	-	1.4	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commerical 1 f	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial L 1	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial L 2	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial L 3	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF K	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
Commercial GF c	-	100	60	804
Commercial GF f	-	100	60	974
Commercial GF g	-	100	60	974
Commercial GF i	-	100	60	1162
Commercial GF h	-	100	60	1177
Commercial L GF	-	59	15	5661
Commercial GF d	-	100	60	1389
Commercial GF e	-	100	60	6501
Commercial GF b	-	100	60	1872
Commercial GF a	-	100	60	2914
Commerical 1 a	-	100	60	551
Commerical 1 b	-	100	60	537
Commerical 1 c	-	100	60	347
Commerical 1 d	-	100	60	525
Commerical 1 e	-	100	60	544
Commerical 1 f	-	100	60	544
Commercial L 1	-	58	15	7211
Commercial L 2	-	58	15	7211
Commercial L 3	-	59	15	5661
Commercial GF K	-	69	15	1355

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial GF c	NO (-44.1%)	NO
Commercial GF f	NO (-46.6%)	NO
Commercial GF g	NO (-30.3%)	NO
Commercial GF i	NO (-17.4%)	NO
Commercial GF h	NO (-18.2%)	NO
Commercial L GF	YES (+21.4%)	NO
Commercial GF d	NO (-43.6%)	NO
Commercial GF e	YES (+28%)	NO
Commercial GF b	YES (+50%)	NO
Commercial GF a	YES (+67.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commerical 1 a	N/A	N/A
Commerical 1 b	N/A	N/A
Commerical 1 c	N/A	N/A
Commerical 1 d	N/A	N/A
Commerical 1 e	N/A	N/A
Commerical 1 f	N/A	N/A
Commercial L 1	NO (-20.9%)	NO
Commercial L 2	NO (-20.9%)	NO
Commercial L 3	NO (-35.6%)	NO
Commercial GF K	NO (-80.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	3058.2	3058.2
External area [m²]	4267.9	4267.9
Weather	NOR	NOR
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	1325.03	1641.26
Average U-value [W/m²K]	0.31	0.38
Alpha value* [%]	10.71	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.05	4.53
Cooling	6.95	9.18
Auxiliary	6.24	3.06
Lighting	37.43	59.81
Hot water	2.05	1.86
Equipment*	20.26	20.26
TOTAL**	**56.71**	**78.44**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	126.99	139.28
Primary energy* [kWh/m²]	162.84	223.45
Total emissions [kg/m²]	27.6	37.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	13	114	4	6.9	6.2	0.89	4.56	0.91	6.1
	Notional	14.1	125.2	4.5	9.2	3.1	0.86	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL00000A:Surf[1]
Floor	0.2	0.13	BL00000A:Surf[0]
Roof	0.15	0.14	CM000009:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	BL00000A:Surf[3]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	CM000005:Surf[13]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block K L - Be Lean - Residential Entrances

As designed

Date: Tue Apr 05 17:34:47 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	15.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	15.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	9.6
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL00000D:Surf[1]
Floor	0.25	0.13	0.13	BL00000D:Surf[0]
Roof	0.25	0.14	0.14	CM000009:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL00000D:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	BL00000D:Surf[6]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.82
Standard value	0.91*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance b	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance a	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Residential Entrance b	-	100	-	108
Residential Entrance a	-	100	-	199

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance b	NO (-32.7%)	NO
Residential Entrance a	NO (-7.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	155	155
External area [m^2]	862	862
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	210.74	256.61
Average U-value [W/m^2K]	0.24	0.3
Alpha value* [%]	15.86	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	28.15	43.27
Cooling	2.26	0.46
Auxiliary	1.34	0.53
Lighting	3.28	10.56
Hot water	0	0
Equipment*	13.13	13.13
TOTAL**	**35.01**	**54.82**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	127.46	140.62
Primary energy* [kWh/m^2]	55.42	87.38
Total emissions [kg/m^2]	9.6	15.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	90.4	37	28.1	2.3	1.3	0.89	4.56	0.91	6.1
	Notional	134.3	6.3	43.3	0.5	0.5	0.86	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL00000D:Surf[1]
Floor	0.2	0.13	BL00000D:Surf[0]
Roof	0.15	0.14	CM000009:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	BL00000D:Surf[3]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	BL00000D:Surf[6]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block M - Be Lean - commercial

As designed

Date: Fri Apr 01 17:44:12 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	32.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	32.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	17.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000002:Surf[3]
Floor	0.25	0.13	0.13	BL000002:Surf[0]
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000002:Surf[4]
Personnel doors	2.2	1.3	1.3	BL000002:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.82
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial A	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial B	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Commercial A	-	100	60	883
Commercial B	-	100	60	4849

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial A	NO (-71.6%)	NO
Commercial B	YES (+7.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	627	627
External area [m^2]	1029.8	1029.8
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	343.72	403.27
Average U-value [W/m^2K]	0.33	0.39
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	8.23	7.76
Cooling	4.31	7.37
Auxiliary	6.24	3.06
Lighting	18.28	50.16
Hot water	2.05	1.86
Equipment*	20.26	20.26
TOTAL**	**39.11**	**70.21**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	97.2	124.55
Primary energy* [kWh/m^2]	101.05	193.11
Total emissions [kg/m^2]	17.2	32.7

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	26.4	70.8	8.2	4.3	6.2	0.89	4.56	0.91	6.1
Notional	24.1	100.5	7.8	7.4	3.1	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000002:Surf[3]
Floor	0.2	0.13	BL000002:Surf[0]
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	BL000002:Surf[4]
Personnel doors	1.5	1.3	BL000002:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block M - Be Lean - resi entrance

As designed

Date: Fri Apr 01 17:43:01 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	15.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	15.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	13
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000005:Surf[2]
Floor	0.25	0.13	0.13	BL000005:Surf[0]
Roof	0.25	0.14	0.14	ST000001:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000005:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.02	0	0	0.82
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Be Lean Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.8	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Residential Entrance	-	100	-	63
Residential Entrance	-	100	-	56

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance	NO (-69.8%)	NO
Residential Entrance	YES (+38.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	48	48
External area [m^2]	127.9	127.9
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	54.7	55.46
Average U-value [W/m^2K]	0.43	0.43
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	29.5	31.89
Cooling	6.43	3.87
Auxiliary	1.34	0.53
Lighting	5.04	13.48
Hot water	0	0
Equipment*	13.14	13.14
TOTAL**	**42.31**	**49.77**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	200.37	151.74
Primary energy* [kWh/m^2]	75.31	92.42
Total emissions [kg/m^2]	13	15.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	94.8	105.6	29.5	6.4	1.3	0.89	4.56	0.91	6.1
	Notional	99	52.8	31.9	3.9	0.5	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000005:Surf[2]
Floor	0.2	0.13	BL000005:Surf[0]
Roof	0.15	0.14	ST000001:Surf[1]
Windows, roof windows, and rooflights	1.5	1.2	BL000005:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Appendix A.4 - BRUKL Reports (Be Green)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Anglia Square Block A - Be Green - Commercial

As designed

Date: Mon Apr 04 12:15:42 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	38.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	38.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	18
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000002:Surf[3]
Floor	0.25	0.13	0.13	BL000002:Surf[0]
Roof	0.25	0.14	0.14	BL000002:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000002:Surf[2]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	CM000000:Surf[3]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial A	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial E	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial D	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial B	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial C	-	-	-	1.4	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Commercial A	NO
Commercial E	NO
Commercial D	NO
Commercial B	NO
Commercial C	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Commercial A	-	100	60	876

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Commercial E	-	100	60	781
Commercial D	-	100	60	7523
Commercial B	-	100	60	2689
Commercial C	-	100	60	1114

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial A	NO (-40.2%)	NO
Commercial E	NO (-22.6%)	NO
Commercial D	NO (-23.9%)	NO
Commercial B	YES (+4.7%)	NO
Commercial C	YES (+9.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1420.4	1420.4
External area [m^2]	1046.3	1046.3
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	386.88	489.33
Average U-value [W/m^2K]	0.37	0.47
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	0.67	0.41
Cooling	4.69	11.94
Auxiliary	6.24	3.06
Lighting	22.62	60.64
Hot water	0.53	0.63
Equipment*	20.26	20.26
TOTAL**	**34.74**	**76.67**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	84.92	166.68
Primary energy* [kWh/m^2]	106.64	229.51
Total emissions [kg/m^2]	18	38.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	8	76.9	0.7	4.7	6.2	3.33	4.56	3.4	6.1
	Notional	3.8	162.9	0.4	11.9	3.1	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000002:Surf[3]
Floor	0.2	0.13	BL000002:Surf[0]
Roof	0.15	0.14	BL000002:Surf[1]
Windows, roof windows, and rooflights	1.5	1.2	BL000002:Surf[2]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	CM000000:Surf[3]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Anglia Square Block A - Be Green - Resi Entrances

As designed

Date: Mon Apr 04 12:30:34 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	7.6
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	7.6
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	4.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	RS000001:Surf[0]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	RS000001:Surf[2]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	RS000001:Surf[5]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Enrtrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Residential Entrance	NO
Residential Enrtrance	NO
Residential Entrance	NO
Residential Entrance	NO
Residential Entrance	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Residential Entrance	-	100	-	190

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Residential Enrtrance	-	100	-	129
Residential Entrance	-	100	-	101
Residential Entrance	-	100	-	25
Residential Entrance	-	100	-	134

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance	NO (-24.5%)	NO
Residential Enrtrance	NO (-3.4%)	NO
Residential Entrance	YES (+31.1%)	NO
Residential Entrance	NO (-4.7%)	NO
Residential Entrance	YES (+1.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	315.1	315.1
External area [m^2]	125.3	125.3
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	93.71	116.35
Average U-value [W/m^2K]	0.75	0.93
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	0.78	2.65
Cooling	3.24	0.72
Auxiliary	1.34	0.53
Lighting	3.74	11.14
Hot water	0	0
Equipment*	13.13	13.13
TOTAL**	**9.09**	**15.04**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	62.48	34.19
Primary energy* [kWh/m^2]	27.9	45.03
Total emissions [kg/m^2]	4.7	7.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	9.4	53.1	0.8	3.2	1.3	3.33	4.56	3.4	6.1
	Notional	24.4	9.8	2.7	0.7	0.5	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	RS000001:Surf[0]
Floor	0.2	-	UNKNOWN
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	RS000001:Surf[2]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	RS000001:Surf[5]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block D - Be Green - Community

As designed

Date: Tue Apr 05 12:53:38 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	13.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	13.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	10.3
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	VL000001:Surf[12]
Floor	0.25	0.13	0.13	VL000001:Surf[27]
Roof	0.25	0.14	0.14	VL000001:Surf[28]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	VL000001:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	FL000002:Surf[53]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Village Hall	-	-	-	1.4	-	-	-	-	-	-	N/A
Community Hub 1	-	-	-	1.4	-	-	-	-	-	-	N/A
Community Hub	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
Village Hall	-	100	-	738
Community Hub 1	-	100	-	652
Community Hub	-	100	-	2117

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Village Hall	NO (-18.9%)	NO
Community Hub 1	N/A	N/A
Community Hub	YES (+21%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	773.8	773.8
External area [m^2]	1077.1	1077.1
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	463.12	446.26
Average U-value [W/m^2K]	0.43	0.41
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
100	**D1 Non-residential Institutions: Community/Day Centre**
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	3.9	5.18
Cooling	2.65	2.76
Auxiliary	7.39	2.95
Lighting	4.57	15.02
Hot water	1.36	1.63
Equipment*	4.72	4.72
TOTAL**	**19.89**	**27.54**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	90.37	85.36
Primary energy* [kWh/m^2]	61.05	82.45
Total emissions [kg/m^2]	10.3	13.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	46.8	43.5	3.9	2.7	7.4	3.33	4.56	3.4	6.1
	Notional	47.7	37.6	5.2	2.8	2.9	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	VL000001:Surf[12]
Floor	0.2	0.13	VL000001:Surf[27]
Roof	0.15	0.14	VL000001:Surf[28]
Windows, roof windows, and rooflights	1.5	1.2	VL000001:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	FL000002:Surf[53]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block D - Be Green - Resi Entrances

As designed

Date: Tue Apr 05 12:50:14 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	32.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	32.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	17.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000002:Surf[2]
Floor	0.25	0.13	0.13	BL000002:Surf[3]
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000001:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	BL000002:Surf[0]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Residential Entrance	-	100	-	21
Residential Entrance	-	100	-	40

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance	NO (-36.9%)	NO
Residential Entrance	YES (+81%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	16.6	16.6
External area [m^2]	53.6	53.6
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	30.53	34.3
Average U-value [W/m^2K]	0.57	0.64
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	13.83	42.4
Cooling	14.28	0.03
Auxiliary	1.34	0.53
Lighting	4.58	20.85
Hot water	0	0
Equipment*	13.14	13.14
TOTAL**	**34.02**	**63.81**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	400.35	390.8
Primary energy* [kWh/m^2]	104.45	190.99
Total emissions [kg/m^2]	17.7	32.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	166	234.3	13.8	14.3	1.3	3.33	4.56	3.4	6.1
	Notional	390.5	0.3	42.4	0	0.5	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000002:Surf[2]
Floor	0.2	0.13	BL000002:Surf[3]
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	BL000001:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	BL000002:Surf[0]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block K L - Be Green - Commercial

As designed

Date: Tue Apr 05 17:52:21 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	37.5
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	37.5
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	27.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL00000A:Surf[1]
Floor	0.25	0.13	0.13	BL00000A:Surf[0]
Roof	0.25	0.14	0.14	CM000009:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL00000A:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	CM000005:Surf[13]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial GF c	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF f	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF g	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF i	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF h	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial L GF	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF d	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF e	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF b	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF a	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 a	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 b	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 c	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 d	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 e	-	-	-	1.4	-	-	-	-	-	-	N/A
Commerical 1 f	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial L 1	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial L 2	-	-	-	1.4	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial L 3	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial GF K	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Commercial GF c	-	100	60	804
Commercial GF f	-	100	60	974
Commercial GF g	-	100	60	974
Commercial GF i	-	100	60	1162
Commercial GF h	-	100	60	1177
Commercial L GF	-	59	15	5661
Commercial GF d	-	100	60	1389
Commercial GF e	-	100	60	6501
Commercial GF b	-	100	60	1872
Commercial GF a	-	100	60	2914
Commerical 1 a	-	100	60	551
Commerical 1 b	-	100	60	537
Commerical 1 c	-	100	60	347
Commerical 1 d	-	100	60	525
Commerical 1 e	-	100	60	544
Commerical 1 f	-	100	60	544
Commercial L 1	-	58	15	7211
Commercial L 2	-	58	15	7211
Commercial L 3	-	59	15	5661
Commercial GF K	-	69	15	1355

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial GF c	NO (-44.1%)	NO
Commercial GF f	NO (-46.6%)	NO
Commercial GF g	NO (-30.3%)	NO
Commercial GF i	NO (-17.4%)	NO
Commercial GF h	NO (-18.2%)	NO
Commercial L GF	YES (+21.4%)	NO
Commercial GF d	NO (-43.6%)	NO
Commercial GF e	YES (+28%)	NO
Commercial GF b	YES (+50%)	NO
Commercial GF a	YES (+67.2%)	NO
Commerical 1 a	N/A	N/A
Commerical 1 b	N/A	N/A
Commerical 1 c	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commerical 1 d	N/A	N/A
Commerical 1 e	N/A	N/A
Commerical 1 f	N/A	N/A
Commercial L 1	NO (-20.9%)	NO
Commercial L 2	NO (-20.9%)	NO
Commercial L 3	NO (-35.6%)	NO
Commercial GF K	NO (-80.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	3058.2	3058.2
External area [m²]	4267.9	4267.9
Weather	NOR	NOR
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	1325.03	1641.26
Average U-value [W/m²K]	0.31	0.38
Alpha value* [%]	10.71	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.08	1.53
Cooling	6.95	9.18
Auxiliary	6.24	3.06
Lighting	37.43	59.81
Hot water	0.53	0.63
Equipment*	20.26	20.26
TOTAL**	**52.23**	**74.2**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	126.99	139.28
Primary energy* [kWh/m²]	160.34	222.1
Total emissions [kg/m²]	27.1	37.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	13	114	1.1	6.9	6.2	3.33	4.56	3.4	6.1
	Notional	14.1	125.2	1.5	9.2	3.1	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL00000A:Surf[1]
Floor	0.2	0.13	BL00000A:Surf[0]
Roof	0.15	0.14	CM000009:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	BL00000A:Surf[3]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	CM000005:Surf[13]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block K L - Be Green - Residential Entrances

As designed

Date: Tue Apr 05 17:36:24 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	13.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	13.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	7.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL00000D:Surf[1]
Floor	0.25	0.13	0.13	BL00000D:Surf[0]
Roof	0.25	0.14	0.14	CM000009:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL00000D:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.2	1.2	BL00000D:Surf[6]

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	1	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance b	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance a	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Residential Entrance b	-	100	-	108
Residential Entrance a	-	100	-	199

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance b	NO (-32.7%)	NO
Residential Entrance a	NO (-7.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	155	155
External area [m^2]	862	862
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	210.74	256.61
Average U-value [W/m^2K]	0.24	0.3
Alpha value* [%]	15.86	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	7.53	14.58
Cooling	2.26	0.46
Auxiliary	1.34	0.53
Lighting	3.28	10.56
Hot water	0	0
Equipment*	13.13	13.13
TOTAL**	**14.4**	**26.14**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	127.46	140.62
Primary energy* [kWh/m^2]	44.21	78.24
Total emissions [kg/m^2]	7.5	13.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	90.4	37	7.5	2.3	1.3	3.33	4.56	3.4	6.1
	Notional	134.3	6.3	14.6	0.5	0.5	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL00000D:Surf[1]
Floor	0.2	0.13	BL00000D:Surf[0]
Roof	0.15	0.14	CM000009:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	BL00000D:Surf[3]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.2	BL00000D:Surf[6]

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block M - Be Green - commercial

As designed

Date: Fri Apr 01 17:45:14 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	32.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	32.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	16.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000002:Surf[3]
Floor	0.25	0.13	0.13	BL000002:Surf[0]
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000002:Surf[4]
Personnel doors	2.2	1.3	1.3	BL000002:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$ $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial A	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial B	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Commercial A	-	100	60	883
Commercial B	-	100	60	4849

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial A	NO (-71.6%)	NO
Commercial B	YES (+7.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	627	627
External area [m^2]	1029.8	1029.8
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	343.72	403.27
Average U-value [W/m^2K]	0.33	0.39
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	2.2	2.61
Cooling	4.31	7.37
Auxiliary	6.24	3.06
Lighting	18.28	50.16
Hot water	0.53	0.63
Equipment*	20.26	20.26
TOTAL**	**31.56**	**63.83**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	97.2	124.55
Primary energy* [kWh/m^2]	96.89	191.08
Total emissions [kg/m^2]	16.4	32.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	26.4	70.8	2.2	4.3	6.2	3.33	4.56	3.4	6.1
	Notional	24.1	100.5	2.6	7.4	3.1	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000002:Surf[3]
Floor	0.2	0.13	BL000002:Surf[0]
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	BL000002:Surf[4]
Personnel doors	1.5	1.3	BL000002:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Anglia Square Block M - Be Green - Resi entrance

As designed

Date: Fri Apr 01 17:41:39 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	14.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	14.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	10.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	BL000005:Surf[2]
Floor	0.25	0.13	0.13	BL000005:Surf[0]
Roof	0.25	0.14	0.14	ST000001:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	BL000005:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$ $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	4.02	0	0	0.82
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A
Residential Entrance	-	-	-	1.4	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
Residential Entrance	-	100	-	63
Residential Entrance	-	100	-	56

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Residential Entrance	NO (-69.8%)	NO
Residential Entrance	YES (+38.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	48	48
External area [m^2]	127.9	127.9
Weather	NOR	NOR
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	54.7	55.46
Average U-value [W/m^2K]	0.43	0.43
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
100	**Residential spaces**
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	7.9	10.75
Cooling	6.43	3.87
Auxiliary	1.34	0.53
Lighting	5.04	13.48
Hot water	0	0
Equipment*	13.14	13.14
TOTAL**	**20.7**	**28.63**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	200.37	151.74
Primary energy* [kWh/m^2]	63.56	85.68
Total emissions [kg/m^2]	10.7	14.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	94.8	105.6	7.9	6.4	1.3	3.33	4.56	3.4	6.1
	Notional	99	52.8	10.7	3.9	0.5	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	BL000005:Surf[2]
Floor	0.2	0.13	BL000005:Surf[0]
Roof	0.15	0.14	ST000001:Surf[1]
Windows, roof windows, and rooflights	1.5	1.2	BL000005:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Appendix A.5 - Overheating Assessment

A.5 Overheating Assessment

Detailed Application

The detailed application has been assessed to reduce overheating and minimise the use of air conditioning.

The assessment includes dynamic thermal modelling of both the domestic and non-domestic elements of the proposed development to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49, TM52 and TM59.

Outline Application

A detailed assessment of the overheating risk will be carried out at a later date for the outline application areas and submitted with the Reserve Matters application.

A.5.1 Overheating Risk Assessment Methodology

Domestic (Apartments)

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

a) For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Non-Domestic

The non-domestic overheating risk assessment has been made against the three criteria outlined in CIBSE TM52. A room or building that fails any two of the three criteria is classed as overheating.

- The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
- The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
- The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The Norwich weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years;-

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, and compliance is therefore not expected.

A.5.2 Domestic Model Input Data

This section summarises the input assumptions that have been used in the dynamic thermal modelling. The modelling has been carried out in accordance with CIBSE TM59: Design methodology for the assessment of overheating risk in home.

Fabric Performance

Refer to Section 6.

Solar Gain

For the residential apartments the size and g-value of the glazing has been optimised using the dynamic thermal modelling, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy. This has resulted in the g-value of the residential glazing being set at 0.5.

Blinds and Shading Devices

Internal blinds have not been included in the dwellings.

The balconies have been modelled to provide external shading for the apartments.

Mechanical Ventilation

Ventilation will be provided to the residential apartments via individual Mechanical Extract Ventilation (MEV) units. Each unit will have a boost mode to operate at higher speed and provide an increased ventilation rate. Fresh air will be provided to habitable rooms via trickle vents.

Natural Ventilation

A typical apartment has balcony doors which can be fully opened and side/top hung opening windows elsewhere to allow natural ventilation when required.

Infiltration

The target air permeability for the development is 3m^3/hr.m^2@50Pa. An average infiltration air change of 0.25ACH has been assumed in the dynamic thermal modelling in accordance with Table 4.24 in CIBSE Guide A.

Air Speed Assumptions

Operative air speed in the apartments has been set at 0.1m/s and assumed elevated air speed of 0.8m/s used in the thermal modelling calculation in accordance with CIBSE TM59.

Thermal Comfort Category

This is a new build development, therefore Cat II building was selected as Normal Expectations.

Internal Gains

A thermal template has been created for each of the spaces within the sample apartments taking into account the internal gains. The internal heat gains consist of occupancy gains, equipment gains and lighting gains. CIBSE TM59 has been used in developing the internal gains profile.

Occupancy Gains

Occupancy heat gains and profiles were assumed in accordance with Table 2 in CIBSE TM59.

Occupancy gain has been set at 75 W/person sensible, 55 W/person latent.

Room Type	Profile/ Gain
Single Bedroom	1 person at 70% gains from 11pm -8am 1 person at full gains from 8am to 11pm
Double Bedroom	2 person at 70% gains from 11pm -8am 2 person at full gains from 8am to 9am and from 10pm to 11pm 1 person at full gains in the bedroom from 9am to 10pm
1 Bedroom (Living room/ kitchen)	1 person from 9am -10am, room is unoccupied for the rest the day
2 Bedroom (Living room/ kitchen)	2 person from 9am -10am, room is unoccupied for the rest the day
3 Bedroom (Living room/ kitchen)	3 person from 9am -10am, room is unoccupied for the rest the day

Table 21: Occupancy Gains

Equipment Gains

Equipment heat gains and profiles were assumed in accordance with Table 2 in CISBE TM59.

Room Type	Profile/ Gain
Living Room/ Kitchen	Peak load of 450W from 6pm-8pm 200W from 8pm- 10pm 110W from 9am to 6pm and from 10pm to 12pm Base load of 85W for the rest of the day
Single Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours
Double Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours

Table 22: Equipment Gains

Lighting Gains

Lighting gains of 2 W/m^2 have been assumed for each flat for the period of 6pm –11pm in accordance with CIBSE TM59. Lighting Gains of 8W/m2 have been assumed for the communal corridors.

A.5.3 Detailed Application Overheating Modelling Results

Domestic Dwellings

The results of the assessment of criteria (a) and (b) for the sample residential dwellings in the detailed application are shown below.

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	< 3	< 3	< 3	< 33	< 33	< 33
Block A						
Dbl Bedroom 1a	1	1.1	2.2	0	1	1
Living/Kitchen 1	1.2	2	3.1	N/A	N/A	N/A
Dbl Bedroom 2a	0.9	1.1	2	2	2	6
Living/Kitchen 2	1.3	2	3.5	N/A	N/A	N/A
Dbl Bedroom 2b	0.5	0.9	1.8	1	2	5
Dbl Bedroom 1b	0.3	0.7	1.4	2	2	7
Dbl Bedroom 3b	0.7	1	2	2	3	7
Living/Kitchen 3	1.1	1.6	3.6	N/A	N/A	N/A
Dbl Bedroom 3a	0.7	1	2.2	2	3	7
Dbl Bedroom 4a	0.1	0.3	1	8	6	17
Living/Kitchen 4	0.7	1.3	2.7	N/A	N/A	N/A
Dbl Bedroom 4b	0.5	0.8	2	9	7	17
Dbl Bedroom 5	0.7	0.9	2	2	3	8
Living/Kitchen 5	1	1.5	3.4	N/A	N/A	N/A
Living/Kitchen 6	0.6	1.2	2.5	N/A	N/A	N/A
Dbl Bedroom 6	0.3	0.6	1.7	7	6	17
Living/Kitchen 7	0.6	1.3	2.6	N/A	N/A	N/A
Dbl Bedroom 7a	0.5	0.9	1.6	0	1	3
Dbl Bedroom 7b	0.6	1	1.9	0	1	3

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	**< 3**	**< 3**	**< 3**	**< 33**	**< 33**	**< 33**
Single Bedroom 8	0.5	1.3	2.2	8	6	17
Living/Kitchen 8	0.7	0.9	2.7	N/A	N/A	N/A
Dbl Bedroom 8	0.6	0.4	2.2	8	6	17
Dbl Bedroom 9a	1	1.3	2.4	2	3	7
Living/Kitchen 9	1.2	1.7	3.4	N/A	N/A	N/A
Dbl Bedroom 9b	0.8	1	2.2	0	2	5
Dbl Bedroom 10a	0.8	1	2	0	2	5
Dbl Bedroom 10b	0.9	1.2	2.4	2	3	8
Living/Kitchen 10	1.4	1.9	3.8	N/A	N/A	N/A
Dbl Bedroom 11	0.2	0.4	1	2	2	9
Living/Kitchen 11	0.1	0.2	0.5	N/A	N/A	N/A
Dbl Bedroom 12b	0.5	0.9	1.5	0	2	4
Living/Kitchen 12	1	1.7	3.1	N/A	N/A	N/A
Dbl Bedroom 12a	0.7	0.9	2	2	2	5
Dbl Bedroom 13	1.3	1.4	2.6	0	1	2
Living/Kitchen 13	1.2	2	2.9	N/A	N/A	N/A
Dbl Bedroom 14b	0.1	0.4	1	10	6	17
Living/Kitcen 14	1.3	1.8	2.8	N/A	N/A	N/A
Dbl Bedroom 14a	1.1	1.3	2.5	0	1	2
Living/Kitchen 15	0.8	1.3	1.5	N/A	N/A	N/A
Dbl Bedroom 15	0.4	0.8	1.5	0	2	5
Living/Kitchen 16	0.9	1.5	3.2	N/A	N/A	N/A
Dbl Bedroom 16a	0.4	0.8	1.6	2	2	7
Dbl Bedroom 16b	0.4	0.8	1.7	2	2	7
Dbl Bedroom 17	0.4	0.8	2.9	0	2	5
Living/Kitchen 17	0.8	1.3	0.6	N/A	N/A	N/A

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	**< 3**	**< 3**	**< 3**	**< 33**	**< 33**	**< 33**
Living/Kitchen 18	0.8	1.5	3	N/A	N/A	N/A
Dbl Bedroom 18	0.4	0.8	1.7	2	2	8
Dbl Bedroom 19a	0.2	0.2	0.6	35	17	51
Dbl Bedroom 19b	0.1	0.3	1.1	2	3	9
Living/Kitchen 19	0.2	0.3	0.9	N/A	N/A	N/A
Living/Kitchen 20	0.3	0.9	2	N/A	N/A	N/A
Dbl Bedroom 20a	0.5	0.8	1.6	2	2	7
Dbl Bedroom 20b	0.3	0.6	1.4	2	3	8
Living/Kitchen 21	0.8	1.4	3.2	N/A	N/A	N/A
Dbl Bedroom 21	0.1	0.3	0.8	7	5	16
Dbl Bedroom 22a	0.5	0.9	1.6	0	2	3
Single Bedroom 22	0.1	0.9	0.8	2	5	11
Living/Kitchen 22	0.4	0.3	2.1	N/A	N/A	N/A
Dbl Bedroom 22b	0.5	0.9	1.7	2	2	7
Block C						
Dbl Bedroom 1	0.7	1.2	1.2	8	6	6
Living/Kitchen 1	2.4	2.9	2.9	N/A	N/A	N/A
Living/Kitchen 2	2.1	2.2	2.2	N/A	N/A	N/A
Dbl Bedroom 2	0.2	0.5	0.5	10	8	8
Dbl Bedroom 3	0.1	0.5	0.5	10	8	8
Living/Kitchen 3	2.3	2.3	2.3	N/A	N/A	N/A
Dbl Bedroom 4	0.1	0.4	0.4	10	8	8
Living/Kitchen 4	2.1	2.2	2.2	N/A	N/A	N/A
Block J						
Dbl Bedroom 1a	2.2	2.6	4.1	2	4	9
Living/Kitchen 1	1.7	1.9	3.8	N/A	N/A	N/A

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	**< 3**	**< 3**	**< 3**	**< 33**	**< 33**	**< 33**
Dbl Bedroom 2	0.4	0.7	1.4	0	1	3
Living/Kitchen 2	0	0.4	1.3	N/A	N/A	N/A
Dbl Bedroom 3	0.3	0.5	1.3	0	1	3
Living/Kitchen 3	0	0.2	0.6	N/A	N/A	N/A
Dbl Bedroom 4b	1.4	1.6	3.1	3	4	10
Dbl Bedroom 4a	0.4	0.8	1.4	0	1	2
Living/Kitchen 4	1	1.3	2.7	N/A	N/A	N/A
Dbl Bedroom 1b	0.3	0.7	1.3	0	1	2
Block KL						
Duplex Living/Kitchen 6	1	1.3	2.1	N/A	N/A	N/A
Duplex Living/Kitchen 5	0.7	0.8	1.7	N/A	N/A	N/A
Single bed 1	0.5	1	1.6	0	2	6
Dbl Bedroom 1	0.4	0.5	1.1	0	1	3
Living/Kitchen 1	0.7	0.8	1.8	N/A	N/A	N/A
Dbl Bedroom 2a	1.3	1.3	2.5	2	3	6
Dbl Bedroom 2b	1.1	1.4	2.7	2	3	7
Living/Kitchen 2	2.7	2.8	5.2	N/A	N/A	N/A
Dbl Bedroom 3a	0	0.2	0.9	1	2	6
Living/Kitchen 3	0	0.2	0.9	N/A	N/A	N/A
Dbl Bedroom 3b	0	0.2	1.2	1	2	6
Living/Kitchen 4	1.2	1.5	2.9	N/A	N/A	N/A
Dbl Bedroom 4	1	1.2	2.2	2	3	6
Dbl Bedroom 5a	0	0.2	0.7	1	2	6
Living/Kitchen 5	0	0.2	0.7	N/A	N/A	N/A
Dbl Bedroom 5b	0	0	0.2	1	2	5
Living/Kitchen 7	1.2	1.4	2.9	N/A	N/A	N/A

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	**< 3**	**< 3**	**< 3**	**< 33**	**< 33**	**< 33**
Dbl Bedroom 7	1	1.2	2.2	2	3	6
Living/Kitchen 6	1.2	1.4	2.9	N/A	N/A	N/A
Dbl Bedroom 6	1.1	1.3	2.4	2	3	6
Dbl Bedroom 8a	0	0.1	0.3	1	2	5
Dbl Bedroom 8c	0.3	0.5	1.3	1	2	6
Living/Kitchen 8	0	0.2	0.4	N/A	N/A	N/A
Dbl Bedroom 8b	0.1	0.2	0.8	1	2	6
Single Bedroom 9	0.5	0.7	1.5	1	2	6
Dbl Bedroom 9	0.9	1.1	2.1	2	3	8
Living/Kitchen 9	1	1.1	2.5	N/A	N/A	N/A
Duplex Kitchen 1	0	0.3	0.9	N/A	N/A	N/A
Duplex Living/Kitchen 2	0.6	0.7	1.5	N/A	N/A	N/A
Duplex Living/Kitchen 3	0.7	0.8	1.8	N/A	N/A	N/A
Duplex Kitchen 4	0	0.4	0.9	N/A	N/A	N/A
Dbl Bedroom 10b	0.2	0.4	1.1	2	2	6
Single Bedroom 10	0.1	0.2	0.9	1	2	6
Living/Kitchen 10	0.3	0.4	1.4	N/A	N/A	N/A
Dbl Bedroom 10a	0.1	0.2	0.7	1	2	5
Living/Kitchen 11	0	0.4	1.3	N/A	N/A	N/A
Dbl Bedroom 11	0	0.2	0.8	1	2	6
Living/Kitchen 12	0	0.2	0.6	N/A	N/A	N/A
Dbl Bedroom 12	0	0.2	0.6	1	2	6
Living/Kitchen 13	0	0	0.4	N/A	N/A	N/A
Dbl Bedroom 13	0	0	0.1	0	1	3
Living/Kitchen 14	0	0.2	0.6	N/A	N/A	N/A
Dbl Bedroom 14	0	0.2	0.7	1	2	6

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	< 3	< 3	< 3	< 33	< 33	< 33
Dbl Bedroom 15	0	0.1	0.6	0	1	4
Living/Kitchen 15	0	0	0	N/A	N/A	N/A
Living/Kitchen 16	0	0.2	0.6	N/A	N/A	N/A
Dbl Bedroom 16	0	0.2	0.6	1	2	6
Living/Kitchen 16	0	0	0.3	N/A	N/A	N/A
Dbl Bedroom 16	0	0.1	0.7	0	1	1
Living/Kitchen 17	0	0.2	0.5	N/A	N/A	N/A
Dbl Bedroom 17	0	0.2	0.9	1	2	3
Liivng/Kitchen 18	0	0	0.4	N/A	N/A	N/A
Dbl Bedroom 18	0	0	0	0	1	3
Living/Kitchen 19	0	0.1	0.3	N/A	N/A	N/A
Dbl Bedroom 19	0	0	0	0	1	6
Duplex Dbl Bedroom 2a	0	0	0.1	0	1	3
Duplex Dbl Bedroom 2b	0	0	0.2	2	2	6
Duplex Dbl Bedroom 3a	0	0	0.2	2	2	6
Duplex Dbl Bedroom 3b	0	0	0.1	0	1	3
Duplex Dbl Bedroom 6a	1	1.1	2.2	0	2	4
Duplex Dbl Bedroom 5b	0	0	0.2	2	2	7
Duplex Dbl Bedroom 5a	1	1.1	2.1	0	2	4
Duplex Dbl Bedroom 6b	0	0.1	0.4	1	2	5

Non-Domestic

The results of the assessment of the three criteria for the non-domestic elements of the detailed application are shown below (using DSY 1).

Reference	Criterion 1: % Hours exceeding comfort range	Criterion 2: Maximum daily degree hours	Criterion 3: Maximum ΔT	Result
Target	< 3	< 6	< 4	
Block A				
Commercial A	71.8	61	10	FAIL
Commercial E	7.9	22	4	FAIL
Commercial D	4.1	16	4	FAIL
Commercial B	9.6	24	5	FAIL
Commercial C	5.5	18	4	FAIL
Block D				
Residential Entrance	33.8	73	9	FAIL
Village Hall	38.4	80	10	FAIL
Community Hub 1	19.7	46	6	FAIL
Residential Entrance	44.8	115	13	FAIL
Community Hub	33.7	72	9	FAIL
Block KL				
Commercial GF f	11.8	32	6	FAIL
Commercial GF g	10.1	28	5	FAIL
Commercial GF i	10.7	30	6	FAIL
Commercial GF h	12.5	32	6	FAIL
Commercial L GF	5.2	24	5	FAIL
Commercial GF d	13.7	31	6	FAIL
Commercial GF e	9.3	27	6	FAIL
Commercial GF b	6.5	27	6	FAIL
Commercial GF a	8.4	27	7	FAIL
Residential Entrance a	3	18	5	FAIL
Commercial 1 a	100	109	14	FAIL
Commercial 1 b	100	114	15	FAIL
Commercial 1 c	100	112	15	FAIL
Commercial 1 d	97.3	82	11	FAIL

Reference	Criterion 1: % Hours exceeding comfort range	Criterion 2: Maximum daily degree hours	Criterion 3: Maximum ΔT	Result
Target	**< 3**	**< 6**	**< 4**	
Commercial 1 e	94.4	79	11	FAIL
Commercial 1 f	93.8	80	11	FAIL
Commercial L 1	99.3	117	15	FAIL
Commercial L 2	99.7	124	16	FAIL
Commercial L 3	9.9	31	6	FAIL
Commercial GF K	46.3	46	7	FAIL

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