January 2021

OSTERLEY PLACE

TESCO OSTERLEY, SYON LANE, TW7 5NZ

ENERGY STATEMENT

Consultant: Hodkinson Consultancy Ltd

St Edward
Designed for life

HODKINSON

Energy Statement

St Edward Homes Limited

Tesco Osterley

Final

Eleanor Risby
BSc (Hons), AMEI

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Executive Summary

The purpose of this Energy Statement is to outline the proposed energy strategy for the Outline planning application for the proposed development at Tesco Osterley, in the London Borough of Hounslow, by St Edward Homes Limited. The energy strategy has been formulated following the London Plan Energy Hierarchy: ***Be Lean***, ***Be Clean*** and ***Be Green***. This is an updated strategy in response to comments from the council on the strategy presented in a previous version in August 2020.

The Proposed Development includes up to 1,677 residential dwellings, and between 3,000m^2 and 5,000m^2 of flexible non-residential space.

In line with the GLA Energy Assessment Guidance (2020) the estimated CO_2 emissions for the development have been calculated using SAP 10 emission factors. All figures presented in the report are assuming the SAP 10 emission factors, with tables presenting CO_2 emissions with current SAP 2012 carbon emission factors presented in the appendix for comparison.

A range of advance ***Be Lean*** energy efficiency measures are proposed. They allow the development to achieve a site wide **12%** reduction in Regulated CO_2 emissions. This is split as an **12%** reduction in Regulated carbon emissions for residential areas and **18%** reduction for non-residential areas, which exceeds draft London Plan requirements. This significantly exceeds minimum Part L 2013 requirements and shows a high level of fabric energy efficiency performance.

In line with the London Plan, the feasibility of decentralised energy production has been considered at the ***Be Clean*** stage. It is proposed that a site wide heat network is installed, sourced by high temperature air source heat pumps. All residential units will be connected to the heat network, with connection points provided to all non-residential units. This delivers a further site wide CO_2 reduction of **45%**.

A range of ***Be Green*** renewable energy generating technologies has been considered. Available roof space will be utilised to provide approximately 222 kWp of solar PV.

In line with the GLA guidance, the development will commit to offset the remaining domestic CO_2 emissions through a payment to the London Borough of Hounslow. The remaining CO_2 emissions to be offset are estimated as **598 Tonnes CO_2 per annum,** resulting in the estimated payment of **£1,076,400.**

Table *iii*, below, summarises the anticipated site wide CO_2 emissions for the Proposed Development. The combination of ***Be Lean, Be Clean*** and ***Be Green*** measures as outlined above results in an overall **59%** reduction over the Part L 2013 baseline.

It is expected that the CO_2 emissions from the development will continue to reduce in the future with the ongoing decarbonisation of the electricity Grid. In reality, the CO_2 emissions will already be lower than presented in this report, as SAP 10 carbon emission factors have been used, not the more up to date “SAP 10.1” emission factors.

Table *i*: Residential Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	**Carbon Dioxide Emissions (Tonnes CO_2 per Annum)**	
	Regulated	**Unregulated**
Baseline: Part L 2013 Compliant Development	1,497	-
After *Be Lean* Measures	1,319	1,059
After *Be Clean* Measures	638	1,059
After *Be Green* Measures	598	1,059
Stage	**Regulated Carbon Dioxide Savings**	
	Tonnes CO_2 per Annum	**Percentage**
Savings from *Be Lean* Measures	178	12%
Savings from *Be Clean* Measures	682	46%
Savings from *Be Green* Measures	40	3%
Cumulative On-Site Savings	**899**	**60%**

Table *ii*: Non- Residential Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	**Carbon Dioxide Emissions (Tonnes CO_2 per Annum)**	
	Regulated	**Unregulated**
Baseline: Part L 2013 Compliant Development	94	39
After *Be Lean* Measures	78	39
After *Be Clean* Measures	41	39
After *Be Green* Measures	41	39
Stage	**Regulated Carbon Dioxide Savings**	
	Tonnes CO_2 per Annum	**Percentage**
Savings from *Be Lean* Measures	17	18%
Savings from *Be Clean* Measures	37	39%
Savings from *Be Green* Measures	0	0%
Cumulative On-Site Savings	**54**	**57%**

Table *iii*: Site Wide Carbon Dioxide Emissions and Cumulative Savings			
Stage	**Regulated Carbon Dioxide Emissions (Tonnes CO_2 per Annum)**	**Regulated Carbon Dioxide Savings**	
		Tonnes CO_2 per Annum	**Percentage**
Baseline: Part L 2013 Compliant Development	1,592	-	-
After ***Be Lean*** Measures	1,397	195	12%
After ***Be Clean*** Measures	679	718	45%
After ***Be Green*** Measures	639	40	2%
Cumulative On-Site Savings		**953**	**59%**

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1. INTRODUCTION

1.1 This document has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development. This statement sets out the energy strategy on behalf of St Edward Homes Limited in respect to the Outline planning application for the residential-led mixed-use redevelopment at Tesco Osterley, in the London Borough of Hounslow.

1.2 This document presents an updated heating strategy in response to comments from the council on the previous version submitted in August 2020.

1.3 The energy strategy for the site has been formulated with the following key objectives in mind:

> To be low carbon from the outset;

> To adapt to climate change;

> To take account of specific site characteristics that link to the energy strategy, for instance acoustics and air quality;

> Provision of a resilient supply of low cost heat to residents;

> Address energy planning policy.

1.4 In line with the GLA's Energy Assessment Guidance (2020), SAP 10 carbon emission factors should be used to estimate carbon emissions from the development. Calculations have also been tested against current Part L 2013 methodology, to ensure current Building Regulations compliance.

1.5 This document provides an overarching strategy for the Outline application. This sets out intentions of how the commitments set out in the Development Specifications could be met. Detailed energy strategies will accompany the submission of future reserved matters applications for each phase, which will set out how the detailed design accords with this overarching strategy.

1.6 The energy performance commitments from the development specification are as follows:

> ***Be Lean*** – minimum 10% reduction over Part L 2013 for residential areas, and 15% reduction from non-residential areas from energy efficiency measures alone;

> ***Be Clean*** – use low emissions air source heat pumps with gas back-up boilers to provide space heating and hot water;

> ***Be Green*** – consideration of the feasibility of on-site renewable technology;

> A minimum on-site 35% reduction over Part L 2013, with any residual residential Regulated CO_2 emissions offset through a carbon offset payment to the local borough, to achieve the standard of ***Zero Carbon.***

2. DEVELOPMENT OVERVIEW

Site Location

2.1 The proposed development site at Tesco, Osterley in the London Borough of Hounslow is located at Syon Lane, Isleworth, as shown in Figure 1, below.

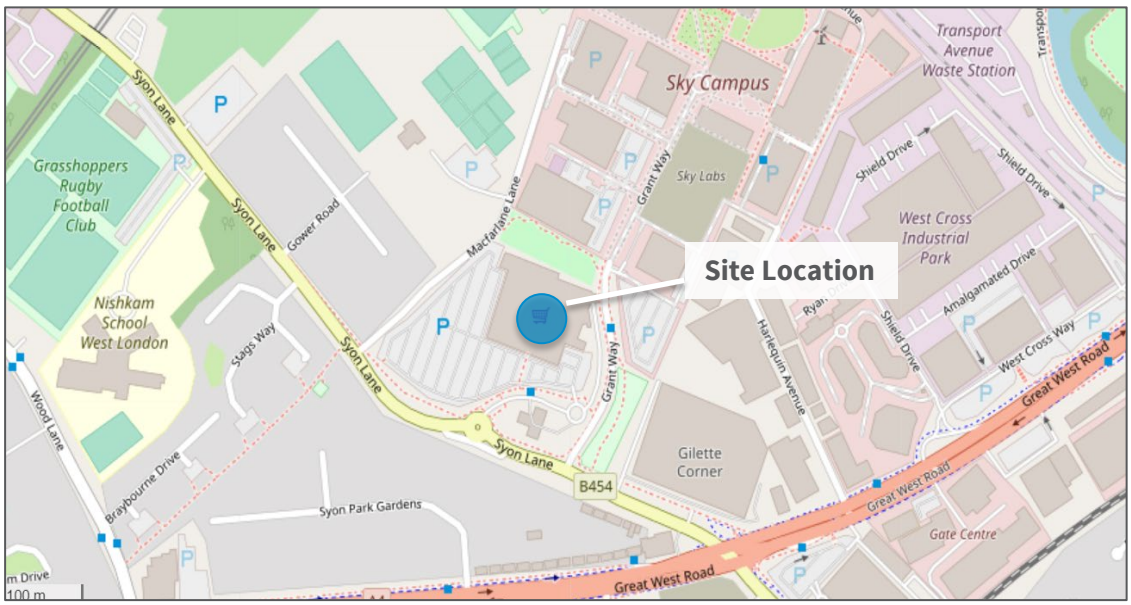

Figure 1: Site Location – OpenStreetMap © 2020

2.2 The 5.45ha site encompasses the existing two storey Tesco Extra store at Osterley Park, Syon Lane. It comprises a total of circa 11,582 m2 GIA if retail floorspace, associated car parking (625 spaces), a petrol filling station and a rectangular shaped open space, located to the north of the site, known as "Water Gardens".

Proposed Development

2.3 The proposed development description is as follows:

"Outline planning application with all matters reserved except access for the demolition of existing building and car park and erection of buildings to provide residential homes, plus flexible non-residential space comprising commercial, business and service space, and/or learning and non-residential institution space, and/or local community space, and/or public house/drinking establishment, and/or a mobility hub, along with associated access, bus turning, car and cycle parking, and landscaping arrangements."

2.4 Figure 2 below illustrates the proposed site layout.

Figure 2: Predominant Ground Floor Uses (JTP, 29.06.2020)

3. RELEVANT PLANNING POLICY

3.1 The following planning policies and requirements will inform the energy strategy for the development.

National Planning Policy

3.2 The revised National Planning Policy Framework (NPPF) was published on the 19th June 2019 and sets out the Government's planning policies for England.

3.3 The NPPF provides a framework for achieving sustainable development, which has been summarised as "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*" (Resolution 42/187 of the United National General Assembly). At the heart of the framework is a **presumption in favour of sustainable development**.

3.4 The document states that the planning system has three overarching objectives which are interdependent and need to be pursued in mutually supportive ways:

a) **An economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

b) **A social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

c) **An environmental objective** – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Regional Policy

Adopted London Plan (2016)

3.5 The existing London Plan sets out an integrated economic, environmental, transport and social framework for the development of London. The following policies are considered relevant to the proposed development and this Statement:

3.6 **Policy 5.2 – Minimising Carbon Dioxide Emissions** requires that all residential and non-residential major development achieve a 35% improvement beyond Part L 2013.

Residential buildings are also required to achieve a standard of Zero Carbon. The remaining regulated carbon dioxide emissions, to 100%, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere. This is defined under the London Plan Housing SPG (2016).

3.7 **Policy 5.3 – Sustainable Design and Construction** states that Major development should meet the minimum standards outlined in the London Plan Supplementary Planning Guidance and this should be clearly demonstrated. The standards include the following sustainable design principles (summarised):

> Minimising CO_2 emissions;

> Avoiding internal overheating and contributing to the urban heat island effect;

> Minimising pollution (including noise, air and urban run-off).

3.8 **Policy 5.5 – Decentralised Energy Networks** states the Mayor will prioritise the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.

3.9 **Policy 5.6 - Decentralised Energy** requires that all developments should evaluate the feasibility of Combined Heat and Power (CHP) systems and examine the opportunities to extend the system beyond the site boundary to adjacent sites.

Intend to Publish London Plan

3.10 While not yet adopted, the draft London Plan now carries increasing weight as a material consideration. The Mayor has set out his Intend to Publish (ItP) version. The ItP version of the London Plan has been reviewed by the Secretary of State. Directions have been issued in respect of some policies but none that relate to the sustainability matters.

3.11 The policies, which are listed below, are considered relevant to the proposed development and this Statement, and should therefore be given substantial weight:

3.12 **Policy SI2 Minimising Greenhouse Gas Emissions**, states:

'Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1) Be lean: use less energy and mange demand during operation;

2) *Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly;*

3) *Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.*

4) *Be seen: monitor, verify and report on energy performance.*

A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures.'

3.13 **Policy SI3 Energy Infrastructure**, states:

'Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system. The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) *Connect to local existing or planned heat networks;*

b) *Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required);*

c) *Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network);*

d) *Use ultra-low NOx gas boilers.'*

3.14 **Policy SI4 Managing Heat Risk** seeks for energy strategies to demonstrate how they intend to reduce the risk of internal overheating, in line with the cooling hierarchy.

Local Policy: London Borough of Hounslow

Local Plan 2015 - 2030

3.15 The Hounslow Local Plan was adopted on 15th September 2015 by Hounslow Borough Council.

3.16 Hounslow Local Plan 2015 to 2030 volume one has the following requirements for Environmental Quality:

> Policy EQ1 – Energy & Carbon Reduction, requiring all developments to "meet the carbon emission reduction requirements set out in the London Plan".

> Policy EQ2 – Sustainable Design and Construction, stating that "all new development should meet the standards for sustainable design and construction set out in the London Plan, including any of the 'optional' Building Regulations requirements it adopts".

3.17 The London Borough of Hounslow is currently working on the Great West Corridor Local Plan Review, which sets out the Council's vision and opportunities for good growth over the next 15 years.

Policy Target Summary

3.18 The policy targets can be summarised as:

> Residential units to achieve a 10% reduction in carbon emissions from energy efficiency, with 15% for non-residential;

> Maximising on-site carbon savings, with a minimum 35% reduction over Part L 2013;

> A carbon offset payment for residual carbon for the Residential part of the development.

4. METHODOLOGY & CARBON EMISSIONS BASELINE

Methodology

4.1 In line with the GLA's Energy Assessment Guidance (2018) the CO_2 emission performance against London Plan policies will be assessed using "SAP 10" carbon emission factors. This is to better estimate actual carbon emissions from the proposed development compared to Part L 2013 emission factors. Therefore, SAP 10.0 carbon emissions are used to estimate CO_2 emissions in this report.

Residential

4.2 The estimated energy demand for the residential portion of the development has been calculated using Standard Assessment Procedure (SAP 2012) methodology. SAP calculates the Regulated energy demand for residential dwellings.

4.3 SAP calculations have been carried out for ten representative dwelling types, which encompass ground, mid and top floor flats. This represents a fair aggregation of the expected unit mix of the development.

4.4 In order to calculate the energy demands across the entire scheme, the current accommodation schedule has been used to extrapolate the results from the modelled units. As this is an outline application, changes may be made at each detailed phase of the development.

4.5 The Unregulated energy demands for the residential development has been calculated using the methodology outlined in the SAP 2012 document (version 9.92 – October 2013). This calculates the CO_2 emissions associated with appliances and cooking.

4.6 In line with GLA guidance, the GLA's Carbon Emissions Reporting spreadsheet (v1.1 2018) has been used to convert the predicted energy performance of the development using SAP 10.0 carbon emission factors.

Non-Residential

4.7 The estimated annual energy demand for the non-residential elements of the development has been calculated using Simplified Building Energy Model (SBEM) software, using the National Calculation Method (NCM 2013 Edition). SBEM calculates the Regulated energy demands associated with hot water, space heating and fixed electrical items, as well as Unregulated energy demands.

4.8 Sample SBEM calculations have been carried out on example units of the expected use types for the Proposed Development. As it is an outline scheme, full details of these areas are not yet known. Results from the example calculations have been extrapolated in order to gain energy demand estimates for the outline scheme.

Baseline Carbon Emissions

4.9 Table 1, below, shows the baseline Regulated and Unregulated CO_2 emissions for the development, based on SAP 10 carbon emission factors. TER and BRUKL worksheets supporting these calculations are shown in Appendices B and C respectively.

Table 1: Carbon Dioxide Emissions Baseline (SAP 10 Carbon Emission Factors)

	Regulated [kg CO_2/year]	Unregulated [kg CO_2/year]	Total [kg CO_2/year]
Residential	1,497	1,059	2,556
Non-Residential	94	39	133
Total	1,592	1,098	2,690

4.10 In addition to the TER, the residential areas are also required to meet the Target Fabric Energy Efficiency (TFEE) requirement. A floor weighted average TFEE of **42.27 kWh/m²/year** has been calculated for the development.

5. BE LEAN: DEMAND REDUCTION

5.1 The first stage of the London Plan Energy Hierarchy is demand reduction from fabric energy efficiency measures. The fabric energy strategy will go above and beyond Part L 2013 CO_2 emission reduction requirements, and achieve the new London Plan target of a 10% CO_2 reduction for residential areas, and 15% CO_2 reduction in non-residential areas at the ***Be Lean*** stage of the Energy Hierarchy. Achieving these standards shows a very high level of fabric energy efficiency performance.

5.2 Within the Future Homes Standard, it is suggested that the fabric energy efficiency (FEE) metric will be omitted. This will enable the CO_2 and Primary Energy targets to be achieved in a non-prescriptive way. A specification for a notion dwelling will be provided within the updated version of Part L, but this is not prescriptive and other combinations of measures can be used to achieve compliance. The proposed energy strategy for this development is considered the most appropriate combination of measures to achieve policy requirements.

5.3 The fabric energy efficiency strategy should be reviewed at each detailed stage of the development, to ensure the most recent policy targets are being achieved.

Residential

Building Fabric

5.4 The following fabric energy efficiency targets have been assumed to estimate the energy performance for the proposed development. It is an example of a strategy that will achieve draft London Plan targets and significantly exceeds minimum Part L 2013 fabric energy efficiency requirements.:

> External wall U-values of 0.18 W/m^{2}K;

> Corridor wall U-values of 0.18 W/m^{2}K (total required wall thickness of 300mm or above);

> Party walls to be fully filled and sealed to achieve 0.00 W/m^{2}K;

> Flat roof with a U-value of 0.10 W/m^{2}K;

> Exposed floors with a U-value of 0.10 W/m^{2}K;

> Double glazing with a U-value of 1.40 W/m^{2}K, and a g-value of 0.40 (to be confirmed in overheating assessments).

Air Tightness and Ventilation

5.5 All dwellings will be fitted with an efficient **Mechanical Ventilation with Heat Recovery (MVHR)** system. This system provides a whole dwelling ventilation system that supplies and extracts air, reusing heat that would have been lost, as illustrated in Figure 3. The dwelling MVHR unit should target a specific fan power (SFP) of 0.42-0.44 W/l/s and have an efficiency of 91%.

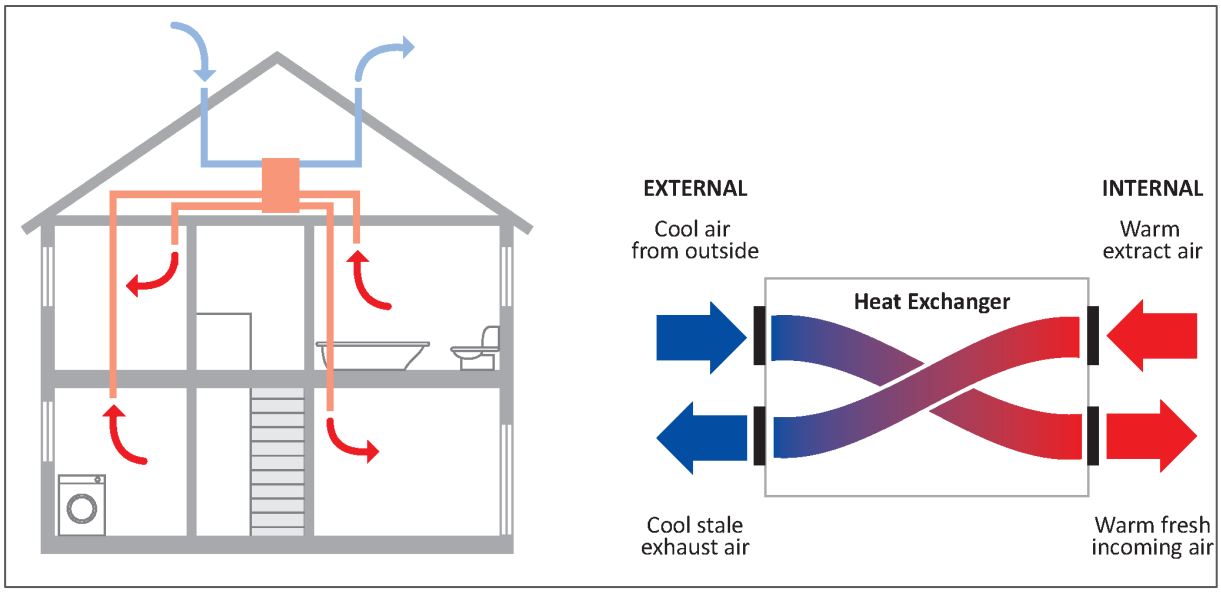

Figure 3: Mechanical Ventilation with Heat Recovery

5.6 All dwellings will be air tested on completion, and have a target design air permeability rate of **3m³/hr.m².**

5.7 Additionally, subject to overheating requirements, all dwellings should have openable windows and be able to naturally ventilate if required. This will facilitate convective ventilation and night purging of heat.

Thermal Bridging

5.8 In well insulated buildings, as much as 30% of heat loss can occur through thermal bridges, which arise when elements are disrupted by changes in construction or penetration through the insulation layer, as shown in Figure 4.

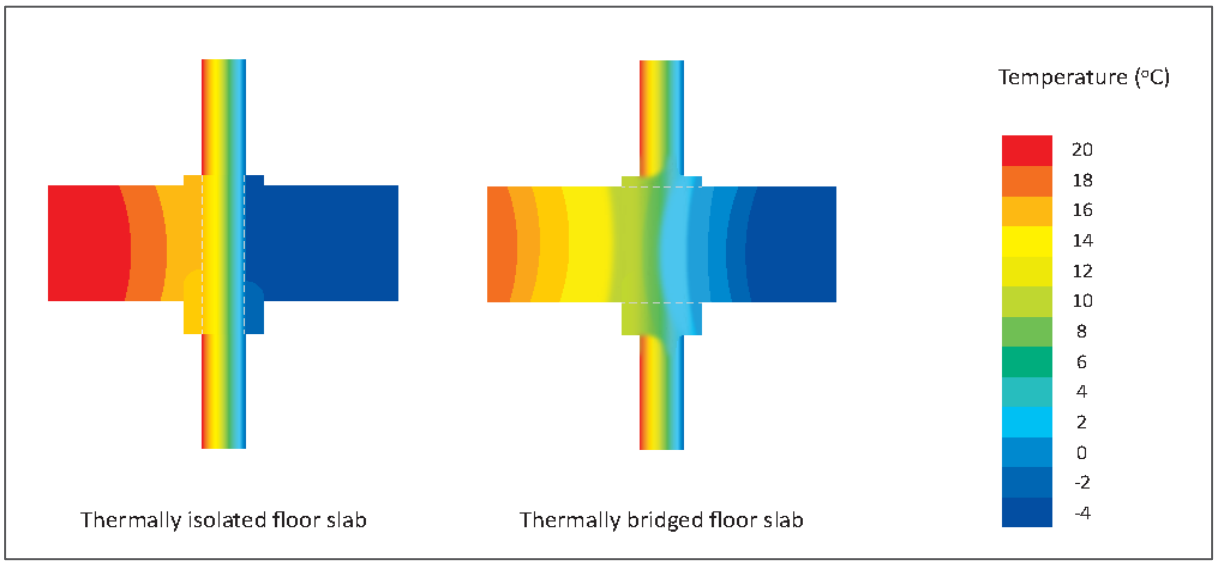

Figure 4: Thermal Bridges

5.9 Part L1A places increased importance on addressing heat losses through thermal bridging. As such, the Applicant is committed to develop a building fabric where these are minimised as far as practical. Bespoke calculations to improve on default psi values should be targeted. Indicative psi values that may be required for each junction are presented in Table 2, but this should be reviewed at the detailed stage of each phase of the development.

Table 2: Indicative Thermal Bridging Psi Value Targets

SAP Ref.	Junction	Default value	Target value
E1	Lintels	1	0.2
E3	Sill	0.08	0.04
E4	Jamb	0.1	0.05
E20	Exposed floor to external wall	0.32	0.32
E7	Intermediate Floor	0.14	0.10
E23	Balconies	1	0.20
E15	Flat roof with parapet	0.56	0.40
E16	External corner	0.18	0.09
E17	Inverted corner	0.00	-0.09
E18	Party corner	0.12	0.06
P7	Party exposed floor	0.16	0.10
P4	Party roof	0.24	0.15

Space Heating and Hot Water

5.10 At the ***Be Lean*** stage, it is assumed the heating and hot water is supplied by a communal gas boiler system, with an efficiency of 89.5%.

5.11 The hot water will be supplied by a Heat Interface Unit (HIU) installed within each dwelling. No temperature top-up is required at the HIU – the heat network will supply sufficient temperature for space heating and hot water.

5.12 The HIU unit should be from a supplier whose product has been tested by an independent third-party, such as BESA (Building Engineering Service Association) to enable performance to be evaluated.

5.13 Heat loss from the HIUs should be minimised by fully insulating the unit, valves and pipework from the HIU to connection point.

Lighting

5.14 Energy efficient lighting will be installed in 100% of residential dwellings. External lighting will also be low energy, controlled through PIR sensors, daylight cut-off devices, or time switches where possible.

Unregulated Energy Demands

5.15 Unregulated energy demands can be energy needed for cooking and powering appliances within the home. The energy associated with these uses are dependent on the occupant of the home and can vary substantially, however, the Applicant is committed to ensuring that all efforts are made to enable the residents to minimise their Unregulated energy consumption.

Mitigation Against Summer Overheating

5.16 A separate Summer Overheating Mitigation Report has been prepared for the Proposed Development as part of this application and is shown in Appendix D. This has been based on standard apartment types and gives mitigation measures to achieve the requirements of CIBSE TM59 Design Methodology for the assessment of overheating risk in homes (2017). These measures should be applied to ensure compliance once design layouts are finalised.

5.17 Reducing the amount of summertime overheating risk will be done through the specification of non-mechanical measures such as good thermal insulation and air tightness. Suitable mechanical ventilation air change rates and openable windows to non-noise sensitive dwellings will reduce overheating risk further. No active cooling measures are proposed for the residential dwellings.

Non-Residential

5.18 As this is an Outline application, the full details of the non-residential units are not yet available. Additionally, some of these units will be shell and core only, so the fit-out specification would not be known until there is a tenant. However, an indicative specification is provided to estimate CO_2 emissions from the Proposed Development. This should be reviewed at the detailed design stage of each unit.

Building Fabric

5.19 An example fabric energy efficiency strategy for the non-residential units is as follows:

> External wall U-value of 0.23 W/m^{2}K;

> Ground floor U-value of 0.10 W/m^{2}K;

> Roof U-value of 0.11 W/m^{2}K;

> Glazing U-value of 1.4 W/m^{2}K, with a g-value of 0.30.

Ventilation

5.20 It is assumed that the non-residential units are supplied with a Mechanical Ventilation with Heat Recovery system (MVHR), with summer bypass and demand control ventilation. The specification of this system will be the responsibility of the tenant fitting out the units, but the target performance is as follows:

> Specific fan power (SFP) of 1.5 W/l/s;

> >85% heat recovery.

5.21 Extract fans are proposed to any WCs and shower rooms, with an SFP of 0.5 W/l/s.

5.22 A suggested target air permeability rate for these units is 5m^3/h.m^2.

Lighting

5.23 The non-residential units should utilise LED lighting, with a target lamp efficacy of 120 lm/W and light output ratio of 1. PIR sensors and photoelectric controls are proposed where appropriate, these help improve energy efficiency, as the lighting will only be utilised when it is required.s

Metering and Controls

5.24 Sub-metering should be applied to all lighting, heating and cooling outputs.

Heating and Hot Water

5.25 At the ***Be Lean*** stage, it is assumed that heating and hot water is supplied by a communal gas boiler, with an efficiency of 91%.

Cooling

5.26 It is assumed that the cooling demands of the non-residential units are met by an Air Source Heat Pump. The assumed efficiency of this system is a SEER of 6.50 and EER of 4.20.

5.27 The cooling demands of the non-residential areas are shown in Table 3, below.

Table 3: Cooling Demands for Non-Domestic Areas

Scheme Component	Area weighted average non-domestic cooling demand (MJ/m^2)
Actual	157.6
Notional	188.9

CO_2 Emissions at Be Lean Stage

5.28 Table 4, below, shows the site wide estimated Regulated CO_2 emissions following the ***Be Lean*** measures outlined above. As shown, these measures result in a CO_2 emissions reduction of **12%** over the Part L 2013 baseline for residential development, and **18%** for non-residential development. This exceeds draft London Plan requirements and is a significant improvement on minimum Part L 2013 fabric energy efficiency performance.

5.29 These figures are calculated using SAP 10 carbon emission factors. A comparison to current SAP 2012 can be found in Appendix A. DER and BRUKL worksheets to support these calculations are shown in Appendices B and C respectively.

Table 4: Regulated Carbon Dioxide Emissions at *Be Lean* Stage

Stage	Carbon Dioxide Emissions (Tonnes CO_2 per Annum)		
	Residential	Non-residential	Cumulative
Baseline: Part L 2013 Compliant Development	1,497	94	1,591
After *Be Lean* Measures	1,319	78	1,397
Total Emissions Reduction	**178**	**17**	**195**
Percentage Reduction	**12%**	**18%**	**12%**

5.30 Table 5, below, shows the total energy demand (MWh/year) for each building use of the Proposed Development. This is the delivered energy requirement at point of use.

Table 5: Energy demand following energy efficiency measures (MWh/year)

Building Use	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity	Unregulated gas
Residential Total	2,438	3,168	477	220	25	4,546	0
Non-residential Total	18	229	48	36	30	166	0

5.31 The floor weighted average Dwelling Fabric Energy Efficiency (DFEE) has been calculated as **39.6 kWh/m²/year**. This represents a **6%** improvement over the calculated TFEE, this is shown in Table 6.

Table 6: Fabric Energy Efficiency

	Target Fabric Energy Efficiency (kWh/m²/year)	Design Fabric Energy Efficiency (kWh/m²/year)	Improvement (%)
Development Total	42.27	39.6	6%

Whole Life Cycle Assessment

5.32 A Whole Life Cycle Carbon Emissions Review has been undertaken to give early recommendations of how to minimise embodied carbon in the construction of the development. This includes encouraged reuse and recycling of materials, consideration of the building materials used for the development, as well as built form. The report can be found in Appendix E.

6. BE CLEAN: HEATING INFRASTRUCTURE

6.1 In line with the draft London Plan Policy SI3 Energy Infrastructure, the heat source for the onsite communal heat network has been considered in line with the following hierarchy from the Intend to Publish London Plan;

> Connect to local or planned heat networks;

> Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required);

> Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network);

> Use ultra-low NOx boilers.

Connection to Local Existing or Planned Heat Networks

6.2 The potential to connect the Proposed Development to an existing planned heat network has been evaluated by using the London Heat Map for the area. An extract of this is presented in Figure 5, and shows that the nearest proposed heat network is a considerable distance away. This is approximately 2.5km away from the Proposed Development and is not considered appropriate or cost efficient to connect to the existing network at this time.

6.3 Consideration has also been given to potential heat sources that are not shown on the London Heat Map. The nearby Sky Campus is the only potential site identified. This site has been contacted with regards to the supply of heat with no response from their side, evidence of correspondence is shown in Appendix F. As of December 2020, still no evidence has been provided, therefore it is assumed that they do not have a sufficient quantity of low carbon heat to export.

6.4 The interconnection of the Tesco Osterley site and the nearby Homebase Syon Lane site has been considered. However, at this stage it is not considered to be viable or offer any benefit for the following reasons:

> The distance between the two sites (which includes the Great West Road) and the consequent high cost of achieving the interconnection;

> Due to the technologies being considered, there is minimal benefit in terms of carbon reductions or costs to residents.

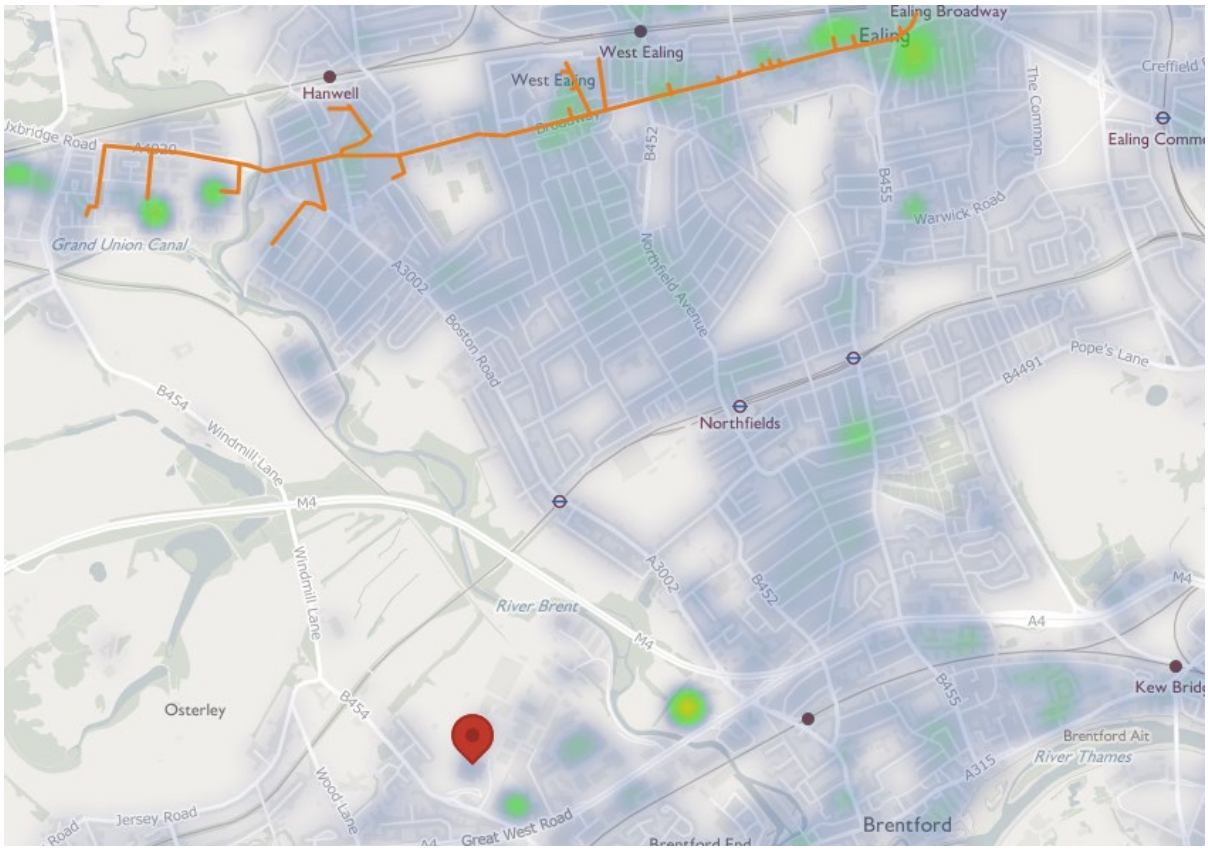

Figure 5: London Heat Map Extract (London Heat Map 2020)

Zero-Emission or Local Secondary Heat Sources (with Heat Pumps)

6.5 Consideration has been given to the available secondary heat sources. Ground Source Heat Pumps require extensive ground works which have a high capital cost, and is not considered appropriate for the Proposed Development. There are no known water source or waste heat sources in close proximity to the development.

6.6 Air Source Heat Pumps are considered to be feasible, and therefore, it is proposed that the heating and hot water for the development is provided by an air source heat pump led heat network.

6.7 The current proposed strategy is to utilise high temperature heat pumps, which can supply 100% of the energy demand meaning electricity is used as the fuel source. In a single stage these would increase the water temperature from 30°C to 60°C.

6.8 A minimum seasonal coefficient of performance (SCOP) of 3.0 can be expected from this type of heat pump. The final plant selection and design may have slightly better performance, but 3.0 has been assumed to ensure that the performance allowed for can realistically be achieved in construction.

6.9 It is expected that a distribution loss factor of 1.3 can be achieved. Heat losses are assumed to align with the CIBSE Heat Networks Code of Practice, which the heat network will adhere to in the design and construction of the network.

6.10 For resilience, the gas boilers are to be designed to the full peak capacity of the site.

6.11 It is proposed that the Energy Centre will be located in Block H. A plan showing the proposed location can be seen in Appendix G. The Energy Centre will contain the heat pump internal units, gas boilers, thermal stores and other ancillary plant.

6.12 Roof space will then be utilised for the heat pump units and will all feed back to the single Energy Centre. It is proposed that the heat pumps will be located on the roofs of Blocks G and H where the Energy Centre is located. Indicative heat pump locations can be seen in Appendix H.

6.13 The Energy Centre will be adaptable in the future for connection to an area-wide heat network should one become available that is appropriate to connect to. This would be achieved through replacement of some heat generating plant (i.e. boilers, heat pumps, thermal stores) with interposing heat exchangers. The potential for future connection has been incorporated into the design. However, full measures to facilitate this (such as heat exchangers) won't be installed until required, as there is a risk they will be incorrectly designed when full details of the potential heat network to connect to, including network temperatures, is not known.

6.14 All residential dwellings will be connected to the heat network, with all non-residential units given connection points. The calculations for this report are assuming that the non-residential units are connected to the network. An indicative heating schematic can be found in Appendix H.

Heat Network Operation

6.15 Heat networks within Berkeley Group schemes provide a fully managed service, either through ESCO contracts or contracts for operation, maintenance and customer services. These provide all necessary information to residents when they move in (a welcome pack). Furthermore, HIUs are generally serviced at regular intervals without call-out charge.

6.16 Standard monitoring of the Energy Centre and heat network will be undertaken during operation. As a minimum, meters will be provided for incoming utilities, bulk heat output of the Energy Centre and inputs/outputs from the heat pumps. This allows boiler and heat pump efficiencies to be calculated and monitored.

CO_2 Emissions at Be Clean Stage

6.17 Table 7, below, shows the expected Regulated CO_2 emissions following the inclusion of the proposed ***Be Clean*** measures. The CO_2 reduction has been estimated using SAP 10 carbon emission factors, a comparison to the performance with current SAP 2012 carbon emission factors can be found in Appendix A. DER and BRUKL worksheets supporting these calculations are presented in Appendices I and J respectively.

Table 7: Regulated Carbon Dioxide Emissions at *Be Clean* Stage

Stage	Carbon Dioxide Emissions (Tonnes CO_2 per Annum)		
	Residential	Non-residential	Cumulative
After *Be Lean* Measures	1,319	78	1,397
After *Be Clean* Measures	638	41	679
Total Emissions Reduction	**682**	**37**	**718**
Percentage Reduction	**46%**	**39%**	**45%**

7. BE GREEN: RENEWABLE ENERGY

7.1 The final part of the London Plan Energy Hierarchy is ***Be Green*** which seeks for renewable energy technologies to be specified to provide, where feasible, a reduction in expected CO_2 emissions.

7.2 The feasibility of a number of renewable energy technologies has been considered, as outlined in this section.

Biomass

7.3 Biomass boilers generate heat on a renewable basis as they are run on biomass fuel which is virtually carbon neutral.

7.4 Biomass boilers are best designed to provide the base heating demand of a development. This would conflict with the heat pump led network that is already proposed and has therefore been discounted. Biomass boilers also require additional fuel delivery and storage.

7.5 It has therefore been concluded that a biomass boiler is not the most suitable technology for the Proposed Development.

Wind Turbines

7.6 As an electricity generating technology, wind turbines would not conflict with heat network. However, the development is situated in an urban location. It has been shown that such locations often experience high turbulent and low speed wind conditions. This would mean the installation of wind turbines would not be a cost-effective method for the generation of renewable energy. Wind turbines are therefore not proposed.

Heat Pumps

7.7 Whilst reducing energy consumption, heat pumps replace gas as the heating fuel with electricity.

7.8 Ground Source Heat Pumps (GSHP) can provide reductions in energy. However, extensive groundworks are required and have considerable capital cost. GSHPs are therefore not proposed for the development.

7.9 As discussed previously, a high-temperature Air Source Heat Pump (AHSP) led head network is proposed to supply heating and hot water to the Proposed Development. The details of this have been included in the ***Be Clean*** stage of the Energy Hierarchy. As outlined in the ***Be Lean*** stage, individual air source heat pumps are also proposed to provide cooling to the non-residential units.

Photovoltaics (PV)

7.10 PV panels generate electricity from solar radiation. The generating potential of PV panels is dependent on the availability of roof space and ensuring that they are not over-shaded.

7.11 It is proposed to install solar PV on available roof space across the scheme, allowing for plant and access. The upper roofs of Blocks A, B, C,D and F are considered suitable for PV. Blocks G and H are being utilised for the heat pump plant, and there is risk of overshading on Block E and the lower roofs of all blocks. It is estimated that 222 kWp could be accommodated on these roofs, allowing for spacing between and around panels.

7.12 It is assumed that the panels will be tilted slightly by approximately 10° and orientated towards the south. It is assumed that 18m^2 is required per kWp, to ensure adequate spacing is allowed for between and around panels, and there is sufficient space available for access. It is assumed the panels would have an efficiency of 250W.

7.13 An indicative roof layout showing the proposed locations of PV panels is shown in Appendix K. This will be reviewed at the detailed design stage.

CO_2 Emissions at the Be Green Stage

7.14 Table 8, below, shows the expected Regulated CO_2 emissions following the inclusion of the proposed ***Be Clean*** measures, which results in a further 2% site-wide CO_2 reduction. The CO_2 reduction has been estimated using SAP 10 carbon emission factors.

Table 8: Regulated Carbon Dioxide Emissions at *Be Green* Stage

Stage	Carbon Dioxide Emissions (Tonnes CO_2 per Annum)		
	Residential	Non-residential	Cumulative
After *Be Clean* Measures	638	41	679
After *Be Green* Measures	598	41	639
Total Emissions Reduction	**40**	**0**	**40**
Percentage Reduction	**3%**	**0%**	**2%**

Further Decarbonisation

7.15 In addition to maximisation of heat pump use on the heat network, the feasibility of incorporating other renewable technologies (solar PV) has also been reviewed. This updated strategy is expected to achieve a site wide 59% CO_2 reduction, which significantly exceeds the minimum onsite CO_2 reduction target of 35% as required in London Plan policy, and is future-proofed to enable further carbon reductions in the future.

7.16 CO_2 emissions for the development will naturally continue to reduce over time with the ongoing decarbonisation of the grid, and is estimated would be approximately a 90% reduction in CO_2 emissions over a Part L 2013 baseline by 2030.

7.17 It is expected that CO_2 emissions reduction will already be greater in reality than is presented in this report, as the BRE have issued more up to date "SAP 10.1" carbon emission factors, that supersede the SAP 10 emission factors that have been used as requested by the GLA.

8. BE SEEN: ENERGY MONITORING

8.1 The Intend to Publish London Plan introduces a fourth stage to the energy hierarchy; the ***Be Seen*** stage, which requires monitoring and reporting of the actual operational energy performance of major developments for at least five years.

8.2 An effectively implemented post-construction monitoring regime can have a number of benefits including environmental (e.g. reduced grid infrastructure strain, carbon emissions reduction) and socio-economic (e.g. reduced occupants bills, and raised awareness around energy use).

8.3 The ***Be Seen*** stage aims to monitor that the actual energy and carbon performance of buildings is aligned with the estimate figures. This will be a key factor is achieving a zero-carbon London.

8.4 The full details of this stage of the policy are not yet finalised. However, standard monitoring of the Energy Centre and heat network will be undertaken during operation. It is expected that the following will be metered:

> Gas, electricity, and water used in the Energy Centre;

> Heat leaving the Energy Centre;

> Heat entering each block;

> Final customer heat consumption.

8.5 The metering and controls strategy will be further developed during the detailed design process.

9. ZERO CARBON HOMES

9.1 London Plan policy requires that all major residential developments are subject to an additional offset payment to meet a 100% reduction in Regulated CO_2 emissions to achieve the standard of *Zero Carbon*. This payment is made to the local borough's Carbon Offsetting Fund and is expected to be allocated to carbon reduction savings elsewhere in the borough.

9.2 There is currently no adopted policy requirement for non-residential development to meet the *Zero Carbon* target.

9.3 It is acknowledged that within the Intend to Publish (ItP) London Plan a new carbon offset price of £95 per tonne/CO_2 is proposed. It is also suggested that the zero-carbon target is extended to non-residential units. However, the GLA's Carbon Offset Funds guidance (October 201) suggests this will not apply until the ItP London Plan is formally adopted.

9.4 The current adopted GLA carbon offsetting policy sets the offset payment price for residential development at £60 per tonne of Regulated CO_2 per year, for a period of 30 years.

9.5 The estimated remaining residential Regulated CO_2 emissions after the ***Be Lean***, ***Be Clean*** and ***Be Green*** stages of the Energy Hierarchy are calculated to be **598 tonnes CO_2 per annum**. Therefore, the estimated payment due to the London Borough of Hounslow is **£1,076,400**.

9.6 These calculations should be refined at each detailed stage of the development. They should be updated based on the accurate heat network efficiencies and based on current Building Regulations and carbon factors at the time of application.

10.SUMMARY

10.1 The purpose of this Energy Statement is to outline the proposed energy strategy for the Outline planning application for the proposed development at Tesco Osterley, in the London Borough of Hounslow, by St Edward Homes Limited. The energy strategy has been formulated following the London Plan Energy Hierarchy: ***Be Lean***, ***Be Clean*** and ***Be Green***. This is an updated strategy in response to comments from the council on the strategy presented in a previous version in August 2020.

10.2 The Proposed Development includes up to 1,677 residential dwellings, and between 3,000m^2 and 5,000m^2 of flexible non-residential space.

10.3 In line with the GLA Energy Assessment Guidance (2020) the estimated CO_2 emissions for the development have been calculated using SAP 10 emission factors. All figures presented in the report are assuming the SAP 10 emission factors, with tables presenting CO_2 emissions with current SAP 2012 carbon emission factors presented in the appendix for comparison.

10.4 A range of advance ***Be Lean*** energy efficiency measures are proposed. They allow the development to achieve a site wide **12%** reduction in Regulated CO_2 emissions. This is split as an **12%** reduction in Regulated carbon emissions for residential areas and **18%** reduction for non-residential areas, which exceeds draft London Plan requirements. This significantly exceeds minimum Part L 2013 requirements and shows a high level of fabric energy efficiency performance.

10.5 In line with the London Plan, the feasibility of decentralised energy production has been considered at the ***Be Clean*** stage. It is proposed that a site wide heat network is installed, sourced by high temperature air source heat pumps. All residential units will be connected to the heat network, with connection points provided to all non-residential units. This delivers a further site wide CO_2 reduction of **45%**.

10.6 A range of ***Be Green*** renewable energy generating technologies has been considered. Available roof space will be utilised to provide approximately 222 kWp of solar PV.

10.7 In line with the GLA guidance, the development will commit to offset the remaining domestic CO_2 emissions through a payment to the London Borough of Hounslow. The remaining CO_2 emissions are estimated as **598 Tonnes CO_2 per annum,** resulting in the estimated payment of **£1,076,400.**

10.8 Table 11, below, summarises the anticipated site wide CO_2 emissions for the Proposed Development. The combination of ***Be Lean***, ***Be Clean*** and ***Be Green*** measures as outlined above results in an overall **59%** reduction over the Part L 2013 baseline. It is expected that the CO_2 emissions from the development will continue to reduce in the future with the ongoing decarbonisation of the electricity Grid. In reality, the CO_2 emissions will already be lower than presented in this report, as SAP 10 carbon emission factors have been used, not the more up to date “SAP 10.1” emission factors.

Table 9: Residential Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	**Carbon Dioxide Emissions (Tonnes CO_2 per Annum)**	
	Regulated	**Unregulated**
Baseline: Part L 2013 Compliant Development	1,497	-
After *Be Lean* Measures	1,319	1,059
After *Be Clean* Measures	638	1,059
After *Be Green* Measures	598	1,059
Stage	**Regulated Carbon Dioxide Savings**	
	Tonnes CO_2 per Annum	**Percentage**
Savings from *Be Lean* Measures	178	12%
Savings from *Be Clean* Measures	682	46%
Savings from *Be Green* Measures	40	3%
Cumulative On-Site Savings	**899**	**60%**

Table 10: Non- Residential Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	**Carbon Dioxide Emissions (Tonnes CO_2 per Annum)**	
	Regulated	**Unregulated**
Baseline: Part L 2013 Compliant Development	94	39
After *Be Lean* Measures	78	39
After *Be Clean* Measures	41	39
After *Be Green* Measures	41	39
Stage	**Regulated Carbon Dioxide Savings**	
	Tonnes CO_2 per Annum	**Percentage**
Savings from *Be Lean* Measures	17	18%
Savings from *Be Clean* Measures	37	39%
Savings from *Be Green* Measures	0	0%
Cumulative On-Site Savings	**54**	**57%**

Table 11: Site Wide Carbon Dioxide Emissions and Cumulative Savings			
Stage	**Regulated Carbon Dioxide Emissions (Tonnes CO_2 per Annum)**	**Regulated Carbon Dioxide Savings**	
		Tonnes CO_2 per Annum	**Percentage**
Baseline: Part L 2013 Compliant Development	1,592	-	-
After ***Be Lean*** Measures	1,397	195	12%
After ***Be Clean*** Measures	679	718	45%
After ***Be Green*** Measures	639	40	2%
Cumulative On-Site Savings		**953**	**59%**

APPENDICES

Appendix A: CO_2 Emissions – SAP 2012 and SAP 10 Emission factors

Appendix B: SAP TER/DER Worksheets – *Be Lean*

Appendix C: SBEM BRUKL Worksheets – *Be Lean*

Appendix D: Overheating Mitigation Report

Appendix E: Life Cycle Assessment

Appendix F: Correspondence with Sky Campus

Appendix G: Proposed Energy Centre Location (JTP Architects)

Appendix H: Indicative Heat Network Schematic and Heat Pump Locations (Buro Happold)

Appendix I: SAP TER/DER Worksheets – *Be Clean*

Appendix J: SBEM BRUKL Worksheets – *Be Clean*

Appendix K: Indicative PV Locations

Appendix A

CO_2 Emissions – SAP 2012 and SAP 10 Emission Factors

SAP 2012 PERFORMANCE

DOMESTIC

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	1,705	2,023
After energy demand reduction	1,549	2,023
After heat network / CHP	1,421	2,023
After renewable energy	1,332	2,023

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	156	9%
Savings from heat network / CHP	128	8%
Savings from renewable energy	88	5%
Cumulative on site savings	**373**	**22%**
Annual savings from off-set payment	1,332	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**39,972**	-
Cash in-lieu contribution (£)	**2,398,317**	

NON-DOMESTIC

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	146	86
After energy demand reduction	111	86
After heat network / CHP	91	86
After renewable energy	91	86

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	35	24%
Savings from heat network / CHP	20	14%
Savings from renewable energy	0	0%
Total Cumulative Savings	**55**	**38%**

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO_2)	Cumulative Shortfall (Tonnes CO_2)
Total Target Savings	**51**	-
Shortfall	-4	-123
Cash in-lieu contribution (£)	**-7,397**	-

SITE-WIDE

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	1,851		
Be lean	1,660	191	10%
Be clean	1,512	148	8%
Be green	1,423	88	5%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**39,849**	-

SAP10 PERFORMANCE

DOMESTIC

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	1,497	1,059
After energy demand reduction	1,319	1,059
After heat network / CHP	638	1,059
After renewable energy	598	1,059

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	178	12%
Savings from heat network / CHP	682	46%
Savings from renewable energy	40	3%
Cumulative on site savings	**899**	**60%**
Annual savings from off-set payment	598	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**17,945**	-
Cash in-lieu contribution (£)	**1,076,701**	

NON-DOMESTIC

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	94	39
After energy demand reduction	78	39
After heat network / CHP	41	39
After renewable energy	41	39

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	17	18%
Savings from heat network / CHP	37	39%
Savings from renewable energy	0	0%
Total Cumulative Savings	**54**	**57%**

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO_2)	Cumulative Shortfall (Tonnes CO_2)
Total Target Savings	33	-
Shortfall	-21	-616
Cash in-lieu contribution (£)	**-36,942**	-

SITE-WIDE

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	1,592		
Be lean	1,397	195	12%
Be clean	679	718	45%
Be green	639	40	2%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**17,329**	-

Appendix B

SAP TER/DER Worksheets – *Be Lean*

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	001 BlcA2-1B2P-03281	Issued on Date	10/07/2020
Assessment Reference	1B2P Be Lean	Prop Type Ref	Exposed Floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	84 B	DER	16.54	TER	19.63
Environmental	90 B	% DER<TER	15.73		
CO_2 Emissions (t/year)	0.72	DFEE	42.82	TFEE	52.53
General Requirements Compliance	Pass	% DFEE<TFEE	18.48		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 56 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.63 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	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 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.42
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing North: 6.98 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Exposed floor U-value 0.10 W/m²K
Door U-value 0.82 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	55.6000 (1b)	x	2.5000 (2b)	=	139.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
Door			2.1200	0.8200	1.7384			(26)
Exposed			55.6000	0.1000	5.5600			(28b)
External Wall	17.5000	6.9800	10.5200	0.1800	1.8936			(29a)
Wall to Stairwell	17.5000	2.1200	15.3800	0.1671	2.5695			(29a)
Total net area of external elements Aum(A, m2)			90.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.0153			(33)
Party Wall 1			39.7500	0.0000	0.0000			(32)
Party Ceilings 1			55.6000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2246	(36)
Total fabric heat loss					(33) + (36) =		30.2399	(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	11.9936	11.8603	11.7270	11.0604	10.9271	10.2605	10.2605	10.1272	10.5272	10.9271	11.1937	11.4603	(38)
Heat transfer coeff	42.2335	42.1002	41.9669	41.3003	41.1670	40.5005	40.5005	40.3671	40.7671	41.1670	41.4336	41.7002	(39)

Average = Sum(39)m / 12 = 41.2670 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7596	0.7572	0.7548	0.7428	0.7404	0.7284	0.7284	0.7260	0.7332	0.7404	0.7452	0.7500	(40)

HLP (average) 0.7422 (40)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	1.8549	(42)
Average daily hot water use (litres/day)	78.2543	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.0797	82.9495	79.8194	76.6892	73.5590	70.4289	70.4289	73.5590	76.6892	79.8194	82.9495	86.0797	(44)
Energy conte	127.6537	111.6468	115.2095	100.4424	96.3769	83.1659	77.0654	88.4337	89.4899	104.2919	113.8427	123.6258	(45)

Energy content (annual) Total = Sum(45)m = 1231.2445 (45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	19.1481	16.7470	17.2814	15.0664	14.4565	12.4749	11.5598	13.2651	13.4235	15.6438	17.0764	18.5439	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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													
	157.6514	138.7415	145.2071	129.4724	126.3746	112.1959	107.0631	118.4314	118.5199	134.2895	142.8727	153.6235	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	157.6514	138.7415	145.2071	129.4724	126.3746	112.1959	107.0631	118.4314	118.5199	134.2895	142.8727	153.6235	(64)
								Total per year (kWh/year) = Sum(64)m =				1584.4432	(64)
Heat gains from water heating, kWh/month													
	66.4430	58.7983	62.3053	56.6211	56.0435	50.8767	49.6224	53.4024	52.9794	58.6752	61.0767	65.1037	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.8446	14.0730	11.4449	8.6645	6.4768	5.4680	5.9084	7.6800	10.3080	13.0884	15.2761	16.2849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	161.7305	163.4087	159.1796	150.1762	138.8111	128.1295	120.9935	119.3152	123.5444	132.5478	143.9129	154.5945	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	(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)													
	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	(71)
Water heating gains (Table 5)													
	89.3051	87.4975	83.7437	78.6404	75.3272	70.6621	66.6968	71.7774	73.5825	78.8645	84.8288	87.5050	(72)
Total internal gains													
	317.7039	315.8030	305.1920	288.3050	271.4389	255.0833	244.4224	249.5963	258.2587	275.3244	294.8415	309.2082	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9800	10.6334	0.4000	0.7000	0.7700	14.4019	(74)
Solar gains	14.4019	27.5227	46.7678	75.1210	101.1949	108.3322	101.1419	80.2432	56.2300	32.7622	17.7665	12.0061	(83)
Total gains	332.1058	343.3257	351.9597	363.4260	372.6339	363.4155	345.5644	329.8395	314.4887	308.0866	312.6081	321.2143	(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, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	91.4230	91.7125	92.0038	93.4887	93.7914	95.3350	95.3350	95.6498	94.7115	93.7914	93.1879	92.5921	
alpha	7.0949	7.1142	7.1336	7.2326	7.2528	7.3557	7.3557	7.3767	7.3141	7.2528	7.2125	7.1728	
util living area	0.9975	0.9961	0.9914	0.9706	0.8904	0.6951	0.5138	0.5594	0.8254	0.9724	0.9944	0.9980	(86)
MIT	20.3198	20.3890	20.5275	20.7318	20.9068	20.9880	20.9988	20.9978	20.9603	20.7653	20.5166	20.3077	(87)
Th 2	20.2885	20.2906	20.2927	20.3032	20.3053	20.3158	20.3158	20.3179	20.3116	20.3053	20.3011	20.2969	(88)
util rest of house	0.9967	0.9948	0.9885	0.9603	0.8555	0.6284	0.4350	0.4784	0.7667	0.9606	0.9923	0.9974	(89)
MIT 2	19.3716	19.4742	19.6771	19.9772	20.2104	20.3074	20.3153	20.3169	20.2792	20.0284	19.6687	19.3606	(90)
Living area fraction										fLA = Living area / (4) =		0.5737	(91)
MIT	19.9157	19.9991	20.1650	20.4102	20.6100	20.6979	20.7074	20.7076	20.6699	20.4512	20.1552	19.9040	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9157	19.9991	20.1650	20.4102	20.6100	20.6979	20.7074	20.7076	20.6699	20.4512	20.1552	19.9040	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9942	0.9879	0.9621	0.8718	0.6663	0.4802	0.5250	0.7987	0.9635	0.9918	0.9969	(94)
Useful gains	330.8324	341.3392	347.7021	349.6423	324.8536	242.1595	165.9537	173.1507	251.1759	296.8363	310.0514	320.2228	(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	659.5035	635.6727	573.4779	475.3742	366.7961	246.9670	166.3531	173.8852	267.8376	405.5445	540.9239	654.8598	(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	244.5313	197.7921	167.9771	90.5269	31.2052	0.0000	0.0000	0.0000	0.0000	80.8790	166.2282	248.9699	(98)
Space heating												1228.1098	(98)
Space heating per m2											(98) / (4) =	22.0883	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1228.1098	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	1289.5153	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1584.4432	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1663.6654	(310a)
Electricity used for heat distribution	29.5318	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	89.0295	(330a)
Total electricity for the above, kWh/year	89.0295	(331)
Electricity for lighting (calculated in Appendix L)	279.8198	(332)
Total delivered energy for all uses	3322.0299	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	3299.6432	0.2160	712.7229	(367)
Electrical energy for heat distribution	29.5318	0.5190	15.3270	(372)
Total CO2 associated with community systems			728.0499	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			728.0499	(376)
Pumps and fans	89.0295	0.5190	46.2063	(378)
Energy for lighting	279.8198	0.5190	145.2265	(379)
Total CO2, kg/year			919.4827	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5400	(384)

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

DER		16.5400	ZC1
Total Floor Area	TFA	55.6000	
Assumed number of occupants	N	1.8549	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.2371	ZC2
CO2 emissions from cooking, equation (L16)		2.9410	ZC3
Total CO2 emissions		36.7180	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.7180	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.6000 (1b)	x	2.5000 (2b)	=	139.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 55.6000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =							20.0000 / (5) =	0.1439	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.3939	(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) =	0.3053	(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													
	0.3892	0.3816	0.3739	0.3358	0.3282	0.2900	0.2900	0.2824	0.3053	0.3282	0.3434	0.3587	(22b)
Effective ac	0.5757	0.5728	0.5699	0.5564	0.5538	0.5420	0.5420	0.5399	0.5466	0.5538	0.5590	0.5643	(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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
Exposed			55.6000	0.1300	7.2280			(28b)
External Wall	17.5000	6.9800	10.5200	0.1800	1.8936			(29a)
Wall to Stairwell	17.5000	2.1200	15.3800	0.1800	2.7684			(29a)
Total net area of external elements Aum(A, m2)			90.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.2638			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6435	(36)
Total fabric heat loss						(33) + (36) =	32.9073	(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	26.4093	26.2743	26.1421	25.5210	25.4048	24.8638	24.8638	24.7636	25.0722	25.4048	25.6399	25.8856	(38)
Heat transfer coeff	59.3165	59.1816	59.0494	58.4283	58.3121	57.7711	57.7711	57.6709	57.9795	58.3121	58.5472	58.7929	(39)
Average = Sum(39)m / 12 =												58.4277	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0668	1.0644	1.0620	1.0509	1.0488	1.0390	1.0390	1.0372	1.0428	1.0488	1.0530	1.0574	(40)
HLP (average)												1.0509	(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	1.8549	(42)
Average daily hot water use (litres/day)	78.2543	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	86.0797	82.9495	79.8194	76.6892	73.5590	70.4289	70.4289	73.5590	76.6892	79.8194	82.9495	86.0797	(44)
Energy conte	127.6537	111.6468	115.2095	100.4424	96.3769	83.1659	77.0654	88.4337	89.4899	104.2919	113.8427	123.6258	(45)
Energy content (annual)										Total = Sum(45)m =		1231.2445	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.1481	16.7470	17.2814	15.0664	14.4565	12.4749	11.5598	13.2651	13.4235	15.6438	17.0764	18.5439	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	155.2714	136.5918	142.8271	127.1692	123.9945	109.8927	104.6831	116.0514	116.2167	131.9095	140.5695	151.2435	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	155.2714	136.5918	142.8271	127.1692	123.9945	109.8927	104.6831	116.0514	116.2167	131.9095	140.5695	151.2435	(64)
Total per year (kWh/year) = Sum(64)m =												1556.4204	(64)
Heat gains from water heating, kWh/month	64.5390	57.0785	60.4013	54.7785	54.1394	49.0341	47.7184	51.4984	51.1368	56.7712	59.2341	63.1997	(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	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8446	14.0730	11.4449	8.6645	6.4768	5.4680	5.9084	7.6800	10.3080	13.0884	15.2761	16.2849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.7305	163.4087	159.1796	150.1762	138.8111	128.1295	120.9935	119.3152	123.5444	132.5478	143.9129	154.5945	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	(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)	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	(71)
Water heating gains (Table 5)	86.7460	84.9383	81.1845	76.0813	72.7681	68.1029	64.1376	69.2182	71.0234	76.3053	82.2696	84.9459	(72)
Total internal gains	318.1448	316.2438	305.6328	288.7458	271.8798	255.5242	244.8633	250.0372	258.6995	275.7653	295.2824	309.6491	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9800	10.6334	0.6300	0.7000	0.7700	22.6829	(74)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	22.6829	43.3482	73.6592	118.3156	159.3820	170.6231	159.2985	126.3830	88.5623	51.6004	27.9823	18.9096	(83)
Total gains	340.8277	359.5920	379.2920	407.0614	431.2618	426.1473	404.1618	376.4202	347.2618	327.3657	323.2647	328.5587	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.0933	65.2417	65.3878	66.0829	66.2146	66.8347	66.8347	66.9508	66.5945	66.2146	65.9487	65.6731	
alpha	5.3396	5.3494	5.3592	5.4055	5.4143	5.4556	5.4556	5.4634	5.4396	5.4143	5.3966	5.3782	
util living area	0.9978	0.9966	0.9929	0.9779	0.9231	0.7794	0.6094	0.6704	0.8978	0.9833	0.9959	0.9982	(86)
MIT	19.8843	19.9800	20.1766	20.4686	20.7518	20.9352	20.9864	20.9777	20.8479	20.5104	20.1542	19.8665	(87)
Th 2	20.0280	20.0300	20.0320	20.0412	20.0429	20.0509	20.0509	20.0524	20.0478	20.0429	20.0394	20.0358	(88)
util rest of house	0.9971	0.9954	0.9902	0.9688	0.8902	0.6958	0.4879	0.5490	0.8418	0.9748	0.9942	0.9976	(89)
MIT 2	18.5381	18.6793	18.9672	19.3947	19.7843	20.0045	20.0455	20.0423	19.9152	19.4594	18.9409	18.5177	(90)
Living area fraction									fLA = Living area / (4) =			0.5737	(91)
MIT	19.3105	19.4255	19.6611	20.0108	20.3394	20.5385	20.5853	20.5790	20.4504	20.0624	19.6370	19.2915	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3105	19.4255	19.6611	20.0108	20.3394	20.5385	20.5853	20.5790	20.4504	20.0624	19.6370	19.2915	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9945	0.9889	0.9685	0.9017	0.7412	0.5580	0.6189	0.8683	0.9750	0.9933	0.9970	(94)
Useful gains	339.5769	357.6086	375.0926	394.2385	388.8534	315.8762	225.5105	232.9696	301.5354	319.1946	321.0881	327.5676	(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	890.3692	859.6451	777.1566	649.1876	503.7821	343.0724	230.2349	241.0069	368.1901	551.7701	734.0067	887.2764	(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	409.7895	337.3685	299.1356	183.5633	85.5070	0.0000	0.0000	0.0000	0.0000	173.0362	297.3014	416.4234	(98)
Space heating												2202.1248	(98)
Space heating per m2											(98) / (4) =	39.6066	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2355.2136	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	409.7895	337.3685	299.1356	183.5633	85.5070	0.0000	0.0000	0.0000	0.0000	173.0362	297.3014	416.4234	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	438.2775	360.8219	319.9311	196.3244	91.4513	0.0000	0.0000	0.0000	0.0000	185.0654	317.9694	445.3726	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	155.2714	136.5918	142.8271	127.1692	123.9945	109.8927	104.6831	116.0514	116.2167	131.9095	140.5695	151.2435	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.2840	87.1330	86.7413	85.7921	83.8461	79.8000	79.8000	79.8000	79.8000	85.5387	86.7652	87.3785	(217)
Fuel for water heating, kWh/month	177.8921	156.7624	164.6586	148.2294	147.8836	137.7101	131.1818	145.4278	145.6349	154.2104	162.0114	173.0901	(219)
Water heating fuel used												1844.6928	(219)

Annual totals kWh/year		
Space heating fuel - main system	2355.2136	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	279.8198	(232)
Total delivered energy for all uses	4554.7262	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2355.2136	0.2160	508.7261	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1844.6928	0.2160	398.4536	(264)
Space and water heating			907.1798	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	279.8198	0.5190	145.2265	(268)
Total CO2, kg/m2/year			1091.3312	(272)
Emissions per m2 for space and water heating			16.3162	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6120	(272b)
Emissions per m2 for pumps and fans			0.7001	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3162 * 1.00) + 2.6120 + 0.7001, rounded to 2 d.p.			19.6300	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	002 BlcD2-3B5P-03281	**Issued on Date**	10/07/2020
Assessment Reference	3B5P GF Be Lean	**Prop Type Ref**	Exposed Floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	85 B	**DER**	14.39	**TER**	15.79
Environmental	89 B	**% DER<TER**	8.84		
CO_2 Emissions (t/year)	0.97	**DFEE**	41.14	**TFEE**	45.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.85		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 87 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.39 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)45.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	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 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.44
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing South East: 16.35 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Exposed floor U-value 0.10 W/m²K
Door U-value 0.82 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	86.6000 (1b)	x	2.5000 (2b)	=	216.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			16.3500	1.3258	21.6761			(27)
Door			2.1200	0.8200	1.7384			(26)
Exposed			86.6000	0.1000	8.6600			(28b)
External Wall	33.9000	16.3500	17.5500	0.1800	3.1590			(29a)
Wall to Stairwell	29.8500	2.1200	27.7300	0.1671	4.6328			(29a)
Total net area of external elements Aum(A, m2)			150.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8664			(33)
Party Wall 1			36.0000	0.0000	0.0000			(32)
Party Ceilings 1			86.6000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2458	(36)
Total fabric heat loss					(33) + (36) =		53.1122	(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	18.6806	18.4730	18.2654	17.2272	17.0195	15.9814	15.9814	15.7737	16.3966	17.0195	17.4348	17.8501	(38)
Heat transfer coeff	71.7928	71.5852	71.3775	70.3393	70.1317	69.0935	69.0935	68.8859	69.5088	70.1317	70.5470	70.9622	(39)
Average = Sum(39)m / 12 =												70.2874	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8290	0.8266	0.8242	0.8122	0.8098	0.7978	0.7978	0.7954	0.8026	0.8098	0.8146	0.8194	(40)
HLP (average)												0.8116	(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	2.5763 (42)
Average daily hot water use (litres/day)	95.3863 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9249	101.1095	97.2940	93.4786	89.6631	85.8477	85.8477	89.6631	93.4786	97.2940	101.1095	104.9249	(44)
Energy conte	155.6006	136.0893	140.4320	122.4320	117.4764	101.3732	93.9372	107.7943	109.0817	127.1242	138.7660	150.6909	(45)
Energy content (annual)											Total = Sum(45)m =	1500.7977	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	23.3401	20.4134	21.0648	18.3648	17.6215	15.2060	14.0906	16.1691	16.3623	19.0686	20.8149	22.6036	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	185.5983	163.1840	170.4297	151.4620	147.4741	130.4032	123.9349	137.7920	138.1117	157.1219	167.7960	180.6886	(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	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h	185.5983	163.1840	170.4297	151.4620	147.4741	130.4032	123.9349	137.7920	138.1117	157.1219	167.7960	180.6886	(64)
										Total per year (kWh/year) = Sum(64)m =		1853.9964	(64)
Heat gains from water heating, kWh/month	75.7354	66.9254	70.6918	63.9327	63.0591	56.9306	55.2323	59.8398	59.4937	66.2670	69.3637	74.1029	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0367	18.6846	15.1953	11.5038	8.5993	7.2599	7.8445	10.1966	13.6859	17.3774	20.2820	21.6214	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6818	235.0963	229.0118	216.0586	199.7076	184.3400	174.0734	171.6589	177.7434	190.6965	207.0476	222.4152	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	(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)	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	(71)
Water heating gains (Table 5)	101.7948	99.5914	95.0158	88.7954	84.7568	79.0703	74.2369	80.4298	82.6301	89.0685	96.3385	99.6006	(72)
Total internal gains	417.1572	415.0163	400.8669	378.0018	354.7076	332.3141	317.7988	323.9293	335.7034	358.7864	385.3120	405.2812	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	16.3500	36.7938	0.4000	0.7000	0.7700	116.7304	(77)
Solar gains	116.7304	198.8351	272.0548	337.0891	377.5679	374.8376	361.3834	331.1844	294.5779	219.7551	139.8161	99.8969	(83)
Total gains	533.8877	613.8514	672.9218	715.0909	732.2756	707.1516	679.1823	655.1137	630.2812	578.5415	525.1281	505.1781	(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, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.7673	84.0103	84.2547	85.4982	85.7514	87.0399	87.0399	87.3022	86.5198	85.7514	85.2466	84.7477	
alpha	6.5845	6.6007	6.6170	6.6999	6.7168	6.8027	6.8027	6.8201	6.7680	6.7168	6.6831	6.6498	
util living area	0.9973	0.9926	0.9789	0.9326	0.8149	0.6155	0.4466	0.4819	0.7284	0.9476	0.9928	0.9981	(86)
MIT	20.2323	20.3740	20.5663	20.7871	20.9359	20.9919	20.9992	20.9987	20.9763	20.7906	20.4695	20.2061	(87)
Th 2	20.2283	20.2303	20.2324	20.2427	20.2448	20.2552	20.2552	20.2573	20.2510	20.2448	20.2407	20.2365	(88)
util rest of house	0.9965	0.9904	0.9724	0.9126	0.7692	0.5481	0.3716	0.4051	0.6618	0.9277	0.9902	0.9975	(89)
MIT 2	19.1966	19.4042	19.6822	19.9969	20.1839	20.2499	20.2549	20.2567	20.2333	20.0083	19.5520	19.1648	(90)
Living area fraction											fLA = Living area / (4) =	0.4031	(91)
MIT	19.6141	19.7951	20.0386	20.3154	20.4870	20.5490	20.5549	20.5558	20.5328	20.3236	19.9219	19.5846	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6141	19.7951	20.0386	20.3154	20.4870	20.5490	20.5549	20.5558	20.5328	20.3236	19.9219	19.5846	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9887	0.9704	0.9147	0.7847	0.5751	0.4018	0.4361	0.6877	0.9301	0.9888	0.9968	(94)
Useful gains	531.5170	606.9419	653.0224	654.1085	574.5959	406.6810	272.9254	285.7060	433.4623	538.1008	519.2214	503.5588	(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	1099.4423	1066.2712	966.3501	802.9546	616.2494	411.0388	273.2592	286.2760	447.1366	681.9357	904.5452	1091.7259	(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	422.5364	308.6693	233.1158	107.1691	30.9902	0.0000	0.0000	0.0000	0.0000	107.0132	277.4331	437.5963	(98)
Space heating												1924.5235	(98)
Space heating per m2											(98) / (4) =	22.2231	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1924.5235	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	2020.7497	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1853.9964	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1946.6962	(310a)
Electricity used for heat distribution	39.6745	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	145.2715	(330a)
Total electricity for the above, kWh/year	145.2715	(331)
Electricity for lighting (calculated in Appendix L)	371.5144	(332)
Total delivered energy for all uses	4484.2318	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	4432.9005	0.2160	957.5065	(367)
Electrical energy for heat distribution	39.6745	0.5190	20.5910	(372)
Total CO2 associated with community systems			978.0975	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			978.0975	(376)
Pumps and fans	145.2715	0.5190	75.3959	(378)
Energy for lighting	371.5144	0.5190	192.8160	(379)
Total CO2, kg/year			1246.3094	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3900	(384)

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

DER		14.3900	ZC1
Total Floor Area	TFA	86.6000	
Assumed number of occupants	N	2.5763	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.9217	ZC2
CO2 emissions from cooking, equation (L16)		2.0881	ZC3
Total CO2 emissions		32.3999	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.3999	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	86.6000 (1b)	x	2.5000 (2b)	=	216.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.5000	(5)

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2. Ventilation rate
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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3886	(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) =	0.3011	(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													
	0.3840	0.3764	0.3689	0.3313	0.3237	0.2861	0.2861	0.2786	0.3011	0.3237	0.3388	0.3538	(22b)
Effective ac	0.5737	0.5708	0.5680	0.5549	0.5524	0.5409	0.5409	0.5388	0.5453	0.5524	0.5574	0.5626	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.3500	1.3258	21.6761			(27)
Exposed			86.6000	0.1300	11.2580			(28b)
External Wall	33.9000	16.3500	17.5500	0.1800	3.1590			(29a)
Wall to Stairwell	29.8500	2.1200	27.7300	0.1800	4.9914			(29a)
Total net area of external elements Aum(A, m2)			150.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2045			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1385	(36)
Total fabric heat loss					(33) + (36) =		55.3430	(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	40.9887	40.7842	40.5838	39.6423	39.4662	38.6462	38.6462	38.4943	38.9620	39.4662	39.8225	40.1951	(38)
Heat transfer coeff	96.3318	96.1273	95.9268	94.9853	94.8092	93.9892	93.9892	93.8373	94.3050	94.8092	95.1655	95.5381	(39)
Average = Sum(39)m / 12 =												94.9845	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1124	1.1100	1.1077	1.0968	1.0948	1.0853	1.0853	1.0836	1.0890	1.0948	1.0989	1.1032	(40)
HLP (average)												1.0968	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5763	(42)
Average daily hot water use (litres/day)	95.3863	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9249	101.1095	97.2940	93.4786	89.6631	85.8477	85.8477	89.6631	93.4786	97.2940	101.1095	104.9249	(44)
Energy conte	155.6006	136.0893	140.4320	122.4320	117.4764	101.3732	93.9372	107.7943	109.0817	127.1242	138.7660	150.6909	(45)
Energy content (annual)										Total = Sum(45)m =		1500.7977	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.3401	20.4134	21.0648	18.3648	17.6215	15.2060	14.0906	16.1691	16.3623	19.0686	20.8149	22.6036	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	183.2183	161.0343	168.0496	149.1588	145.0941	128.1000	121.5549	135.4120	135.8085	154.7419	165.4928	178.3086	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	183.2183	161.0343	168.0496	149.1588	145.0941	128.1000	121.5549	135.4120	135.8085	154.7419	165.4928	178.3086	(64)
Total per year (kWh/year) = Sum(64)m =												1825.9736	(64)
Heat gains from water heating, kWh/month	73.8313	65.2057	68.7878	62.0901	61.1550	55.0880	53.3283	57.9357	57.6511	64.3629	67.5211	72.1989	(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	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0367	18.6846	15.1953	11.5038	8.5993	7.2599	7.8445	10.1966	13.6859	17.3774	20.2820	21.6214	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6818	235.0963	229.0118	216.0586	199.7076	184.3400	174.0734	171.6589	177.7434	190.6965	207.0476	222.4152	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	(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)	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	(71)
Water heating gains (Table 5)	99.2357	97.0323	92.4567	86.2362	82.1976	76.5111	71.6778	77.8706	80.0710	86.5093	93.7793	97.0415	(72)
Total internal gains	417.5981	415.4571	401.3078	378.4426	355.1485	332.7549	318.2397	324.3701	336.1442	359.2272	385.7528	405.7220	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	16.3500	36.7938	0.6300	0.7000	0.7700	183.8504	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	183.8504	313.1653	428.4864	530.9154	594.6695	590.3692	569.1789	521.6155	463.9601	346.1143	220.2104	157.3376	(83)
Total gains	601.4485	728.6224	829.7941	909.3580	949.8180	923.1241	887.4185	845.9856	800.1043	705.3415	605.9632	563.0597	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4289	62.5617	62.6925	63.3139	63.4315	63.9849	63.9849	64.0884	63.7706	63.4315	63.1940	62.9476	
alpha	5.1619	5.1708	5.1795	5.2209	5.2288	5.2657	5.2657	5.2726	5.2514	5.2288	5.2129	5.1965	
util living area	0.9961	0.9891	0.9710	0.9199	0.8067	0.6261	0.4615	0.5029	0.7426	0.9436	0.9907	0.9972	(86)
MIT	19.8975	20.0966	20.3604	20.6574	20.8734	20.9741	20.9956	20.9932	20.9379	20.6490	20.2091	19.8585	(87)
Th 2	19.9907	19.9927	19.9945	20.0034	20.0051	20.0128	20.0128	20.0143	20.0098	20.0051	20.0017	19.9982	(88)
util rest of house	0.9948	0.9857	0.9617	0.8945	0.7518	0.5401	0.3604	0.3990	0.6612	0.9201	0.9871	0.9963	(89)
MIT 2	18.5302	18.8204	19.1998	19.6165	19.8875	19.9965	20.0113	20.0116	19.9644	19.6157	18.9922	18.4789	(90)
Living area fraction									fLA = Living area / (4) =			0.4031	(91)
MIT	19.0814	19.3349	19.6677	20.0361	20.2849	20.3906	20.4081	20.4073	20.3569	20.0322	19.4827	19.0350	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0814	19.3349	19.6677	20.0361	20.2849	20.3906	20.4081	20.4073	20.3569	20.0322	19.4827	19.0350	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9827	0.9579	0.8955	0.7684	0.5740	0.4013	0.4410	0.6915	0.9209	0.9846	0.9950	(94)
Useful gains	597.3658	716.0106	794.8928	814.2945	729.8484	529.9017	356.1219	373.1127	553.2735	649.5301	596.6274	560.2493	(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	1423.9191	1387.5846	1263.1334	1057.7676	813.9311	544.2543	357.9188	376.0366	590.0550	894.2602	1178.4109	1417.3122	(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	614.9556	451.2977	348.3709	175.3007	62.5576	0.0000	0.0000	0.0000	0.0000	182.0792	418.8841	637.6548	(98)
Space heating												2891.1006	(98)
Space heating per m2											(98) / (4) =	33.3845	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3092.0862	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	614.9556	451.2977	348.3709	175.3007	62.5576	0.0000	0.0000	0.0000	0.0000	182.0792	418.8841	637.6548	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	657.7066	482.6714	372.5892	187.4873	66.9065	0.0000	0.0000	0.0000	0.0000	194.7371	448.0044	681.9837	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	183.2183	161.0343	168.0496	149.1588	145.0941	128.1000	121.5549	135.4120	135.8085	154.7419	165.4928	178.3086	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.7977	87.4174	86.7163	85.2454	82.7474	79.8000	79.8000	79.8000	79.8000	85.2486	87.1892	87.9237	(217)
Fuel for water heating, kWh/month	208.6824	184.2130	193.7924	174.9758	175.3459	160.5263	152.3244	169.6892	170.1861	181.5184	189.8088	202.7991	(219)
Water heating fuel used												2163.8616	(219)

Annual totals kWh/year		
Space heating fuel - main system	3092.0862	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	371.5144	(232)
Total delivered energy for all uses	5702.4621	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3092.0862	0.2160	667.8906	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2163.8616	0.2160	467.3941	(264)
Space and water heating			1135.2847	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	371.5144	0.5190	192.8160	(268)
Total CO2, kg/m2/year			1367.0257	(272)
Emissions per m2 for space and water heating			13.1095	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2265	(272b)
Emissions per m2 for pumps and fans			0.4495	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.1095 * 1.00) + 2.2265 + 0.4495, rounded to 2 d.p.			15.7900	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	003 BlcE1-1B1P-03281	**Issued on Date**	10/07/2020
Assessment Reference	1B1P MF Be Lean	**Prop Type Ref**	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	82 B	**DER**	21.88	**TER**	24.16
Environmental	88 B	**% DER<TER**	9.44		
CO_2 Emissions (t/year)	0.71	**DFEE**	59.39	**TFEE**	56.20
General Requirements Compliance	Fail	**% DFEE<TFEE**	-5.68		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 40 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 24.16 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 21.88 kgCO□/m²OK
-----------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)59.4 kWh/m²/yrFail
Excess energy =3.2 kWh/m²/yr  (5.7%)
-----------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.17 (max. 0.30)        0.18 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           (no floor)
Roof            (no roof)
Openings        1.32 (max. 2.00)        1.40 (max. 3.30)          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                                 10.0                                          OK
-----------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Community heating scheme                      -

Secondary heating system:               None
-----------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                          OK
Primary pipework insulated:             No primary pipework
-----------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Charging system linked to use of community heating, programmer and at least two room statsOK


Hot water controls:                     No cylinderstat


-----------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                           OK
-----------------------------------------------------------------------------------------------
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                     0.42
Maximum                                 1.5                                           OK
MVHR efficiency:                        91%
Minimum:                                70%                                           OK
-----------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Midlands):            Medium                                        OK
Based on:
Overshading:                            Average
Windows facing North East:              2.55 m², No overhang
Windows facing North West:              10.75 m², No overhang
Air change rate:                        2.00 ach
Blinds/curtains:                        None
-----------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Door U-value                            0.82 W/m²K
Air permeability                        3.0 m³/m²h



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	40.3000	(1b)	x 2.5000	(2b) =	100.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	40.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		100.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			13.3000	1.3258	17.6326			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	22.8300	13.3000	9.5300	0.1800	1.7154			(29a)
Wall to CA	40.7500	2.1200	38.6300	0.1671	6.4539			(29a)
Total net area of external elements Aum(A, m2)			63.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.5402			(33)
Party Wall 1			14.0500	0.0000	0.0000			(32)
Party Floor 1			40.3000					(32d)
Party Ceilings 1			40.3000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.4248 (36)
Total fabric heat loss (33) + (36) =	35.9650 (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	8.6932	8.5966	8.4999	8.0168	7.9202	7.4371	7.4371	7.3404	7.6303	7.9202	8.1134	8.3067	(38)
Heat transfer coeff	44.6582	44.5616	44.4650	43.9818	43.8852	43.4021	43.4021	43.3055	43.5953	43.8852	44.0785	44.2717	(39)

Average = Sum(39)m / 12 = 43.9577 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1081	1.1057	1.1033	1.0914	1.0890	1.0770	1.0770	1.0746	1.0818	1.0890	1.0938	1.0986	(40)
HLP (average)												1.0908	(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	1.4143 (42)
Average daily hot water use (litres/day)	67.7904 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.5694	71.8578	69.1462	66.4346	63.7230	61.0113	61.0113	63.7230	66.4346	69.1462	71.8578	74.5694	(44)
Energy conte	110.5843	96.7177	99.8040	87.0116	83.4897	72.0452	66.7605	76.6087	77.5236	90.3463	98.6201	107.0950	(45)
Energy content (annual)										Total = Sum(45)m =		1066.6067	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	16.5876	14.5077	14.9706	13.0517	12.5235	10.8068	10.0141	11.4913	11.6285	13.5519	14.7930	16.0642	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	140.5820	123.8124	129.8017	116.0416	113.4874	101.0753	96.7582	106.6064	106.5536	120.3440	127.6501	137.0927	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	140.5820	123.8124	129.8017	116.0416	113.4874	101.0753	96.7582	106.6064	106.5536	120.3440	127.6501	137.0927	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.8054	(64)
Heat gains from water heating, kWh/month	60.7674	53.8344	57.1830	52.1554	51.7585	47.1791	46.1960	49.4705	49.0006	54.0383	56.0152	59.6072	(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	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.9021	9.6832	7.8749	5.9618	4.4565	3.7624	4.0654	5.2843	7.0926	9.0057	10.5110	11.2051	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	122.2887	123.5576	120.3599	113.5522	104.9587	96.8821	91.4864	90.2174	93.4152	100.2228	108.8163	116.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	(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)	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	(71)
Water heating gains (Table 5)	81.6767	80.1107	76.8589	72.4380	69.5678	65.5265	62.0914	66.4927	68.0564	72.6321	77.7989	80.1173	(72)
Total internal gains	259.0824	257.5665	249.3086	236.1670	223.1980	210.3859	201.8581	206.2094	212.7792	226.0756	241.3412	252.4303	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5500	11.2829	0.4000	0.7000	0.7700	5.5828	(75)
Northwest	10.7500	11.2829	0.4000	0.7000	0.7700	23.5354	(81)

Solar gains	29.1182	59.2710	106.7876	175.3758	235.7395	251.3233	235.1078	187.4307	130.1223	72.4339	36.6383	23.7794	(83)
Total gains	288.2007	316.8375	356.0961	411.5428	458.9376	461.7092	436.9659	393.6400	342.9015	298.5096	277.9794	276.2098	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.6673	62.8032	62.9397	63.6310	63.7711	64.4810	64.4810	64.6249	64.1952	63.7711	63.4916	63.2144	
alpha	5.1778	5.1869	5.1960	5.2421	5.2514	5.2987	5.2987	5.3083	5.2797	5.2514	5.2328	5.2143	
util living area	0.9955	0.9919	0.9790	0.9263	0.7870	0.5847	0.4340	0.4992	0.7810	0.9600	0.9912	0.9964	(86)
MIT	19.9224	20.0528	20.3040	20.6444	20.8894	20.9816	20.9968	20.9937	20.9222	20.5997	20.2061	19.8978	(87)
Th 2	19.9942	19.9961	19.9981	20.0079	20.0099	20.0197	20.0197	20.0216	20.0157	20.0099	20.0059	20.0020	(88)
util rest of house	0.9941	0.9892	0.9719	0.9024	0.7306	0.5024	0.3389	0.3966	0.7024	0.9420	0.9878	0.9952	(89)
MIT 2	18.5689	18.7599	19.1234	19.6037	19.9085	20.0083	20.0186	20.0192	19.9568	19.5550	18.9911	18.5387	(90)
Living area fraction										fLA = Living area / (4) =		0.7983	(91)
MIT	19.6494	19.7920	20.0658	20.4344	20.6915	20.7852	20.7995	20.7971	20.7274	20.3890	19.9610	19.6236	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6494	19.7920	20.0658	20.4344	20.6915	20.7852	20.7995	20.7971	20.7274	20.3890	19.9610	19.6236	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9886	0.9725	0.9135	0.7706	0.5672	0.4147	0.4784	0.7611	0.9497	0.9876	0.9947	(94)
Useful gains	286.3107	313.2227	346.2888	375.9537	353.6380	261.8856	181.2286	188.3141	260.9810	283.5029	274.5364	274.7371	(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	685.4748	663.6102	603.2032	507.3047	394.5932	268.4512	182.2659	190.4171	288.9242	429.5917	566.8942	682.8289	(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	296.9781	235.4604	191.1443	94.5727	30.4707	0.0000	0.0000	0.0000	0.0000	108.6900	210.4976	303.6203	(98)
Space heating												1471.4342	(98)
Space heating per m2											(98) / (4) =	36.5120	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1471.4342	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	1545.0059	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1419.8054	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1490.7957	(310a)
Electricity used for heat distribution	30.3580	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	64.5304	(330a)
Total electricity for the above, kWh/year	64.5304	(331)
Electricity for lighting (calculated in Appendix L)	192.5349	(332)
Total delivered energy for all uses	3292.8668	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	3391.9570	0.2160	732.6627	(367)
Electrical energy for heat distribution	30.3580	0.5190	15.7558	(372)
Total CO2 associated with community systems			748.4185	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			748.4185	(376)
Pumps and fans	64.5304	0.5190	33.4913	(378)
Energy for lighting	192.5349	0.5190	99.9256	(379)
Total CO2, kg/year			881.8354	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			21.8800	(384)

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

DER		21.8800	ZC1
Total Floor Area	TFA	40.3000	
Assumed number of occupants	N	1.4143	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.9816	ZC2
CO2 emissions from cooking, equation (L16)		3.7951	ZC3
Total CO2 emissions		43.6567	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		43.6567	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.3000 (1b)	x	2.5000 (2b)	=	100.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 40.3000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	100.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =							20.0000 / (5) =	0.1985	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.4485	(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) =	0.3476	(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													
	0.4432	0.4345	0.4258	0.3824	0.3737	0.3302	0.3302	0.3215	0.3476	0.3737	0.3910	0.4084	(22b)
Effective ac	0.5982	0.5944	0.5907	0.5731	0.5698	0.5545	0.5545	0.5517	0.5604	0.5698	0.5765	0.5834	(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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			7.9600	1.3258	10.5530			(27)
External Wall	22.8300	7.9600	14.8700	0.1800	2.6766			(29a)
Wall to CA	40.7500	2.1200	38.6300	0.1800	6.9534			(29a)
Total net area of external elements Aum(A, m2)			63.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.3030			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3077	(36)
Total fabric heat loss						(33) + (36) =	27.6107	(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	19.8889	19.7621	19.6378	19.0541	18.9449	18.4365	18.4365	18.3423	18.6323	18.9449	19.1658	19.3968	(38)
Heat transfer coeff													
	47.4996	47.3728	47.2485	46.6648	46.5556	46.0472	46.0472	45.9530	46.2430	46.5556	46.7765	47.0075	(39)
Average = Sum(39)m / 12 =												46.6643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1787	1.1755	1.1724	1.1579	1.1552	1.1426	1.1426	1.1403	1.1475	1.1552	1.1607	1.1664	(40)
HLP (average)												1.1579	(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	1.4143	(42)
Average daily hot water use (litres/day)	67.7904	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	74.5694	71.8578	69.1462	66.4346	63.7230	61.0113	61.0113	63.7230	66.4346	69.1462	71.8578	74.5694	(44)
Energy conte	110.5843	96.7177	99.8040	87.0116	83.4897	72.0452	66.7605	76.6087	77.5236	90.3463	98.6201	107.0950	(45)
Energy content (annual)										Total = Sum(45)m =		1066.6067	(45)
Distribution loss (46)m = 0.15 x (45)m													
	16.5876	14.5077	14.9706	13.0517	12.5235	10.8068	10.0141	11.4913	11.6285	13.5519	14.7930	16.0642	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	138.2020	121.6627	127.4217	113.7384	111.1074	98.7720	94.3782	104.2263	104.2504	117.9640	125.3468	134.7127	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	138.2020	121.6627	127.4217	113.7384	111.1074	98.7720	94.3782	104.2263	104.2504	117.9640	125.3468	134.7127	(64)
Total per year (kWh/year) = Sum(64)m =												1391.7826	(64)
Heat gains from water heating, kWh/month	58.8634	52.1146	55.2790	50.3128	49.8545	45.3365	44.2920	47.5665	47.1580	52.1343	54.1726	57.7032	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts (66)m	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.9938	9.7646	7.9411	6.0119	4.4940	3.7940	4.0996	5.3288	7.1522	9.0814	10.5993	11.2993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	122.2887	123.5576	120.3599	113.5522	104.9587	96.8821	91.4864	90.2174	93.4152	100.2228	108.8163	116.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	(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)	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	(71)
Water heating gains (Table 5)	79.1175	77.5516	74.2997	69.8789	67.0087	62.9673	59.5323	63.9335	65.4973	70.0730	75.2397	77.5581	(72)
Total internal gains	259.6149	258.0887	249.8156	236.6579	223.6763	210.8584	202.3332	206.6946	213.2796	226.5922	241.8703	252.9654	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.5300	11.2829	0.6300	0.7000	0.7700	5.2758	(75)
Northwest	6.4300	11.2829	0.6300	0.7000	0.7700	22.1720	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	27.4478	55.8707	100.6613	165.3148	222.2155	236.9053	221.6200	176.6781	122.6574	68.2785	34.5364	22.4152	(83)
Total gains	287.0627	313.9595	350.4770	401.9727	445.8919	447.7636	423.9532	383.3727	335.9370	294.8707	276.4068	275.3806	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.9186	59.0763	59.2317	59.9726	60.1133	60.7770	60.7770	60.9016	60.5197	60.1133	59.8294	59.5354	
alpha	4.9279	4.9384	4.9488	4.9982	5.0076	5.0518	5.0518	5.0601	5.0346	5.0076	4.9886	4.9690	
util living area	0.9957	0.9926	0.9820	0.9394	0.8210	0.6286	0.4718	0.5389	0.8121	0.9656	0.9919	0.9965	(86)
MIT	19.8237	19.9537	20.2087	20.5648	20.8443	20.9691	20.9940	20.9888	20.8921	20.5356	20.1254	19.8027	(87)
Th 2	20.4107	20.4122	20.4138	20.4210	20.4224	20.4287	20.4287	20.4299	20.4263	20.4224	20.4196	20.4168	(88)
util rest of house	0.9950	0.9914	0.9787	0.9285	0.7923	0.5805	0.4129	0.4767	0.7718	0.9575	0.9903	0.9959	(89)
MIT 2	19.2988	19.4296	19.6841	20.0385	20.2995	20.4089	20.4258	20.4242	20.3487	20.0151	19.6071	19.2828	(90)
Living area fraction — fLA = Living area / (4) =												0.7983	(91)
MIT	19.7178	19.8480	20.1029	20.4586	20.7344	20.8561	20.8794	20.8749	20.7825	20.4306	20.0209	19.6978	(92)
Temperature adjustment												0.6000	
adjusted MIT	20.3178	20.4480	20.7029	21.0586	21.3344	21.4561	21.4794	21.4749	21.3825	21.0306	20.6209	20.2978	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9914	0.9804	0.9404	0.8360	0.6646	0.5197	0.5880	0.8353	0.9660	0.9909	0.9958	(94)
Useful gains	285.5919	311.2710	343.6066	378.0108	372.7640	297.5855	220.3160	225.4407	280.6132	284.8445	273.8846	274.2243	(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	760.8378	736.5511	671.0639	567.3784	448.5350	315.7047	224.6819	233.2071	336.7647	485.6041	632.4585	756.7189	(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	353.5829	285.7882	243.6282	136.3447	56.3736	0.0000	0.0000	0.0000	0.0000	149.3651	258.1732	358.9760	(98)
Space heating												1842.2319	(98)
Space heating per m2 — (98) / (4) =												45.7130	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	88.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2081.6180	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	353.5829	285.7882	243.6282	136.3447	56.3736	0.0000	0.0000	0.0000	0.0000	149.3651	258.1732	358.9760	(98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (main heating system)	399.5287	322.9246	275.2861	154.0618	63.6990	0.0000	0.0000	0.0000	0.0000	168.7741	291.7211	405.6226	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	138.2020	121.6627	127.4217	113.7384	111.1074	98.7720	94.3782	104.2263	104.2504	117.9640	125.3468	134.7127	(64)
Efficiency of water heater												74.8000	(216)
(217)m	82.1958	81.9976	81.4966	80.2773	78.0894	74.8000	74.8000	74.8000	74.8000	80.4235	81.6812	82.2880	(217)
Fuel for water heating, kWh/month	168.1376	148.3735	156.3522	141.6819	142.2822	132.0482	126.1740	139.3400	139.3722	146.6786	153.4587	163.7087	(219)
Water heating fuel used												1757.6078	(219)

Annual totals kWh/year		
Space heating fuel - main system	2081.6180	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	39.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	84.0000	(231)
Electricity for lighting (calculated in Appendix L)	194.1534	(232)
Total delivered energy for all uses	4117.3792	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2081.6180	0.2160	449.6295	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1757.6078	0.2160	379.6433	(264)
Space and water heating			829.2728	(265)
Pumps and fans	84.0000	0.5190	43.5960	(267)
Energy for lighting	194.1534	0.5190	100.7656	(268)
Total CO2, kg/m2/year			973.6344	(272)
Emissions per m2 for space and water heating			20.5775	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5004	(272b)
Emissions per m2 for pumps and fans			1.0818	(272c)
Target Carbon Dioxide Emission Rate (TER) = (20.5775 * 1.00) + 2.5004 + 1.0818, rounded to 2 d.p.			24.1600	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	004 BlcC1-1B2P-03281	Issued on Date	10/07/2020
Assessment Reference	1B2P MF Be Lean	Prop Type Ref	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	85 B	DER	13.94	TER	15.87
Environmental	91 B	% DER<TER	12.16		
CO_2 Emissions (t/year)	0.60	DFEE	30.57	TFEE	31.39
General Requirements Compliance	Pass	% DFEE<TFEE	2.61		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 50 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.87 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.94 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)31.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	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 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.42
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing South East: 6.98 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 0.82 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	50.4000	(1b)	x 2.5000	(2b) =	126.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		126.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.3500 (23c)

Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	18.0800	6.9800	11.1000	0.1800	1.9980			(29a)
Wall to Stairwell	20.0500	2.1200	17.9300	0.1671	2.9955			(29a)
Total net area of external elements Aum(A, m2)			38.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.9857			(33)
Party Wall 1			34.3500	0.0000	0.0000			(32)
Party Floor 1			50.4000					(32d)
Party Ceilings 1			50.4000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6066	(36)
Total fabric heat loss (33) + (36) =	21.5923	(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	10.8719	10.7510	10.6302	10.0260	9.9051	9.3009	9.3009	9.1801	9.5426	9.9051	10.1468	10.3885	(38)
Heat transfer coeff	32.4642	32.3434	32.2225	31.6183	31.4975	30.8933	30.8933	30.7724	31.1349	31.4975	31.7392	31.9808	(39)

Average = Sum(39)m / 12 = 31.5881 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6441	0.6417	0.6393	0.6273	0.6249	0.6130	0.6130	0.6106	0.6178	0.6249	0.6297	0.6345	(40)
HLP (average)												0.6267	(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	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:
Store volume 3.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0212 (51)
Volume factor from Table 2a 3.4200 (52)
Temperature factor from Table 2b 1.0000 (53)
Enter (49) or (54) in (55) 0.2173 (55)
Total storage loss

	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)

If cylinder contains dedicated solar storage

	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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

	151.7225	133.5560	139.8562	124.8073	121.8983	108.3332	103.4838	114.3241	114.3635	129.4456	137.5852	147.8816	(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	(63)

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

	151.7225	133.5560	139.8562	124.8073	121.8983	108.3332	103.4838	114.3241	114.3635	129.4456	137.5852	147.8816	(64)

Total per year (kWh/year) = Sum(64)m = 1527.2573 (64)
Heat gains from water heating, kWh/month

	64.4716	57.0741	60.5261	55.0700	54.5551	49.5923	48.4323	52.0367	51.5974	57.0646	59.3186	63.1946	(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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)

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

	14.2147	12.6253	10.2676	7.7732	5.8106	4.9055	5.3006	6.8899	9.2477	11.7420	13.7047	14.6097	(67)

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

	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)

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

	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(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)

	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)

Water heating gains (Table 5)

	86.6554	84.9317	81.3523	76.4861	73.3267	68.8783	65.0972	69.9418	71.6631	76.6997	82.3870	84.9389	(72)
Total internal gains	297.6711	295.8967	286.0823	270.4675	254.9261	239.7798	229.8516	234.7469	242.7032	258.4884	276.5577	289.8075	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.4000	0.7000	0.7700	49.8335	(77)

Solar gains	49.8335	84.8850	116.1433	143.9072	161.1880	160.0224	154.2787	141.3864	125.7586	93.8160	59.6891	42.6471	(83)
Total gains	347.5047	380.7817	402.2256	414.3747	416.1141	399.8022	384.1302	376.1333	368.4618	352.3043	336.2468	332.4546	(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, n1,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	107.8111	108.2139	108.6197	110.6954	111.1200	113.2933	113.2933	113.7382	112.4139	111.1200	110.2739	109.4405	
alpha	8.1874	8.2143	8.2413	8.3797	8.4080	8.5529	8.5529	8.5825	8.4943	8.4080	8.3516	8.2960	
util living area	0.9904	0.9782	0.9460	0.8544	0.6926	0.4939	0.3538	0.3763	0.5805	0.8584	0.9733	0.9928	(86)
MIT	20.5937	20.6956	20.8218	20.9412	20.9903	20.9995	21.0000	21.0000	20.9981	20.9482	20.7655	20.5739	(87)
Th 2	20.3904	20.3926	20.3947	20.4054	20.4076	20.4183	20.4183	20.4205	20.4140	20.4076	20.4033	20.3990	(88)
util rest of house	0.9878	0.9726	0.9332	0.8269	0.6522	0.4493	0.3071	0.3289	0.5323	0.8264	0.9655	0.9908	(89)
MIT 2	19.8520	19.9994	20.1769	20.3416	20.3989	20.4180	20.4183	20.4205	20.4127	20.3540	20.1091	19.8308	(90)
Living area fraction										fLA = Living area / (4) =		0.5843	(91)
MIT	20.2854	20.4062	20.5537	20.6920	20.7445	20.7578	20.7582	20.7591	20.7548	20.7012	20.4926	20.2650	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2854	20.4062	20.5537	20.6920	20.7445	20.7578	20.7582	20.7591	20.7548	20.7012	20.4926	20.2650	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9873	0.9728	0.9368	0.8406	0.6754	0.4754	0.3344	0.3566	0.5605	0.8429	0.9668	0.9903	(94)
Useful gains	343.0886	370.4195	376.7955	348.3103	281.0556	190.0605	128.4532	134.1272	206.5107	296.9437	325.0798	329.2276	(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	518.9528	501.5233	452.8472	372.8433	284.8786	190.2344	128.4605	134.1396	207.1958	318.1621	425.0713	513.7715	(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	130.8430	88.1018	56.5825	17.6637	2.8444	0.0000	0.0000	0.0000	0.0000	15.7865	71.9939	137.3007	(98)
Space heating												521.1163	(98)
Space heating per m2											(98) / (4) =	10.3396	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	521.1163	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	547.1721	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1527.2573	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1603.6202	(310a)
Electricity used for heat distribution	21.5079	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	80.7030	(330a)
Total electricity for the above, kWh/year	80.7030	(331)
Electricity for lighting (calculated in Appendix L)	251.0355	(332)
Total delivered energy for all uses	2482.5309	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	2403.1199	0.2160	519.0739	(367)
Electrical energy for heat distribution	21.5079	0.5190	11.1626	(372)
Total CO2 associated with community systems			530.2365	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			530.2365	(376)
Pumps and fans	80.7030	0.5190	41.8849	(378)
Energy for lighting	251.0355	0.5190	130.2874	(379)
Total CO2, kg/year			702.4088	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9400	(384)

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

DER		13.9400	ZC1
Total Floor Area	TFA	50.4000	
Assumed number of occupants	N	1.7019	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4332	ZC2
CO2 emissions from cooking, equation (L16)		3.1715	ZC3
Total CO2 emissions		34.5447	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.5447	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.5000 (2b)	=	126.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.4000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =							20.0000 / (5) =	0.1587	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.4087	(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) =	0.3168	(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													
	0.4039	0.3960	0.3880	0.3484	0.3405	0.3009	0.3009	0.2930	0.3168	0.3405	0.3564	0.3722	(22b)
Effective ac	0.5816	0.5784	0.5753	0.5607	0.5580	0.5453	0.5453	0.5429	0.5502	0.5580	0.5635	0.5693	(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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
External Wall	18.0800	6.9800	11.1000	0.1800	1.9980			(29a)
Wall to Stairwell	20.0500	2.1200	17.9300	0.1800	3.2274			(29a)
Total net area of external elements Aum(A, m2)			38.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.5992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6645	(36)
Total fabric heat loss						(33) + (36) =	20.2637	(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	24.1812	24.0495	23.9204	23.3142	23.2007	22.6727	22.6727	22.5749	22.8761	23.2007	23.4302	23.6701	(38)
Heat transfer coeff													
	44.4449	44.3132	44.1841	43.5778	43.4644	42.9364	42.9364	42.8386	43.1398	43.4644	43.6939	43.9338	(39)
Average = Sum(39)m / 12 =												43.5773	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8818	0.8792	0.8767	0.8646	0.8624	0.8519	0.8519	0.8500	0.8559	0.8624	0.8669	0.8717	(40)
HLP (average)												0.8646	(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	1.7019	(42)
Average daily hot water use (litres/day)	74.6197	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
                4.3553    3.9338    4.3553    4.2148    4.3553    4.2148    4.3553    4.3553    4.2148    4.3553    4.2148    4.3553 (56)
If cylinder contains dedicated solar storage
                4.3553    3.9338    4.3553    4.2148    4.3553    4.2148    4.3553    4.3553    4.2148    4.3553    4.2148    4.3553 (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
              149.3424  131.4063  137.4762  122.5041  119.5183  106.0300  101.1038  111.9440  112.0603  127.0656  135.2820  145.5016 (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 (63)
                                                                                   Solar input (sum of months) = Sum(63)m =       0.0000 (63)
Output from w/h
              149.3424  131.4063  137.4762  122.5041  119.5183  106.0300  101.1038  111.9440  112.0603  127.0656  135.2820  145.5016 (64)
                                                                                     Total per year (kWh/year) = Sum(64)m =    1499.2345 (64)
Heat gains from water heating, kWh/month
               62.5676   55.3544   58.6221   53.2274   52.6511   47.7497   46.5283   50.1327   49.7548   55.1606   57.4760   61.2905 (65)
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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                  Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m          85.0941   85.0941   85.0941   85.0941   85.0941   85.0941   85.0941   85.0941   85.0941   85.0941   85.0941   85.0941 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               14.2147   12.6253   10.2676    7.7732    5.8106    4.9055    5.3006    6.8899    9.2477   11.7420   13.7047   14.6097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              148.2728  149.8114  145.9342  137.6800  127.2605  117.4677  110.9256  109.3869  113.2642  121.5184  131.9378  141.7306 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               31.5094   31.5094   31.5094   31.5094   31.5094   31.5094   31.5094   31.5094   31.5094   31.5094   31.5094   31.5094 (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)
              -68.0753  -68.0753  -68.0753  -68.0753  -68.0753  -68.0753  -68.0753  -68.0753  -68.0753  -68.0753  -68.0753  -68.0753 (71)
Water heating gains (Table 5)
               84.0963   82.3726   78.7931   73.9269   70.7676   66.3191   62.5380   67.3826   69.1039   74.1406   79.8278   82.3798 (72)
Total internal gains
              298.1120  296.3375  286.5231  270.9084  255.3670  240.2206  230.2924  235.1877  243.1440  258.9292  276.9986  290.2484 (73)
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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
---------------------------------------------------------------------------------------------------
Southeast                            6.9800        36.7938         0.6300         0.7000       0.7700         78.4878 (77)
---------------------------------------------------------------------------------------------------

Solar gains    78.4878  133.6938  182.9257  226.6538  253.8711  252.0353  242.9889  222.6835  198.0698  147.7601   94.0103   67.1692 (83)
Total gains   376.5998  430.0313  469.4488  497.5622  509.2381  492.2559  473.2813  457.8713  441.2138  406.6894  371.0089  357.4176 (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, nil,m (see Table 9a)
                  Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            78.7492   78.9833   79.2140   80.3160   80.5256   81.5160   81.5160   81.7020   81.1316   80.5256   80.1027   79.6653
alpha           6.2499    6.2656    6.2809    6.3544    6.3684    6.4344    6.4344    6.4468    6.4088    6.3684    6.3402    6.3110
util living area
                0.9929    0.9829    0.9577    0.8878    0.7478    0.5524    0.3985    0.4293    0.6560    0.9054    0.9824    0.9947 (86)

MIT            20.2784   20.4301   20.6253   20.8318   20.9539   20.9943   20.9994   20.9990   20.9838   20.8352   20.5229   20.2490 (87)
Th 2           20.1830   20.1852   20.1874   20.1977   20.1996   20.2086   20.2086   20.2102   20.2051   20.1996   20.1957   20.1916 (88)
util rest of house
                0.9907    0.9780    0.9458    0.8594    0.6970    0.4867    0.3272    0.3562    0.5879    0.8751    0.9765    0.9930 (89)
MIT 2          19.2280   19.4481   19.7257   20.0114   20.1578   20.2050   20.2083   20.2098   20.1936   20.0229   19.5916   19.1922 (90)
Living area fraction                                                                           fLA = Living area / (4) =      0.5843 (91)
MIT            19.8418   20.0219   20.2513   20.4908   20.6230   20.6662   20.6706   20.6710   20.6554   20.4976   20.1358   19.8097 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT   19.8418   20.0219   20.2513   20.4908   20.6230   20.6662   20.6706   20.6710   20.6554   20.4976   20.1358   19.8097 (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     0.9896    0.9768    0.9469    0.8704    0.7246    0.5249    0.3689    0.3989    0.6271    0.8873    0.9760    0.9921 (94)
Useful gains  372.6862  420.0689  444.5171  433.0955  368.9784  258.4016  174.5941  182.6658  276.7012  360.8582  362.0868  354.5931 (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
              690.7526  670.0989  607.5912  505.1003  387.8338  260.4609  174.7756  182.9630  282.7967  430.1914  569.5834  685.7942 (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
              236.6414  168.0202  121.3271   51.8434   14.0284    0.0000    0.0000    0.0000    0.0000   51.5839  149.3976  246.4136 (98)
Space heating                                                                                                              1039.2555 (98)
Space heating per m2                                                                                    (98) / (4) =      20.6201 (99)
```

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


---------------------------------------------------------------------------------------------------
```


CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
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 %)                                                                             93.5000 (206)
Efficiency of secondary/supplementary heating system, %                                                                       0.0000 (208)
Space heating requirement                                                                                                  1111.5033 (211)

                  Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Space heating requirement
              236.6414  168.0202  121.3271   51.8434   14.0284    0.0000    0.0000    0.0000    0.0000   51.5839  149.3976  246.4136 (98)
Space heating efficiency (main heating system 1)
               93.5000   93.5000   93.5000   93.5000   93.5000    0.0000    0.0000    0.0000    0.0000   93.5000   93.5000   93.5000 (210)
Space heating fuel (main heating system)
              253.0924  179.7007  129.7616   55.4475   15.0037    0.0000    0.0000    0.0000    0.0000   55.1700  159.7835  263.5440 (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
              149.3424  131.4063  137.4762  122.5041  119.5183  106.0300  101.1038  111.9440  112.0603  127.0656  135.2820  145.5016 (64)
Efficiency of water heater                                                                                                   79.8000 (216)
(217)m         86.0365   85.4705   84.4826   82.7078   80.8036   79.8000   79.8000   79.8000   79.8000   82.6206   85.0789   86.2085 (217)
Fuel for water heating, kWh/month
              173.5804  153.7445  162.7271  148.1168  147.9121  132.8697  126.6964  140.2808  140.4264  153.7942  159.0077  168.7787 (219)
Water heating fuel used                                                                                                    1807.9348 (219)
Annual totals kWh/year
Space heating fuel - main system                                                                                           1111.5033 (211)
Space heating fuel - secondary                                                                                                0.0000 (215)

Electricity for pumps and fans:
   central heating pump                                                                                                      30.0000 (230c)
   main heating flue fan                                                                                                     45.0000 (230e)
Total electricity for the above, kWh/year                                                                                    75.0000 (231)
Electricity for lighting (calculated in Appendix L)                                                                         251.0355 (232)
Total delivered energy for all uses                                                                                        3245.4735 (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                                     1111.5033               0.2160             240.0847 (261)
Space heating - secondary                                            0.0000               0.0000               0.0000 (263)
Water heating (other fuel)                                        1807.9348               0.2160             390.5139 (264)
Space and water heating                                                                                      630.5986 (265)
Pumps and fans                                                      75.0000               0.5190              38.9250 (267)
Energy for lighting                                                251.0355               0.5190             130.2874 (268)
Total CO2, kg/m2/year                                                                                        799.8110 (272)
Emissions per m2 for space and water heating                                                                  12.5119 (272a)
Fuel factor (mains gas)                                                                                        1.0000
Emissions per m2 for lighting                                                                                  2.5851 (272b)
Emissions per m2 for pumps and fans                                                                            0.7723 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5119 * 1.00) + 2.5851 + 0.7723, rounded to 2 d.p.             15.8700 (273)
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	005 BlcD2-2B3P-03281	Issued on Date	10/07/2020
Assessment Reference	2B3P MF Be Lean	Prop Type Ref	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	85 B	DER	14.07	TER	15.32
Environmental	90 B	% DER<TER	8.16		
CO_2 Emissions (t/year)	0.71	DFEE	34.72	TFEE	34.94
General Requirements Compliance	Pass	% DFEE<TFEE	0.65		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 62 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.32 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.07 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)34.7 kWh/m²/yrOK

2 Fabric U-values
Element          Average              Highest
External wall    0.17 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall       0.00 (max. 0.20)     -                         OK
Floor            (no floor)
Roof             (no roof)
Openings         1.31 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                  No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.42
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing South East:           10.98 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	62.2000 (1b)	x	2.5000 (2b)	=	155.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	155.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.3500 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			10.9800	1.3258	14.5568			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	24.6800	10.9800	13.7000	0.1800	2.4660			(29a)
Wall to CA	36.7000	2.1200	34.5800	0.1671	5.7772			(29a)
Total net area of external elements Aum(A, m2)			61.3800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.5385			(33)
Party Wall 1			19.9500	0.0000	0.0000			(32)
Party Floor 1			62.2000					(32d)
Party Ceilings 1			62.2000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.8756	(36)
Total fabric heat loss (33) + (36) =	32.4141	(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	13.4173	13.2681	13.1190	12.3733	12.2242	11.4785	11.4785	11.3294	11.7768	12.2242	12.5225	12.8207	(38)
Heat transfer coeff	45.8313	45.6822	45.5331	44.7874	44.6383	43.8926	43.8926	43.7434	44.1909	44.6383	44.9365	45.2348	(39)
Average = Sum(39)m / 12 =												44.7501	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7368	0.7344	0.7320	0.7201	0.7177	0.7057	0.7057	0.7033	0.7105	0.7177	0.7225	0.7272	(40)
HLP (average)												0.7195	(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	2.0431 (42)
Average daily hot water use (litres/day)	82.7237 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.9961	87.6872	84.3782	81.0693	77.7603	74.4514	74.4514	77.7603	81.0693	84.3782	87.6872	90.9961	(44)
Energy conte	134.9446	118.0234	121.7896	106.1791	101.8814	87.9159	81.4670	93.4846	94.6011	110.2484	120.3448	130.6866	(45)
Energy content (annual)											Total = Sum(45)m =	1301.5665	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	20.2417	17.7035	18.2684	15.9269	15.2822	13.1874	12.2200	14.0227	14.1902	16.5373	18.0517	19.6030	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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													
	164.9423	145.1181	151.7873	135.2091	131.8791	116.9459	111.4647	123.4823	123.6311	140.2461	149.3748	160.6843	(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	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	164.9423	145.1181	151.7873	135.2091	131.8791	116.9459	111.4647	123.4823	123.6311	140.2461	149.3748	160.6843	(64)
										Total per year (kWh/year) = Sum(64)m =		1654.7651	(64)
Heat gains from water heating, kWh/month													
	68.8672	60.9185	64.4932	58.5286	57.8737	52.4561	51.0859	55.0818	54.6789	60.6558	63.2387	67.4515	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.3014	14.4788	11.7749	8.9144	6.6636	5.6257	6.0788	7.9014	10.6053	13.4658	15.7166	16.7545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	178.4593	180.3112	175.6446	165.7099	153.1692	141.3827	133.5086	131.6568	136.3234	146.2580	158.7987	170.5852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	(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)													
	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	(71)
Water heating gains (Table 5)													
	92.5635	90.6526	86.6844	81.2897	77.7873	72.8556	68.6639	74.0346	75.9429	81.5266	87.8315	90.6606	(72)
Total internal gains													
	340.9708	339.0891	327.7505	309.5606	291.2667	273.5106	261.8979	267.2394	276.5181	294.8970	315.9934	331.6469	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.9800	36.7938	0.4000	0.7000	0.7700	78.3914	(77)

Solar gains	78.3914	133.5296	182.7011	226.3755	253.5594	251.7258	242.6905	222.4101	197.8266	147.5787	93.8949	67.0867	(83)
Total gains	419.3622	472.6187	510.4515	535.9360	544.8260	525.2364	504.5884	489.6495	474.3447	442.4756	409.8882	398.7336	(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, n1,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	94.2465	94.5542	94.8639	96.4433	96.7655	98.4094	98.4094	98.7449	97.7452	96.7655	96.1232	95.4894	
alpha	7.2831	7.3036	7.3243	7.4296	7.4510	7.5606	7.5606	7.5830	7.5163	7.4510	7.4082	7.3660	
util living area	0.9943	0.9855	0.9610	0.8862	0.7354	0.5326	0.3826	0.4107	0.6343	0.9017	0.9844	0.9959	(86)
MIT	20.4311	20.5594	20.7226	20.8903	20.9762	20.9981	20.9999	20.9998	20.9934	20.8931	20.6379	20.4064	(87)
Th 2	20.3084	20.3105	20.3126	20.3232	20.3253	20.3358	20.3358	20.3379	20.3316	20.3253	20.3210	20.3168	(88)
util rest of house	0.9926	0.9814	0.9504	0.8599	0.6902	0.4784	0.3249	0.3517	0.5764	0.8731	0.9793	0.9946	(89)
MIT 2	19.5493	19.7359	19.9685	20.2014	20.3037	20.3346	20.3358	20.3378	20.3269	20.2105	19.8589	19.5203	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	19.9796	20.1377	20.3365	20.5375	20.6319	20.6584	20.6598	20.6608	20.6521	20.5436	20.2390	19.9527	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9796	20.1377	20.3365	20.5375	20.6319	20.6584	20.6598	20.6608	20.6521	20.5436	20.2390	19.9527	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9802	0.9508	0.8687	0.7112	0.5048	0.3531	0.3805	0.6045	0.8830	0.9785	0.9938	(94)
Useful gains	415.8660	463.2708	485.3603	465.5864	387.4602	265.1504	178.1515	186.3072	286.7410	390.7268	401.0867	396.2751	(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	718.6169	696.0934	630.0160	521.2142	398.7032	265.9169	178.1956	186.3833	289.5432	443.8633	590.4205	712.5690	(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	225.2467	156.4568	107.6239	40.0520	8.3648	0.0000	0.0000	0.0000	0.0000	39.5336	136.3203	235.3227	(98)
Space heating												948.9207	(98)
Space heating per m2											(98) / (4) =	15.2560	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	1.0000 (303a)
Fraction of total space heat from community Boilers	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	948.9207 (98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	996.3667 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1654.7651 (64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1737.5034 (310a)
Electricity used for heat distribution	27.3387 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	99.5978 (330a)
Total electricity for the above, kWh/year	99.5978 (331)
Electricity for lighting (calculated in Appendix L)	287.8882 (332)
Total delivered energy for all uses	3121.3561 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	3054.6035	0.2160	659.7944	(367)
Electrical energy for heat distribution	27.3387	0.5190	14.1888	(372)
Total CO2 associated with community systems			673.9831	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			673.9831	(376)
Pumps and fans	99.5978	0.5190	51.6912	(378)
Energy for lighting	287.8882	0.5190	149.4140	(379)
Total CO2, kg/year			875.0884	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0700	(384)

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

DER		14.0700	ZC1
Total Floor Area	TFA	62.2000	
Assumed number of occupants	N	2.0431	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0018	ZC2
CO2 emissions from cooking, equation (L16)		2.7015	ZC3
Total CO2 emissions		33.7733	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.7733	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.2000 (1b)	x	2.5000 (2b)	=	155.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	155.5000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =							20.0000 / (5) =	0.1286	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.3786	(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) =	0.2934	(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													
	0.3741	0.3668	0.3594	0.3228	0.3154	0.2788	0.2788	0.2714	0.2934	0.3154	0.3301	0.3448	(22b)
Effective ac	0.5700	0.5673	0.5646	0.5521	0.5497	0.5389	0.5389	0.5368	0.5431	0.5497	0.5545	0.5594	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			10.9800	1.3258	14.5568			(27)
External Wall	24.6800	10.9800	13.7000	0.1800	2.4660			(29a)
Wall to CA	36.7000	2.1200	34.5800	0.1800	6.2244			(29a)
Total net area of external elements Aum(A, m2)			61.3800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.3672			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2265	(36)
Total fabric heat loss						(33) + (36) =	30.5937	(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	29.2487	29.1092	28.9726	28.3305	28.2104	27.6512	27.6512	27.5477	27.8666	28.2104	28.4534	28.7075	(38)
Heat transfer coeff													
	59.8424	59.7030	59.5663	58.9243	58.8041	58.2449	58.2449	58.1414	58.4603	58.8041	59.0471	59.3012	(39)
Average = Sum(39)m / 12 =												58.9237	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9621	0.9599	0.9577	0.9473	0.9454	0.9364	0.9364	0.9347	0.9399	0.9454	0.9493	0.9534	(40)
HLP (average)												0.9473	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0431 (42)
Average daily hot water use (litres/day)	82.7237 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	90.9961	87.6872	84.3782	81.0693	77.7603	74.4514	74.4514	77.7603	81.0693	84.3782	87.6872	90.9961	(44)
Energy conte	134.9446	118.0234	121.7896	106.1791	101.8814	87.9159	81.4670	93.4846	94.6011	110.2484	120.3448	130.6866	(45)
Energy content (annual)										Total = Sum(45)m =		1301.5665	(45)
Distribution loss (46)m = 0.15 x (45)m													
	20.2417	17.7035	18.2684	15.9269	15.2822	13.1874	12.2200	14.0227	14.1902	16.5373	18.0517	19.6030	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage													
	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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													
	162.5623	142.9684	149.4073	132.9059	129.4991	114.6427	109.0847	121.1022	121.3279	137.8661	147.0716	158.3043	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.5623	142.9684	149.4073	132.9059	129.4991	114.6427	109.0847	121.1022	121.3279	137.8661	147.0716	158.3043	(64)
								Total per year (kWh/year) = Sum(64)m =				1626.7423	(64)
Heat gains from water heating, kWh/month													
	66.9632	59.1988	62.5892	56.6860	55.9697	50.6135	49.1819	53.1778	52.8363	58.7517	61.3961	65.5474	(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	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.3014	14.4788	11.7749	8.9144	6.6636	5.6257	6.0788	7.9014	10.6053	13.4658	15.7166	16.7545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	178.4593	180.3112	175.6446	165.7099	153.1692	141.3827	133.5086	131.6568	136.3234	146.2580	158.7987	170.5852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	(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)													
	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	(71)
Water heating gains (Table 5)													
	90.0043	88.0934	84.1252	78.7305	75.2281	70.2965	66.1047	71.4755	73.3837	78.9674	85.2723	88.1014	(72)
Total internal gains													
	341.4116	339.5299	328.1913	310.0014	291.7075	273.9515	262.3387	267.6803	276.9589	295.3378	316.4342	332.0877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.9800	36.7938	0.6300	0.7000	0.7700	123.4665	(77)
Solar gains	123.4665	210.3092	287.7542	356.5413	399.3560	396.4681	382.2376	350.2959	311.5769	232.4364	147.8844	105.6616	(83)
Total gains	464.8782	549.8391	615.9455	666.5428	691.0635	670.4196	644.5763	617.9761	588.5358	527.7742	464.3186	437.7493	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.1803	72.3489	72.5149	73.3050	73.4548	74.1600	74.1600	74.2921	73.8868	73.4548	73.1525	72.8391	
alpha	5.8120	5.8233	5.8343	5.8870	5.8970	5.9440	5.9440	5.9528	5.9258	5.8970	5.8768	5.8559	
util living area													
	0.9937	0.9831	0.9557	0.8820	0.7395	0.5484	0.3966	0.4311	0.6606	0.9099	0.9844	0.9954	(86)
MIT	20.1598	20.3420	20.5696	20.8038	20.9438	20.9919	20.9990	20.9984	20.9771	20.7940	20.4301	20.1223	(87)
Th 2	20.1150	20.1169	20.1188	20.1275	20.1291	20.1367	20.1367	20.1381	20.1337	20.1291	20.1258	20.1224	(88)
util rest of house													
	0.9918	0.9781	0.9431	0.8516	0.6855	0.4778	0.3193	0.3512	0.5874	0.8793	0.9789	0.9940	(89)
MIT 2	19.0036	19.2677	19.5909	19.9117	20.0786	20.1317	20.1363	20.1374	20.1176	19.9079	19.4037	18.9547	(90)
Living area fraction									fLA = Living area / (4) =			0.4879	(91)
MIT	19.5678	19.7919	20.0684	20.3470	20.5008	20.5514	20.5572	20.5575	20.5370	20.3403	19.9045	19.5244	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5678	19.7919	20.0684	20.3470	20.5008	20.5514	20.5572	20.5575	20.5370	20.3403	19.9045	19.5244	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9759	0.9422	0.8598	0.7093	0.5120	0.3571	0.3903	0.6223	0.8876	0.9772	0.9928	(94)
Useful gains	460.3340	536.5619	580.3572	573.1107	490.1850	343.2866	230.1610	241.1717	366.2698	468.4276	453.7421	434.5791	(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													
	913.6608	889.0911	808.2212	674.5066	517.5216	346.6400	230.4891	241.7235	376.3087	572.7706	756.0681	908.7555	(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													
	337.2751	236.8996	169.5308	73.0051	20.3384	0.0000	0.0000	0.0000	0.0000	77.6312	217.6747	352.7873	(98)
Space heating												1485.1423	(98)
Space heating per m2											(98) / (4) =	23.8769	(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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1588.3875	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	337.2751	236.8996	169.5308	73.0051	20.3384	0.0000	0.0000	0.0000	0.0000	77.6312	217.6747	352.7873	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	360.7221	253.3686	181.3164	78.0803	21.7523	0.0000	0.0000	0.0000	0.0000	83.0280	232.8072	377.3126	(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													
	162.5623	142.9684	149.4073	132.9059	129.4991	114.6427	109.0847	121.1022	121.3279	137.8661	147.0716	158.3043	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.7183	86.1523	85.1514	83.2915	81.1016	79.8000	79.8000	79.8000	79.8000	83.3501	85.8581	86.8913	(217)
Fuel for water heating, kWh/month													
	187.4601	165.9484	175.4607	159.5672	159.6752	143.6625	136.6976	151.7572	152.0399	165.4061	171.2962	182.1866	(219)
Water heating fuel used												1951.1576	(219)
Annual totals kWh/year													
Space heating fuel - main system												1588.3875	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												287.8882	(232)
Total delivered energy for all uses												3902.4333	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1588.3875	0.2160	343.0917	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1951.1576	0.2160	421.4500	(264)
Space and water heating			764.5417	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	287.8882	0.5190	149.4140	(268)
Total CO2, kg/m2/year			952.8807	(272)
Emissions per m2 for space and water heating			12.2917	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4022	(272b)
Emissions per m2 for pumps and fans			0.6258	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.2917 * 1.00) + 2.4022 + 0.6258, rounded to 2 d.p.			15.3200	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	006 BlcE2-2B4P-03281	**Issued on Date**	10/07/2020
Assessment Reference	2B4P MF Be Lean	**Prop Type Ref**	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	85 B	**DER**	14.83	**TER**	15.44
Environmental	89 B	**% DER<TER**	3.96		
CO_2 Emissions (t/year)	0.88	**DFEE**	40.90	**TFEE**	40.67
General Requirements Compliance	Fail	**% DFEE<TFEE**	-0.58		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

Mid-floor flat, total floor area 75 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.44 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.83 kgCO□/m²OK
-----------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)40.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.9 kWh/m²/yrFail
Excess energy =0.2 kWh/m²/yr  (0.5%)
-----------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.17 (max. 0.30)        0.18 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           (no floor)
Roof            (no roof)
Openings        1.34 (max. 2.00)        1.40 (max. 3.30)          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                                 10.0                                          OK
-----------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Community heating scheme                      -

Secondary heating system:               None
-----------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                          OK
Primary pipework insulated:             No primary pipework
-----------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Charging system linked to use of community heating, programmer and at least two room statsOK


Hot water controls:                     No cylinderstat


-----------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                           OK
-----------------------------------------------------------------------------------------------
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                     0.44
Maximum                                 1.5                                           OK
MVHR efficiency:                        91%
Minimum:                                70%                                           OK
-----------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Midlands):            Medium                                        OK
Based on:
Overshading:                            Average
Windows facing North East:              6.00 m², No overhang
Windows facing South East:              12.90 m², No overhang
Air change rate:                        2.00 ach
Blinds/curtains:                        None
-----------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Door U-value                            0.82 W/m²K
Air permeability                        3.0 m³/m²h



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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	75.0000 (1b)	x	2.5000 (2b)	=	187.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.3500 (23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			18.9000	1.3258	25.0568			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	46.0800	18.9000	27.1800	0.1800	4.8924			(29a)
Wall to CA	30.6800	2.1200	28.5600	0.1671	4.7715			(29a)
Total net area of external elements Aum(A, m2)			76.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.4591			(33)
Party Wall 1			20.0500	0.0000	0.0000			(32)
Party Floor 1			75.0000					(32d)
Party Ceilings 1			75.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1164	(36)
Total fabric heat loss (33) + (36) =	46.5755	(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	17.0659	16.8687	16.6714	15.6853	15.4881	14.5020	14.5020	14.3047	14.8964	15.4881	15.8825	16.2770	(38)
Heat transfer coeff	63.6414	63.4442	63.2470	62.2608	62.0636	61.0775	61.0775	60.8802	61.4719	62.0636	62.4580	62.8525	(39)

Average = Sum(39)m / 12 = 62.2115 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8486	0.8459	0.8433	0.8301	0.8275	0.8144	0.8144	0.8117	0.8196	0.8275	0.8328	0.8380	(40)
HLP (average)												0.8295	(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	2.3612 (42)
Average daily hot water use (litres/day)	90.2775 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3053	95.6942	92.0831	88.4720	84.8609	81.2498	81.2498	84.8609	88.4720	92.0831	95.6942	99.3053	(44)
Energy conte	147.2668	128.8005	132.9106	115.8747	111.1845	95.9438	88.9060	102.0210	103.2394	120.3156	131.3339	142.6201	(45)
Energy content (annual)										Total = Sum(45)m =		1420.4168	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	22.0900	19.3201	19.9366	17.3812	16.6777	14.3916	13.3359	15.3031	15.4859	18.0473	19.7001	21.3930	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	177.2645	155.8952	162.9083	144.9047	141.1822	124.9738	118.9037	132.0186	132.2694	150.3133	160.3639	172.6178	(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	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h	177.2645	155.8952	162.9083	144.9047	141.1822	124.9738	118.9037	132.0186	132.2694	150.3133	160.3639	172.6178	(64)
									Total per year (kWh/year) = Sum(64)m =			1773.6154	(64)
Heat gains from water heating, kWh/month	72.9644	64.5019	68.1909	61.7524	60.9670	55.1253	53.5594	57.9201	57.5511	64.0031	66.8925	71.4193	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6035	16.5235	13.4378	10.1733	7.6046	6.4202	6.9372	9.0173	12.1029	15.3675	17.9361	19.1206	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	208.6751	210.8404	205.3837	193.7670	179.1030	165.3209	156.1136	153.9482	159.4049	171.0216	185.6856	199.4678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	(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)	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	(71)
Water heating gains (Table 5)	98.0704	95.9850	91.6545	85.7672	81.9449	76.5630	71.9884	77.8496	79.9321	86.0256	92.9063	95.9937	(72)
Total internal gains	383.7664	381.7663	368.8934	348.1248	327.0699	306.7214	293.4566	299.2324	309.8573	330.8321	354.9454	372.9994	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.0000	11.2829	0.4000	0.7000	0.7700	13.1361	(75)
Southeast	12.9000	36.7938	0.4000	0.7000	0.7700	92.0992	(77)

Solar gains	105.2353	183.6179	262.8236	345.0772	404.2463	409.1223	391.1919	345.8567	291.1210	206.0617	126.8422	89.5453	(83)
Total gains	489.0016	565.3842	631.7170	693.2020	731.3162	715.8437	684.6485	645.0891	600.9784	536.8939	481.7876	462.5447	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.8388	82.0932	82.3492	83.6535	83.9193	85.2742	85.2742	85.5505	84.7270	83.9193	83.3893	82.8660	
alpha	6.4559	6.4729	6.4899	6.5769	6.5946	6.6849	6.6849	6.7034	6.6485	6.5946	6.5593	6.5244	
util living area	0.9964	0.9902	0.9705	0.9012	0.7474	0.5417	0.3921	0.4332	0.6838	0.9337	0.9905	0.9974	(86)
MIT	20.2374	20.3881	20.5968	20.8290	20.9593	20.9958	20.9996	20.9992	20.9824	20.8082	20.4804	20.2106	(87)
Th 2	20.2115	20.2137	20.2160	20.2273	20.2296	20.2409	20.2409	20.2432	20.2364	20.2296	20.2250	20.2205	(88)
util rest of house	0.9953	0.9872	0.9617	0.8754	0.6979	0.4794	0.3247	0.3624	0.6168	0.9100	0.9871	0.9966	(89)
MIT 2	19.1908	19.4110	19.7110	20.0356	20.1926	20.2383	20.2407	20.2428	20.2236	20.0170	19.5551	19.1589	(90)
Living area fraction										fLA = Living area / (4) =		0.4516	(91)
MIT	19.6634	19.8523	20.1110	20.3939	20.5388	20.5804	20.5834	20.5844	20.5663	20.3743	19.9730	19.6338	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6634	19.8523	20.1110	20.3939	20.5388	20.5804	20.5834	20.5844	20.5663	20.3743	19.9730	19.6338	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9855	0.9604	0.8814	0.7184	0.5075	0.3551	0.3944	0.6464	0.9150	0.9858	0.9958	(94)
Useful gains	486.1965	557.1978	606.6900	610.9998	525.3744	363.2631	243.1424	254.4442	388.4945	491.2561	474.9321	460.6086	(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	977.7515	948.6336	860.8566	715.6183	548.5680	365.2659	243.2979	254.7486	397.4938	606.6294	804.0211	970.0552	(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	365.7169	263.0449	189.0999	75.3253	17.2561	0.0000	0.0000	0.0000	0.0000	85.8378	236.9441	379.0283	(98)
Space heating												1612.2532	(98)
Space heating per m2											(98) / (4) =	21.4967	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1612.2532	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	1692.8658	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1773.6154	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1862.2962	(310a)
Electricity used for heat distribution	35.5516	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	125.8125	(330a)
Total electricity for the above, kWh/year	125.8125	(331)
Electricity for lighting (calculated in Appendix L)	328.5442	(332)
Total delivered energy for all uses	4009.5187	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	3972.2481	0.2160	858.0056	(367)
Electrical energy for heat distribution	35.5516	0.5190	18.4513	(372)
Total CO2 associated with community systems			876.4569	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			876.4569	(376)
Pumps and fans	125.8125	0.5190	65.2967	(378)
Energy for lighting	328.5442	0.5190	170.5144	(379)
Total CO2, kg/year			1112.2680	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8300	(384)

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

DER		14.8300	ZC1
Total Floor Area	TFA	75.0000	
Assumed number of occupants	N	2.3612	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4875	ZC2
CO2 emissions from cooking, equation (L16)		2.3422	ZC3
Total CO2 emissions		33.6598	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.6598	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.0000 (1b)	x	2.5000 (2b)	=	187.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.5000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4100	(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) =	0.3485	(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	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.6300	1.3258	22.0473			(27)
External Wall	46.0800	16.6300	29.4500	0.1800	5.3010			(29a)
Wall to CA	30.6800	2.1200	28.5600	0.1800	5.1408			(29a)
Total net area of external elements Aum(A, m2)			76.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.6091			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3975	(36)
Total fabric heat loss					(33) + (36) =		41.0066	(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	37.0457	36.8085	36.5760	35.4840	35.2797	34.3286	34.3286	34.1525	34.6949	35.2797	35.6930	36.1251	(38)
Heat transfer coeff	78.0523	77.8151	77.5826	76.4906	76.2863	75.3352	75.3352	75.1591	75.7016	76.2863	76.6996	77.1317	(39)
Average = Sum(39)m / 12 =												76.4897	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0407	1.0375	1.0344	1.0199	1.0172	1.0045	1.0045	1.0021	1.0094	1.0172	1.0227	1.0284	(40)
HLP (average)												1.0199	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3612	(42)
Average daily hot water use (litres/day)	90.2775	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3053	95.6942	92.0831	88.4720	84.8609	81.2498	81.2498	84.8609	88.4720	92.0831	95.6942	99.3053	(44)
Energy conte	147.2668	128.8005	132.9106	115.8747	111.1845	95.9438	88.9060	102.0210	103.2394	120.3156	131.3339	142.6201	(45)
Energy content (annual)										Total = Sum(45)m =		1420.4168	(45)
Distribution loss (46)m = 0.15 x (45)m	22.0900	19.3201	19.9366	17.3812	16.6777	14.3916	13.3359	15.3031	15.4859	18.0473	19.7001	21.3930	(46)

Water storage loss:		
Store volume	3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	0.2602	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.1405	(55)
Total storage loss		

	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage													
	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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													
	174.8845	153.7455	160.5283	142.6015	138.8022	122.6706	116.5237	129.6386	129.9662	147.9332	158.0606	170.2377	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.8845	153.7455	160.5283	142.6015	138.8022	122.6706	116.5237	129.6386	129.9662	147.9332	158.0606	170.2377	(64)
								Total per year (kWh/year) = Sum(64)m =				1745.5926	(64)
Heat gains from water heating, kWh/month													
	71.0604	62.7822	66.2869	59.9098	59.0630	53.2827	51.6554	56.0161	55.7085	62.0991	65.0499	69.5153	(65)

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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	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	18.6058	16.5255	13.4395	10.1745	7.6056	6.4210	6.9381	9.0184	12.1044	15.3693	17.9383	19.1229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	208.6751	210.8404	205.3837	193.7670	179.1030	165.3209	156.1136	153.9482	159.4049	171.0216	185.6856	199.4678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	(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)													
	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	(71)
Water heating gains (Table 5)													
	95.5112	93.4258	89.0953	83.2080	79.3857	74.0038	69.4293	75.2905	77.3730	83.4665	90.3471	93.4346	(72)
Total internal gains													
	384.2095	382.2092	369.3359	348.5669	327.5117	307.1630	293.8983	299.6744	310.2997	331.2748	355.3884	373.4426	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.2800	11.2829	0.6300	0.7000	0.7700	18.2066	(75)
Southeast	11.3500	36.7938	0.6300	0.7000	0.7700	127.6270	(77)
Solar gains	145.8336	254.4561	364.2211	478.2120	560.2126	566.9713	542.1223	479.2935	403.4370	285.5592	175.7764	124.0906	(83)
Total gains	530.0431	636.6653	733.5570	826.7789	887.7243	874.1343	836.0206	778.9679	713.7366	616.8341	531.1648	497.5332	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.7287	66.9321	67.1327	68.0911	68.2735	69.1354	69.1354	69.2974	68.8009	68.2735	67.9056	67.5252	
alpha	5.4486	5.4621	5.4755	5.5394	5.5516	5.6090	5.6090	5.6198	5.5867	5.5516	5.5270	5.5017	
util living area													
	0.9956	0.9877	0.9643	0.8906	0.7391	0.5426	0.3952	0.4413	0.6925	0.9319	0.9892	0.9968	(86)
MIT	20.0088	20.2023	20.4658	20.7573	20.9316	20.9899	20.9986	20.9974	20.9639	20.7195	20.3069	19.9757	(87)
Th 2	20.0496	20.0522	20.0547	20.0668	20.0691	20.0796	20.0796	20.0816	20.0755	20.0691	20.0645	20.0597	(88)
util rest of house													
	0.9942	0.9838	0.9534	0.8605	0.6826	0.4685	0.3132	0.3545	0.6147	0.9057	0.9852	0.9958	(89)
MIT 2	18.7353	19.0173	19.3948	19.7988	20.0080	20.0735	20.0791	20.0806	20.0499	19.7614	19.1800	18.6946	(90)
Living area fraction									fLA = Living area / (4) =			0.4516	(91)
MIT	19.3104	19.5524	19.8785	20.2316	20.4251	20.4873	20.4943	20.4946	20.4627	20.1941	19.6889	19.2731	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3104	19.5524	19.8785	20.2316	20.4251	20.4873	20.4943	20.4946	20.4627	20.1941	19.6889	19.2731	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9813	0.9510	0.8664	0.7051	0.5018	0.3503	0.3938	0.6485	0.9097	0.9831	0.9946	(94)
Useful gains	526.1658	624.7291	697.5978	716.2803	625.9183	438.6080	292.8442	306.7376	462.8481	561.1576	522.1976	494.8539	(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													
	1171.5971	1140.1794	1037.9383	866.7634	665.6029	443.5237	293.3803	307.7474	481.6630	731.8978	965.5640	1162.6172	(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													
	480.2009	346.3826	253.2134	108.3478	29.5253	0.0000	0.0000	0.0000	0.0000	127.0307	319.2238	496.8158	(98)
Space heating												2160.7404	(98)
Space heating per m2											(98) / (4) =	28.8099	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2310.9523	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	480.2009	346.3826	253.2134	108.3478	29.5253	0.0000	0.0000	0.0000	0.0000	127.0307	319.2238	496.8158	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	513.5838	370.4627	270.8164	115.8800	31.5779	0.0000	0.0000	0.0000	0.0000	135.8618	341.4159	531.3538	(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													
	174.8845	153.7455	160.5283	142.6015	138.8022	122.6706	116.5237	129.6386	129.9662	147.9332	158.0606	170.2377	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.3724	86.9173	86.0247	84.0927	81.4900	79.8000	79.8000	79.8000	79.8000	84.4107	86.6522	87.5056	(217)
Fuel for water heating, kWh/month													
	200.1599	176.8871	186.6073	169.5766	170.3304	153.7225	146.0197	162.4544	162.8649	175.2542	182.4080	194.5450	(219)
Water heating fuel used												2080.8298	(219)
Annual totals kWh/year													
Space heating fuel - main system												2310.9523	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												328.5844	(232)
Total delivered energy for all uses												4795.3665	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2310.9523	0.2160	499.1657	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2080.8298	0.2160	449.4592	(264)
Space and water heating			948.6249	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	328.5844	0.5190	170.5353	(268)
Total CO2, kg/m2/year			1158.0852	(272)
Emissions per m2 for space and water heating			12.6483	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2738	(272b)
Emissions per m2 for pumps and fans			0.5190	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6483 * 1.00) + 2.2738 + 0.5190, rounded to 2 d.p.			15.4400	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	007 BlcB1-2B4P-03281	Issued on Date	10/07/2020
Assessment Reference	2B4P MF Be Lean	Prop Type Ref	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	85 B	DER	14.74	TER	16.15
Environmental	89 B	% DER<TER	8.75		
CO_2 Emissions (t/year)	0.92	DFEE	42.13	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	7.28		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 81 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.15 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.74 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)45.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values
Element          Average              Highest
External wall    0.17 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall       0.00 (max. 0.20)     -                         OK
Floor            (no floor)
Roof             (no roof)
Openings         1.33 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK


Hot water controls:                  No cylinderstat


7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.42
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing North East:           16.25 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	80.9000 (1b)	x	2.5000 (2b)	=	202.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.3500 (23c)

Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			16.2500	1.3258	21.5436			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	39.7000	16.2500	23.4500	0.1800	4.2210			(29a)
Wall to CA	41.3000	2.1200	39.1800	0.1671	6.5458			(29a)
Total net area of external elements Aum(A, m2)			81.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.0487			(33)
Party Wall 1			26.5000	0.0000	0.0000			(32)
Party Floor 1			80.9000					(32d)
Party Ceilings 1			80.9000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.1020 (36)
Total fabric heat loss	(33) + (36) =	44.1507 (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	17.4511	17.2571	17.0631	16.0933	15.8993	14.9295	14.9295	14.7355	15.3174	15.8993	16.2873	16.6752	(38)
Heat transfer coeff	61.6018	61.4078	61.2139	60.2440	60.0500	59.0802	59.0802	58.8862	59.4681	60.0500	60.4380	60.8259	(39)

Average = Sum(39)m / 12 = 60.1955 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7615	0.7591	0.7567	0.7447	0.7423	0.7303	0.7303	0.7279	0.7351	0.7423	0.7471	0.7519	(40)
HLP (average)												0.7441	(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	2.4797 (42)
Average daily hot water use (litres/day)	93.0933 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.4026	98.6788	94.9551	91.2314	87.5077	83.7839	83.7839	87.5077	91.2314	94.9551	98.6788	102.4026	(44)
Energy conte	151.8601	132.8178	137.0561	119.4888	114.6523	98.9362	91.6790	105.2030	106.4594	124.0682	135.4301	147.0684	(45)
Energy content (annual)											Total = Sum(45)m =	1464.7193	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	22.7790	19.9227	20.5584	17.9233	17.1979	14.8404	13.7518	15.7804	15.9689	18.6102	20.3145	22.0603	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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													
	181.8578	159.9125	167.0537	148.5188	144.6500	127.9663	121.6767	135.2007	135.4895	154.0659	164.4602	177.0661	(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	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	181.8578	159.9125	167.0537	148.5188	144.6500	127.9663	121.6767	135.2007	135.4895	154.0659	164.4602	177.0661	(64)
										Total per year (kWh/year) = Sum(64)m =		1817.9180	(64)
Heat gains from water heating, kWh/month													
	74.4916	65.8377	69.5693	62.9540	62.1201	56.1203	54.4814	58.9781	58.6218	65.2508	68.2545	72.8984	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.8602	17.6397	14.3455	10.8605	8.1183	6.8539	7.4058	9.6264	12.9205	16.4055	19.1477	20.4122	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.3112	223.6078	217.8206	205.5004	189.9485	175.3318	165.5669	163.2704	169.0576	181.3777	196.9297	211.5464	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	(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)													
	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	(71)
Water heating gains (Table 5)													
	100.1232	97.9727	93.5071	87.4362	83.4947	77.9449	73.2277	79.2717	81.4191	87.7027	94.7980	97.9817	(72)
Total internal gains													
	401.4903	399.4159	385.8690	363.9928	341.7572	320.3263	306.3962	312.3642	323.5929	345.6817	371.0711	390.1360	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.2500	11.2829	0.4000	0.7000	0.7700	35.5768	(75)
Solar gains	35.5768	72.4176	130.4735	214.2750	288.0276	307.0679	287.2558	229.0036	158.9840	88.5001	44.7648	29.0538	(83)
Total gains	437.0671	471.8335	516.3425	578.2678	629.7849	627.3942	593.6520	541.3679	482.5770	434.1818	415.8360	419.1898	(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, nil,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	91.1995	91.4876	91.7775	93.2550	93.5562	95.0920	95.0920	95.4053	94.4717	93.5562	92.9557	92.3629	
alpha	7.0800	7.0992	7.1185	7.2170	7.2371	7.3395	7.3395	7.3604	7.2981	7.2371	7.1970	7.1575	
util living area	0.9987	0.9973	0.9910	0.9543	0.8198	0.5968	0.4373	0.4988	0.7976	0.9769	0.9968	0.9990	(86)
MIT	20.2601	20.3524	20.5300	20.7780	20.9471	20.9953	20.9996	20.9990	20.9681	20.7487	20.4668	20.2451	(87)
Th 2	20.2869	20.2890	20.2911	20.3015	20.3036	20.3142	20.3142	20.3163	20.3099	20.3036	20.2994	20.2952	(88)
util rest of house	0.9982	0.9964	0.9880	0.9397	0.7766	0.5354	0.3695	0.4255	0.7367	0.9667	0.9956	0.9987	(89)
MIT 2	19.2832	19.4196	19.6793	20.0381	20.2531	20.3111	20.3140	20.3158	20.2846	20.0043	19.5953	19.2680	(90)
Living area fraction										fLA = Living area / (4) =		0.4405	(91)
MIT	19.7135	19.8305	20.0540	20.3641	20.5588	20.6125	20.6160	20.6168	20.5857	20.3323	19.9792	19.6984	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7135	19.8305	20.0540	20.3641	20.5588	20.6125	20.6160	20.6168	20.5857	20.3323	19.9792	19.6984	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9956	0.9868	0.9412	0.7932	0.5624	0.3994	0.4579	0.7622	0.9672	0.9949	0.9983	(94)
Useful gains	436.0945	469.7744	509.5330	544.2415	499.5426	352.8315	237.0969	247.8751	367.8201	419.9575	413.6977	418.4846	(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	949.5020	916.8524	829.6949	690.6419	531.9730	355.2218	237.2670	248.3092	385.6910	584.4231	778.3941	942.7066	(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	381.9751	300.4365	238.2005	105.4083	24.1282	0.0000	0.0000	0.0000	0.0000	122.3625	262.5814	390.0212	(98)
Space heating												1825.1136	(98)
Space heating per m2											(98) / (4) =	22.5601	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1825.1136	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	1916.3693	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1817.9180	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1908.8139	(310a)
Electricity used for heat distribution	38.2518	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	129.5411	(330a)
Total electricity for the above, kWh/year	129.5411	(331)
Electricity for lighting (calculated in Appendix L)	350.7375	(332)
Total delivered energy for all uses	4305.4618	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	4273.9477	0.2160	923.1727	(367)
Electrical energy for heat distribution	38.2518	0.5190	19.8527	(372)
Total CO2 associated with community systems			943.0254	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			943.0254	(376)
Pumps and fans	129.5411	0.5190	67.2318	(378)
Energy for lighting	350.7375	0.5190	182.0328	(379)
Total CO2, kg/year			1192.2900	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7400	(384)

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

DER		14.7400	ZC1
Total Floor Area	TFA	80.9000	
Assumed number of occupants	N	2.4797	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2107	ZC2
CO2 emissions from cooking, equation (L16)		2.2066	ZC3
Total CO2 emissions		33.1573	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.1573	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.9000 (1b)	x	2.5000 (2b)	=	202.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.2500	(5)

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2. Ventilation rate
---

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1483	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3983	(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) =	0.3087	(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													
	0.3936	0.3859	0.3782	0.3396	0.3319	0.2933	0.2933	0.2856	0.3087	0.3319	0.3473	0.3627	(22b)
Effective ac	0.5775	0.5745	0.5715	0.5577	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.2500	1.3258	21.5436			(27)
External Wall	39.7000	16.2500	23.4500	0.1800	4.2210			(29a)
Wall to CA	41.3000	2.1200	39.1800	0.1800	7.0524			(29a)
Total net area of external elements Aum(A, m2)			81.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.9370			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7965	(36)
Total fabric heat loss					(33) + (36) =		41.7335	(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	38.5412	38.3404	38.1437	37.2194	37.0465	36.2414	36.2414	36.0924	36.5515	37.0465	37.3963	37.7620	(38)
Heat transfer coeff													
	80.2746	80.0739	79.8771	78.9528	78.7799	77.9749	77.9749	77.8258	78.2850	78.7799	79.1297	79.4955	(39)
Average = Sum(39)m / 12 =												78.9520	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9923	0.9898	0.9874	0.9759	0.9738	0.9638	0.9638	0.9620	0.9677	0.9738	0.9781	0.9826	(40)
HLP (average)												0.9759	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4797	(42)
Average daily hot water use (litres/day)	93.0933	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	102.4026	98.6788	94.9551	91.2314	87.5077	83.7839	83.7839	87.5077	91.2314	94.9551	98.6788	102.4026	(44)
Energy conte	151.8601	132.8178	137.0561	119.4888	114.6523	98.9362	91.6790	105.2030	106.4594	124.0682	135.4301	147.0684	(45)
Energy content (annual)										Total = Sum(45)m =		1464.7193	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.7790	19.9227	20.5584	17.9233	17.1979	14.8404	13.7518	15.7804	15.9689	18.6102	20.3145	22.0603	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	179.4777	157.7628	164.6737	146.2156	142.2700	125.6630	119.2967	132.8206	133.1862	151.6859	162.1569	174.6860	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	179.4777	157.7628	164.6737	146.2156	142.2700	125.6630	119.2967	132.8206	133.1862	151.6859	162.1569	174.6860	(64)
Total per year (kWh/year) = Sum(64)m =												1789.8952	(64)
Heat gains from water heating, kWh/month	72.5876	64.1179	67.6653	61.1114	60.2160	54.2777	52.5774	57.0741	56.7792	63.3468	66.4119	70.9944	(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	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8602	17.6397	14.3455	10.8605	8.1183	6.8539	7.4058	9.6264	12.9205	16.4055	19.1477	20.4122	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.3112	223.6078	217.8206	205.5004	189.9485	175.3318	165.5669	163.2704	169.0576	181.3777	196.9297	211.5464	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	(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)	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	(71)
Water heating gains (Table 5)	97.5640	95.4136	90.9480	84.8770	80.9355	75.3857	70.6685	76.7125	78.8600	85.1436	92.2388	95.4225	(72)
Total internal gains	401.9312	399.8567	386.3098	364.4337	342.1981	320.7671	306.8371	312.8051	324.0338	346.1226	371.5120	390.5769	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.2500	11.2829	0.6300	0.7000	0.7700	56.0335	(75)

Solar gains	56.0335	114.0577	205.4958	337.4831	453.6435	483.6320	452.4278	360.6807	250.3998	139.3876	70.5046	45.7598	(83)
Total gains	457.9646	513.9145	591.8056	701.9168	795.8416	804.3991	759.2649	673.4858	574.4336	485.5102	442.0166	436.3366	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.9854	70.1609	70.3337	71.1571	71.3133	72.0495	72.0495	72.1875	71.7642	71.3133	70.9980	70.6714	
alpha	5.6657	5.6774	5.6889	5.7438	5.7542	5.8033	5.8033	5.8125	5.7843	5.7542	5.7332	5.7114	
util living area	0.9985	0.9967	0.9892	0.9484	0.8145	0.6050	0.4494	0.5252	0.8251	0.9793	0.9968	0.9989	(86)
MIT	19.9442	20.0709	20.3147	20.6527	20.8987	20.9852	20.9977	20.9948	20.9205	20.5876	20.2099	19.9227	(87)
Th 2	20.0898	20.0919	20.0939	20.1034	20.1052	20.1136	20.1136	20.1151	20.1104	20.1052	20.1016	20.0978	(88)
util rest of house	0.9980	0.9957	0.9853	0.9307	0.7638	0.5278	0.3602	0.4275	0.7561	0.9693	0.9955	0.9985	(89)
MIT 2	18.6710	18.8575	19.2130	19.6974	20.0099	20.1042	20.1127	20.1130	20.0467	19.6165	19.0681	18.6455	(90)
Living area fraction									fLA = Living area / (4) =			0.4405	(91)
MIT	19.2319	19.3921	19.6984	20.1183	20.4015	20.4923	20.5026	20.5015	20.4317	20.0443	19.5711	19.2082	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2319	19.3921	19.6984	20.1183	20.4015	20.4923	20.5026	20.5015	20.4317	20.0443	19.5711	19.2082	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9945	0.9832	0.9311	0.7817	0.5615	0.3996	0.4707	0.7832	0.9684	0.9945	0.9980	(94)
Useful gains	456.7484	511.0930	581.8757	653.5401	622.0975	451.6392	303.4001	316.9972	449.8712	470.1873	439.5640	435.4503	(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	1198.6538	1160.4357	1054.2477	885.7139	685.5003	459.4499	304.3066	319.2000	495.6754	744.0221	986.8368	1193.0819	(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	551.9776	436.3583	351.4448	167.1651	47.1717	0.0000	0.0000	0.0000	0.0000	203.7331	394.0364	563.6779	(98)
Space heating												2715.5650	(98)
Space heating per m2										(98) / (4) =		33.5669	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2904.3476	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	551.9776	436.3583	351.4448	167.1651	47.1717	0.0000	0.0000	0.0000	0.0000	203.7331	394.0364	563.6779	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	590.3504	466.6934	375.8768	178.7862	50.4510	0.0000	0.0000	0.0000	0.0000	217.8964	421.4293	602.8641	(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	179.4777	157.7628	164.6737	146.2156	142.2700	125.6630	119.2967	132.8206	133.1862	151.6859	162.1569	174.6860	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.6173	87.3885	86.7871	85.1716	82.2206	79.8000	79.8000	79.8000	79.8000	85.6015	87.0953	87.7174	(217)
Fuel for water heating, kWh/month	204.8427	180.5303	189.7444	171.6717	173.0345	157.4725	149.4946	166.4419	166.9000	177.2001	186.1834	199.1464	(219)
Water heating fuel used												2122.6626	(219)

Annual totals kWh/year

Space heating fuel - main system	2904.3476	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	350.7375	(232)
Total delivered energy for all uses	5452.7477	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2904.3476	0.2160	627.3391	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2122.6626	0.2160	458.4951	(264)
Space and water heating			1085.8342	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.7375	0.5190	182.0328	(268)
Total CO2, kg/m2/year			1306.7920	(272)
Emissions per m2 for space and water heating			13.4219	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2501	(272b)
Emissions per m2 for pumps and fans			0.4811	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4219 * 1.00) + 2.2501 + 0.4811, rounded to 2 d.p.			16.1500	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	008 BlcA2-2B4P-03281	**Issued on Date**	10/07/2020
Assessment Reference	2B4P MF Be Lean	**Prop Type Ref**	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	86 B	**DER**	12.75	**TER**	13.65
Environmental	91 B	**% DER<TER**	6.56		
CO_2 Emissions (t/year)	0.80	**DFEE**	32.53	**TFEE**	31.97
General Requirements Compliance	Fail	**% DFEE<TFEE**	-1.75		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 77 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.65 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.75 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)32.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.5 kWh/m²/yrFail
Excess energy =0.5 kWh/m²/yr  (1.6%)

2 Fabric U-values
Element         Average                 Highest
External wall   0.18 (max. 0.30)        0.18 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           (no floor)
Roof            (no roof)
Openings        1.34 (max. 2.00)        1.40 (max. 3.30)          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                                 10.0                                    OK

4 Heating efficiency
Main heating system:                    Community heating scheme                -

Secondary heating system:               None

5 Cylinder insulation
Hot water storage                       Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                          OK
Primary pipework insulated:             No primary pipework

6 Controls
Space heating controls:                 Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                     No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                     0.44
Maximum                                 1.5                                     OK
MVHR efficiency:                        91%
Minimum:                                70%                                     OK

9 Summertime temperature
Overheating risk (Midlands):            Medium                                  OK
Based on:
Overshading:                            Average
Windows facing South:                   8.10 m², No overhang
Windows facing South West:              10.13 m², No overhang
Air change rate:                        2.00 ach
Blinds/curtains:                        None

10 Key features
Party wall U-value                      0.00 W/m²K
Door U-value                            0.82 W/m²K
Air permeability                        3.0 m³/m²h
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	76.8000 (1b)	x	2.5000 (2b)	=	192.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.3500 (23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			18.2300	1.3258	24.1686			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	40.0000	18.2300	21.7700	0.1800	3.9186			(29a)
Wall to CA	12.8000	2.1200	10.6800	0.1671	1.7843			(29a)
Total net area of external elements Aum(A, m2)			52.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.6099			(33)
Party Wall 1			36.7500	0.0000	0.0000			(32)
Party Floor 1			76.8000					(32d)
Party Ceilings 1			76.8000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.0106	(36)
Total fabric heat loss (33) + (36) =	39.6205	(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	17.4755	17.2735	17.0716	16.0618	15.8598	14.8500	14.8500	14.6480	15.2539	15.8598	16.2637	16.6676	(38)
Heat transfer coeff	57.0959	56.8940	56.6920	55.6822	55.4803	54.4705	54.4705	54.2685	54.8744	55.4803	55.8842	56.2881	(39)

Average = Sum(39)m / 12 = 55.6317 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7434	0.7408	0.7382	0.7250	0.7224	0.7093	0.7093	0.7066	0.7145	0.7224	0.7277	0.7329	(40)

HLP (average) 0.7244 (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	2.3993 (42)
Average daily hot water use (litres/day)	91.1843 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3028	96.6554	93.0080	89.3606	85.7133	82.0659	82.0659	85.7133	89.3606	93.0080	96.6554	100.3028	(44)
Energy conte	148.7461	130.0943	134.2456	117.0386	112.3013	96.9075	89.7991	103.0457	104.2764	121.5241	132.6531	144.0527	(45)
Energy content (annual)										Total = Sum(45)m =		1434.6845	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	22.3119	19.5141	20.1368	17.5558	16.8452	14.5361	13.4699	15.4569	15.6415	18.2286	19.8980	21.6079	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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													
	178.7438	157.1890	164.2433	146.0686	142.2990	125.9375	119.7967	133.0434	133.3064	151.5218	161.6831	174.0503	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.7438	157.1890	164.2433	146.0686	142.2990	125.9375	119.7967	133.0434	133.3064	151.5218	161.6831	174.0503	(64)
								Total per year (kWh/year) = Sum(64)m =				1787.8832	(64)
Heat gains from water heating, kWh/month													
	73.4562	64.9321	68.6348	62.1394	61.3383	55.4458	53.8563	58.2609	57.8959	64.4049	67.3312	71.8957	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9555	16.8361	13.6920	10.3657	7.7485	6.5416	7.0685	9.1878	12.3319	15.6582	18.2754	19.4823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.6229	214.8293	209.2693	197.4328	182.4914	168.4485	159.0670	156.8607	162.4206	174.2571	189.1986	203.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	(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)													
	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)													
	98.7315	96.6252	92.2511	86.3047	82.4440	77.0080	72.3876	78.3076	80.4110	86.5658	93.5155	96.6340	(72)
Total internal gains													
	389.3000	387.2806	374.2026	353.0933	331.6740	310.9883	297.5131	303.3462	314.1537	335.4712	359.9796	378.3478	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	8.1000	46.7521	0.4000	0.7000	0.7700	73.4813	(78)
Southwest	10.1300	36.7938	0.4000	0.7000	0.7700	72.3229	(79)

Solar gains	145.8042	243.5361	321.8538	382.1090	414.4761	405.9894	393.6679	370.0578	342.6482	265.9559	173.7266	125.3880	(83)
Total gains	535.1042	630.8167	696.0564	735.2023	746.1501	716.9777	691.1811	673.4040	656.8019	601.4270	533.7062	503.7357	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.4100	93.7416	94.0756	95.7816	96.1303	97.9124	97.9124	98.2768	97.1917	96.1303	95.4355	94.7506	
alpha	7.2273	7.2494	7.2717	7.3854	7.4087	7.5275	7.5275	7.5518	7.4794	7.4087	7.3624	7.3167	
util living area	0.9932	0.9782	0.9388	0.8390	0.6770	0.4851	0.3467	0.3706	0.5725	0.8620	0.9794	0.9953	(86)
MIT	20.4426	20.6050	20.7772	20.9245	20.9856	20.9990	20.9999	20.9999	20.9965	20.9223	20.6634	20.4121	(87)
Th 2	20.3026	20.3049	20.3072	20.3188	20.3211	20.3327	20.3327	20.3350	20.3280	20.3211	20.3165	20.3118	(88)
util rest of house	0.9912	0.9723	0.9241	0.8080	0.6323	0.4351	0.2941	0.3171	0.5184	0.8279	0.9728	0.9939	(89)
MIT 2	19.5612	19.7958	20.0370	20.2377	20.3084	20.3320	20.3326	20.3349	20.3256	20.2407	19.8908	19.5245	(90)
Living area fraction										fLA = Living area / (4) =		0.4583	(91)
MIT	19.9652	20.1667	20.3763	20.5525	20.6188	20.6377	20.6385	20.6397	20.6331	20.5531	20.2449	19.9313	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9652	20.1667	20.3763	20.5525	20.6188	20.6377	20.6385	20.6397	20.6331	20.5531	20.2449	19.9313	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9710	0.9257	0.8191	0.6522	0.4580	0.3182	0.3416	0.5431	0.8402	0.9720	0.9930	(94)
Useful gains	529.7792	612.5171	644.3329	602.1931	486.6093	328.3710	219.9508	230.0369	356.7317	505.3380	518.7837	500.2009	(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													
	894.4200	868.5809	786.6730	648.8366	494.8177	328.8758	219.9779	230.0825	358.5002	552.2015	734.5917	885.4835	(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													
	271.2928	172.0749	105.9011	33.5833	6.1070	0.0000	0.0000	0.0000	0.0000	34.8664	155.3817	286.6503	(98)
Space heating												1065.8575	(98)
Space heating per m2											(98) / (4) =	13.8784	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1065.8575	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	1119.1504	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1787.8832	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1877.2773	(310a)
Electricity used for heat distribution	29.9643	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	128.8320	(330a)
Total electricity for the above, kWh/year	128.8320	(331)
Electricity for lighting (calculated in Appendix L)	334.7598	(332)
Total delivered energy for all uses	3460.0195	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	3347.9639	0.2160	723.1602	(367)
Electrical energy for heat distribution	29.9643	0.5190	15.5515	(372)
Total CO2 associated with community systems			738.7117	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			738.7117	(376)
Pumps and fans	128.8320	0.5190	66.8638	(378)
Energy for lighting	334.7598	0.5190	173.7403	(379)
Total CO2, kg/year			979.3158	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7500	(384)

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

DER		12.7500	ZC1
Total Floor Area	TFA	76.8000	
Assumed number of occupants	N	2.3993	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4057	ZC2
CO2 emissions from cooking, equation (L16)		2.2993	ZC3
Total CO2 emissions		31.4550	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.4550	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.8000 (1b)	x	2.5000 (2b)	=	192.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 76.8000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.0000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1563	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4063	(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) =	0.3453	(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													
	0.4403	0.4316	0.4230	0.3798	0.3712	0.3280	0.3280	0.3194	0.3453	0.3712	0.3885	0.4057	(22b)
Effective ac	0.5969	0.5932	0.5895	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5755	0.5823	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			17.0600	1.3258	22.6174			(27)
External Wall	40.0000	17.0600	22.9400	0.1800	4.1292			(29a)
Wall to CA	12.8000	2.1200	10.6800	0.1800	1.9224			(29a)
Total net area of external elements Aum(A, m2)			52.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.7890			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5713	(36)
Total fabric heat loss						(33) + (36) =	36.3603	(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	37.8209	37.5824	37.3487	36.2508	36.0454	35.0892	35.0892	34.9122	35.4575	36.0454	36.4610	36.8954	(38)
Heat transfer coeff													
	74.1812	73.9427	73.7090	72.6112	72.4058	71.4496	71.4496	71.2725	71.8179	72.4058	72.8213	73.2557	(39)
Average = Sum(39)m / 12 =												72.6102	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9659	0.9628	0.9598	0.9455	0.9428	0.9303	0.9303	0.9280	0.9351	0.9428	0.9482	0.9539	(40)
HLP (average)												0.9454	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3993	(42)
Average daily hot water use (litres/day)												91.1843	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3028	96.6554	93.0080	89.3606	85.7133	82.0659	82.0659	85.7133	89.3606	93.0080	96.6554	100.3028	(44)
Energy conte	148.7461	130.0943	134.2456	117.0386	112.3013	96.9075	89.7991	103.0457	104.2764	121.5241	132.6531	144.0527	(45)
Energy content (annual)										Total = Sum(45)m =		1434.6845	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.3119	19.5141	20.1368	17.5558	16.8452	14.5361	13.4699	15.4569	15.6415	18.2286	19.8980	21.6079	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
                4.3553    3.9338    4.3553    4.2148    4.3553    4.2148    4.3553    4.3553    4.2148    4.3553    4.2148    4.3553 (56)
If cylinder contains dedicated solar storage
                4.3553    3.9338    4.3553    4.2148    4.3553    4.2148    4.3553    4.3553    4.2148    4.3553    4.2148    4.3553 (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
              176.3638  155.0393  161.8633  143.7654  139.9190  123.6343  117.4167  130.6634  131.0032  149.1418  159.3799  171.6703 (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 (63)
                                                                                 Solar input (sum of months) = Sum(63)m =       0.0000 (63)
Output from w/h
              176.3638  155.0393  161.8633  143.7654  139.9190  123.6343  117.4167  130.6634  131.0032  149.1418  159.3799  171.6703 (64)
                                                                                   Total per year (kWh/year) = Sum(64)m =    1759.8604 (64)
Heat gains from water heating, kWh/month
               71.5522   63.2123   66.7308   60.2968   59.4343   53.6032   51.9523   56.3568   56.0533   62.5009   65.4886   69.9916 (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         119.9670  119.9670  119.9670  119.9670  119.9670  119.9670  119.9670  119.9670  119.9670  119.9670  119.9670  119.9670 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               18.9570   16.8374   13.6931   10.3666    7.7491    6.5421    7.0690    9.1886   12.3329   15.6594   18.2769   19.4839 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              212.6229  214.8293  209.2693  197.4328  182.4914  168.4485  159.0670  156.8607  162.4206  174.2571  189.1986  203.2414 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               34.9967   34.9967   34.9967   34.9967   34.9967   34.9967   34.9967   34.9967   34.9967   34.9967   34.9967   34.9967 (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)
              -95.9736  -95.9736  -95.9736  -95.9736  -95.9736  -95.9736  -95.9736  -95.9736  -95.9736  -95.9736  -95.9736  -95.9736 (71)
Water heating gains (Table 5)
               96.1723   94.0660   89.6920   83.7455   79.8849   74.4489   69.8284   75.7484   77.8519   84.0066   90.9563   94.0748 (72)
Total internal gains
              389.7423  387.7228  374.6445  353.5350  332.1155  311.4296  297.9545  303.7878  314.5955  335.9132  360.4219  378.7902 (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
---------------------------------------------------------------------------------------------------
South                                   7.5800         46.7521            0.6300            0.7000        0.7700          108.3033 (78)
Southwest                               9.4800         36.7938            0.6300            0.7000        0.7700          106.5995 (79)
---------------------------------------------------------------------------------------------------

Solar gains   214.9028  358.9514  474.3852  563.1967  610.9034  598.3949  580.2339  545.4343  505.0345  391.9962  256.0580  184.8110 (83)
Total gains   604.6452  746.6741  849.0296  916.7316  943.0188  909.8245  878.1885  849.2221  819.6300  727.9094  616.4799  563.6012 (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, nil,m (see Table 9a)
                  Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            71.8960   72.1279   72.3566   73.4506   73.6590   74.6447   74.6447   74.8302   74.2619   73.6590   73.2387   72.8043
alpha           5.7931    5.8085    5.8238    5.8967    5.9106    5.9763    5.9763    5.9887    5.9508    5.9106    5.8826    5.8536
util living area
                0.9919    0.9741    0.9321    0.8362    0.6832    0.4985    0.3575    0.3853    0.5923    0.8694    0.9781    0.9944 (86)

MIT            20.1914   20.4136   20.6486   20.8577   20.9630   20.9952   20.9994   20.9991   20.9871   20.8473   20.4805   20.1500 (87)
Th 2           20.1118   20.1145   20.1170   20.1290   20.1313   20.1418   20.1418   20.1437   20.1377   20.1313   20.1267   20.1220 (88)
util rest of house
                0.9895    0.9669    0.9146    0.8005    0.6290    0.4335    0.2880    0.3140    0.5233    0.8315    0.9708    0.9926 (89)
MIT 2          19.0469   19.3671   19.6955   19.9774   20.0990   20.1389   20.1416   20.1434   20.1290   19.9734   19.4756   18.9946 (90)
Living area fraction                                                                      fLA = Living area / (4) =    0.4583 (91)
MIT            19.5714   19.8467   20.1323   20.3809   20.4950   20.5314   20.5348   20.5356   20.5223   20.3739   19.9362   19.5242 (92)
Temperature adjustment                                                                                                  0.0000
adjusted MIT   19.5714   19.8467   20.1323   20.3809   20.4950   20.5314   20.5348   20.5356   20.5223   20.3739   19.9362   19.5242 (93)
```

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

                  Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9876    0.9643    0.9149    0.8114    0.6522    0.4632    0.3199    0.3467    0.5545    0.8430    0.9688    0.9911 (94)
Useful gains  597.1174  719.9979  776.8029  743.8777  615.0570  421.4281  280.9266  294.4151  454.5255  613.6082  597.2456  558.5852 (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
             1132.8533 1105.2035 1004.8251  833.6414  636.8083  423.7940  281.1381  294.7559  461.2375  707.6874  934.7469 1122.5833 (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
              398.5875  258.8582  169.6485   64.6299   16.1830    0.0000    0.0000    0.0000    0.0000   69.9949  243.0010  419.6146 (98)
Space heating                                                                                                        1640.5175 (98)
Space heating per m2                                                                              (98) / (4) =      21.3609 (99)
```

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


FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014


```
---------------------------------------------------------------------------------------------------
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 %)                                                                      93.5000 (206)
Efficiency of secondary/supplementary heating system, %                                                                0.0000 (208)
Space heating requirement                                                                                           1754.5642 (211)

                  Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Space heating requirement
              398.5875  258.8582  169.6485   64.6299   16.1830    0.0000    0.0000    0.0000    0.0000   69.9949  243.0010  419.6146 (98)
Space heating efficiency (main heating system 1)
               93.5000   93.5000   93.5000   93.5000   93.5000    0.0000    0.0000    0.0000    0.0000   93.5000   93.5000   93.5000 (210)
Space heating fuel (main heating system)
              426.2968  276.8537  181.4422   69.1229   17.3080    0.0000    0.0000    0.0000    0.0000   74.8609  259.8941  448.7857 (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
              176.3638  155.0393  161.8633  143.7654  139.9190  123.6343  117.4167  130.6634  131.0032  149.1418  159.3799  171.6703 (64)
Efficiency of water heater                                                                                            79.8000 (216)
(217)m         86.9248   86.1719   84.9392   82.8374   80.7902   79.8000   79.8000   79.8000   79.8000   82.9319   85.9359   87.1089 (217)
Fuel for water heating, kWh/month
              202.8924  179.9186  190.5638  173.5512  173.1880  154.9302  147.1388  163.7386  164.1644  179.8365  185.4636  197.0755 (219)
Water heating fuel used                                                                                             2112.4615 (219)
Annual totals kWh/year
Space heating fuel - main system                                                                                    1754.5642 (211)
Space heating fuel - secondary                                                                                         0.0000 (215)

Electricity for pumps and fans:
   central heating pump                                                                                               30.0000 (230c)
   main heating flue fan                                                                                              45.0000 (230e)
Total electricity for the above, kWh/year                                                                             75.0000 (231)
Electricity for lighting (calculated in Appendix L)                                                                  334.7862 (232)
Total delivered energy for all uses                                                                                 4276.8119 (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                                       1754.5642             0.2160           378.9859 (261)
Space heating - secondary                                              0.0000             0.0000             0.0000 (263)
Water heating (other fuel)                                          2112.4615             0.2160           456.2917 (264)
Space and water heating                                                                                    835.2776 (265)
Pumps and fans                                                        75.0000             0.5190            38.9250 (267)
Energy for lighting                                                  334.7862             0.5190           173.7540 (268)
Total CO2, kg/m2/year                                                                                     1047.9566 (272)
Emissions per m2 for space and water heating                                                                10.8760 (272a)
Fuel factor (mains gas)                                                                                      1.0000
Emissions per m2 for lighting                                                                                2.2624 (272b)
Emissions per m2 for pumps and fans                                                                          0.5068 (272c)
Target Carbon Dioxide Emission Rate (TER) = (10.8760 * 1.00) + 2.2624 + 0.5068, rounded to 2 d.p.           13.6500 (273)
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

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Property Reference	009 BlcB3-1B2P-03281	**Issued on Date**	10/07/2020
Assessment Reference	1B2P TF Be Lean	**Prop Type Ref**	Top floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	82 B	**DER**	21.17	**TER**	23.31
Environmental	87 B	**% DER<TER**	9.19		
CO_2 Emissions (t/year)	0.87	**DFEE**	60.04	**TFEE**	71.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.08		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 52 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 23.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 21.17 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)71.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)60.0 kWh/m²/yrOK

2 Fabric U-values
Element         Average              Highest
External wall   0.18 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)     -                         OK
Floor           (no floor)
Roof            0.10 (max. 0.20)     0.10 (max. 0.35)          OK
Openings        1.31 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                  No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.42
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing North East:           7.98 m², No overhang
Windows facing North West:           3.00 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Roof U-value                         0.10 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h
```

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	51.6000 (1b)	x	2.5000 (2b)	=	129.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	129.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			10.9800	1.3258	14.5568			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	42.9000	10.9800	31.9200	0.1800	5.7456			(29a)
Wall to CA	20.1000	2.1200	17.9800	0.1671	3.0039			(29a)
External Roof 1	51.6000		51.6000	0.1000	5.1600			(30)
Total net area of external elements Aum(A, m2)			114.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.2047			(33)
Party Wall 1			22.8000	0.0000	0.0000			(32)
Party Floor 1			51.6000					(32d)
Party Ceilings 1			51.6000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4892	(36)
Total fabric heat loss					(33) + (36) =		44.6939	(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	11.7413	11.6056	11.4700	10.7915	10.6558	9.9773	9.9773	9.8417	10.2487	10.6558	10.9272	11.1986	(38)
Heat transfer coeff	56.4353	56.2996	56.1639	55.4854	55.3497	54.6713	54.6713	54.5356	54.9426	55.3497	55.6211	55.8925	(39)
Average = Sum(39)m / 12 =												55.4515	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0937	1.0911	1.0884	1.0753	1.0727	1.0595	1.0595	1.0569	1.0648	1.0727	1.0779	1.0832	(40)
HLP (average)												1.0746	(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	1.7373	(42)
Average daily hot water use (litres/day)	75.4602	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.0062	79.9878	76.9694	73.9510	70.9326	67.9141	67.9141	70.9326	73.9510	76.9694	79.9878	83.0062	(44)
Energy conte	123.0958	107.6603	111.0958	96.8560	92.9357	80.1964	74.3138	85.2761	86.2946	100.5680	109.7779	119.2117	(45)
Energy content (annual)										Total = Sum(45)m =		1187.2821	(45)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m

18.4644	16.1491	16.6644	14.5284	13.9404	12.0295	11.1471	12.7914	12.9442	15.0852	16.4667	17.8818	(46)

Water storage loss:
Store volume 3.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0212 (51)
Volume factor from Table 2a 3.4200 (52)
Temperature factor from Table 2b 1.0000 (53)
Enter (49) or (54) in (55) 0.2173 (55)
Total storage loss

6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)

If cylinder contains dedicated solar storage

6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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

153.0935	134.7550	141.0935	125.8861	122.9334	109.2264	104.3115	115.2738	115.3246	130.5657	138.8079	149.2094	(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	(63)
							Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

153.0935	134.7550	141.0935	125.8861	122.9334	109.2264	104.3115	115.2738	115.3246	130.5657	138.8079	149.2094	(64)
							Total per year (kWh/year) = Sum(64)m =				1540.4808	(64)

Heat gains from water heating, kWh/month

64.9275	57.4728	60.9375	55.4287	54.8993	49.8893	48.7075	52.3525	51.9170	57.4370	59.7252	63.6360	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts (66)m	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.5218	12.0099	9.7671	7.3943	5.5274	4.6664	5.0422	6.5541	8.7969	11.1697	13.0367	13.8976	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.3882	152.9591	149.0004	140.5728	129.9344	119.9359	113.2562	111.6853	115.6440	124.0716	134.7100	144.7085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	(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)	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	(71)
Water heating gains (Table 5)	87.2681	85.5250	81.9053	76.9842	73.7893	69.2907	65.4670	70.3662	72.1069	77.2003	82.9516	85.5323	(72)
Total internal gains	301.2371	299.5531	289.7318	274.0104	258.3102	242.9521	232.8246	237.6647	245.6069	261.5007	279.7573	293.1975	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.9800	11.2829	0.4000	0.7000	0.7700	17.4709	(75)
Northwest	3.0000	11.2829	0.4000	0.7000	0.7700	6.5680	(81)

Solar gains	24.0390	48.9320	88.1600	144.7840	194.6181	207.4834	194.0965	154.7360	107.4243	59.7988	30.2473	19.6314	(83)
Total gains	325.2761	348.4851	377.8918	418.7944	452.9282	450.4355	426.9211	392.4007	353.0311	321.2995	310.0046	312.8289	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4946	63.6476	63.8014	64.5815	64.7399	65.5433	65.5433	65.7064	65.2195	64.7399	64.4240	64.1112	
alpha	5.2330	5.2432	5.2534	5.3054	5.3160	5.3696	5.3696	5.3804	5.3480	5.3160	5.2949	5.2741	
util living area	0.9975	0.9959	0.9904	0.9676	0.8903	0.7210	0.5519	0.6173	0.8709	0.9796	0.9952	0.9980	(86)
MIT	19.8635	19.9709	20.1899	20.5089	20.7941	20.9534	20.9908	20.9840	20.8675	20.5184	20.1431	19.8451	(87)
Th 2	20.0060	20.0081	20.0103	20.0211	20.0232	20.0340	20.0340	20.0362	20.0297	20.0232	20.0189	20.0146	(88)
util rest of house	0.9967	0.9945	0.9869	0.9550	0.8487	0.6337	0.4368	0.4989	0.8068	0.9693	0.9933	0.9973	(89)
MIT 2	18.4918	18.6500	18.9701	19.4343	19.8170	20.0025	20.0305	20.0293	19.9188	19.4551	18.9097	18.4712	(90)
Living area fraction										fLA = Living area / (4) =		0.5814	(91)
MIT	19.2893	19.4179	19.6793	20.0591	20.3851	20.5554	20.5889	20.5844	20.4704	20.0733	19.6268	19.2700	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2893	19.4179	19.6793	20.0591	20.3851	20.5554	20.5889	20.5844	20.4704	20.0733	19.6268	19.2700	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9934	0.9855	0.9556	0.8656	0.6827	0.5039	0.5679	0.8388	0.9700	0.9923	0.9966	(94)
Useful gains	323.9256	346.1848	372.3998	400.1862	392.0642	307.5056	215.1405	222.8612	296.1295	311.6545	307.6272	311.7676	(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	845.9259	817.3529	740.1992	619.1653	480.7166	325.5872	218.0757	228.1969	350.0046	524.3423	696.7554	842.2985	(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	388.3682	316.6250	273.6428	157.6650	65.9574	0.0000	0.0000	0.0000	0.0000	158.2397	280.1723	394.7150	(98)
Space heating												2035.3852	(98)
Space heating per m2											(98) / (4) =	39.4454	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2035.3852	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	2137.1545	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1540.4808	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1617.5048	(310a)
Electricity used for heat distribution	37.5466	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	82.6245	(330a)
Total electricity for the above, kWh/year	82.6245	(331)
Electricity for lighting (calculated in Appendix L)	238.7986	(332)
Total delivered energy for all uses	4076.0824	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	4195.1500	0.2160	906.1524	(367)
Electrical energy for heat distribution	37.5466	0.5190	19.4867	(372)
Total CO2 associated with community systems			925.6391	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			925.6391	(376)
Pumps and fans	82.6245	0.5190	42.8821	(378)
Energy for lighting	238.7986	0.5190	123.9365	(379)
Total CO2, kg/year			1092.4577	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			21.1700	(384)

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

DER		21.1700	ZC1
Total Floor Area	TFA	51.6000	
Assumed number of occupants	N	1.7373	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3856	ZC2
CO2 emissions from cooking, equation (L16)		3.1142	ZC3
Total CO2 emissions		41.6698	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		41.6698	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.6000 (1b)	x	2.5000 (2b)	=	129.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	129.0000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1550	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4050	(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) =	0.3443	(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													
	0.4390	0.4304	0.4217	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4045	(22b)
Effective ac	0.5963	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			10.7900	1.3258	14.3049			(27)
External Wall	42.9000	10.7900	32.1100	0.1800	5.7798			(29a)
Wall to CA	20.1000	2.1200	17.9800	0.1800	3.2364			(29a)
External Roof 1	51.6000		51.6000	0.1300	6.7080			(30)
Total net area of external elements Aum(A, m2)			114.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1491			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.3157	(36)
Total fabric heat loss				(33) + (36) =	47.4648		47.4648	(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	25.3863	25.2271	25.0710	24.3377	24.2006	23.5619	23.5619	23.4437	23.8079	24.2006	24.4781	24.7682	(38)
Heat transfer coeff	72.8512	72.6919	72.5358	71.8026	71.6654	71.0268	71.0268	70.9085	71.2728	71.6654	71.9429	72.2330	(39)
Average = Sum(39)m / 12 =												71.8019	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4118	1.4088	1.4057	1.3915	1.3889	1.3765	1.3765	1.3742	1.3813	1.3889	1.3942	1.3999	(40)
HLP (average)												1.3915	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7373	(42)
Average daily hot water use (litres/day)	75.4602	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	83.0062	79.9878	76.9694	73.9510	70.9326	67.9141	67.9141	70.9326	73.9510	76.9694	79.9878	83.0062	(44)
Energy conte	123.0958	107.6603	111.0958	96.8560	92.9357	80.1964	74.3138	85.2761	86.2946	100.5680	109.7779	119.2117	(45)
Energy content (annual)										Total = Sum(45)m =		1187.2821	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.4644	16.1491	16.6644	14.5284	13.9404	12.0295	11.1471	12.7914	12.9442	15.0852	16.4667	17.8818	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
4.3553 3.9338 4.3553 4.2148 4.3553 4.2148 4.3553 4.3553 4.2148 4.3553 4.2148 4.3553 (56)
If cylinder contains dedicated solar storage
4.3553 3.9338 4.3553 4.2148 4.3553 4.2148 4.3553 4.3553 4.2148 4.3553 4.2148 4.3553 (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
150.7134 132.6053 138.7135 123.5828 120.5533 106.9232 101.9314 112.8938 113.0214 128.1857 136.5047 146.8293 (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 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
150.7134 132.6053 138.7135 123.5828 120.5533 106.9232 101.9314 112.8938 113.0214 128.1857 136.5047 146.8293 (64)
Total per year (kWh/year) = Sum(64)m = 1512.4580 (64)
Heat gains from water heating, kWh/month
63.0235 55.7531 59.0335 53.5861 52.9952 48.0467 46.8035 50.4485 50.0744 55.5330 57.8826 61.7320 (65)

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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	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5375	12.0239	9.7785	7.4029	5.5338	4.6719	5.0481	6.5617	8.8071	11.1827	13.0518	13.9138	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.3882	152.9591	149.0004	140.5728	129.9344	119.9359	113.2562	111.6853	115.6440	124.0716	134.7100	144.7085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	(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)													
	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	(71)
Water heating gains (Table 5)													
	84.7090	82.9659	79.3461	74.4251	71.2302	66.7316	62.9079	67.8071	69.5478	74.6411	80.3925	82.9731	(72)
Total internal gains													
	301.6937	300.0079	290.1841	274.4599	258.7575	243.3984	233.2713	238.1131	246.0579	261.9545	280.2133	293.6545	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8400	11.2829	0.6300	0.7000	0.7700	27.0340	(75)
Northwest	2.9500	11.2829	0.6300	0.7000	0.7700	10.1722	(81)

Solar gains	37.2062	75.7343	136.4492	224.0888	301.2193	321.1317	300.4121	239.4920	166.2655	92.5534	46.8151	30.3845	(83)
Total gains	338.9000	375.7423	426.6333	498.5487	559.9768	564.5300	533.6834	477.6051	412.3234	354.5079	327.0284	324.0390	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.1870	49.2948	49.4009	49.9054	50.0009	50.4505	50.4505	50.5346	50.2763	50.0009	49.8080	49.6080	
alpha	4.2791	4.2863	4.2934	4.3270	4.3334	4.3634	4.3634	4.3690	4.3518	4.3334	4.3205	4.3072	
util living area													
	0.9970	0.9948	0.9875	0.9594	0.8758	0.7165	0.5607	0.6360	0.8771	0.9786	0.9946	0.9975	(86)
MIT	19.4734	19.6155	19.9036	20.3192	20.6929	20.9125	20.9768	20.9608	20.7727	20.3051	19.8242	19.4502	(87)
Th 2	19.7543	19.7566	19.7589	19.7698	19.7719	19.7814	19.7814	19.7832	19.7777	19.7719	19.7678	19.7634	(88)
util rest of house													
	0.9959	0.9929	0.9828	0.9428	0.8255	0.6129	0.4176	0.4896	0.8054	0.9670	0.9923	0.9966	(89)
MIT 2	17.7484	17.9571	18.3772	18.9771	19.4749	19.7250	19.7735	19.7677	19.5921	18.9685	18.2700	17.7205	(90)
Living area fraction									fLA = Living area / (4) =			0.5814	(91)
MIT	18.7513	18.9212	19.2647	19.7574	20.1831	20.4154	20.4731	20.4613	20.2785	19.7456	19.1736	18.7261	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7513	18.9212	19.2647	19.7574	20.1831	20.4154	20.4731	20.4613	20.2785	19.7456	19.1736	18.7261	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9912	0.9803	0.9426	0.8443	0.6699	0.5012	0.5749	0.8389	0.9667	0.9908	0.9956	(94)
Useful gains	337.0971	372.4327	418.2326	469.9336	472.7832	378.1643	267.4775	274.5545	345.8856	342.7134	324.0161	322.6162	(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													
	1052.7940	1019.2308	925.8947	779.5880	607.9414	413.0491	275.0914	287.9831	440.3596	655.4243	868.6111	1049.2647	(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													
	532.4785	434.6483	377.7006	222.9512	100.5577	0.0000	0.0000	0.0000	0.0000	232.6569	392.1084	540.6264	(98)
Space heating												2833.7280	(98)
Space heating per m2											(98) / (4) =	54.9172	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %) 93.5000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3030.7252 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	532.4785	434.6483	377.7006	222.9512	100.5577	0.0000	0.0000	0.0000	0.0000	232.6569	392.1084	540.6264	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	569.4957	464.8645	403.9578	238.4505	107.5484	0.0000	0.0000	0.0000	0.0000	248.8309	419.3673	578.2101	(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													
	150.7134	132.6053	138.7135	123.5828	120.5533	106.9232	101.9314	112.8938	113.0214	128.1857	136.5047	146.8293	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.9000	87.7495	87.3538	86.3699	84.3347	79.8000	79.8000	79.8000	79.8000	86.3853	87.4713	87.9804	(217)
Fuel for water heating, kWh/month													
	171.4602	151.1180	158.7950	143.0854	142.9464	133.9890	127.7336	141.4709	141.6308	148.3884	156.0565	166.8887	(219)
Water heating fuel used												1783.5630	(219)
Annual totals kWh/year													
Space heating fuel - main system												3030.7252	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.0768	(232)
Total delivered energy for all uses												5128.3649	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3030.7252	0.2160	654.6366	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.5630	0.2160	385.2496	(264)
Space and water heating			1039.8862	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.0768	0.5190	124.0808	(268)
Total CO2, kg/m2/year			1202.8921	(272)
Emissions per m2 for space and water heating			20.1528	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4047	(272b)
Emissions per m2 for pumps and fans			0.7544	(272c)
Target Carbon Dioxide Emission Rate (TER) = (20.1528 * 1.00) + 2.4047 + 0.7544, rounded to 2 d.p.			23.3100	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	010 BlcB1-2B4P-03281	Issued on Date	10/07/2020
Assessment Reference	2B4P TF Be Lean	Prop Type Ref	Top floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	83 B	DER	17.71	TER	19.29
Environmental	87 B	% DER<TER	8.20		
CO_2 Emissions (t/year)	1.07	DFEE	52.44	TFEE	60.81
General Requirements Compliance	Pass	% DFEE<TFEE	13.76		

Assessor Details	Miss Eleanor Ballinger, Eleanor Ballinger, Tel: 02036031625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 78 m²

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 (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.29 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.71 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	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 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.44
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing North East: 8.10 m², No overhang
Windows facing South East: 8.10 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Door U-value 0.82 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	77.6000 (1b)	x	2.5000 (2b)	=	194.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			16.2000	1.3258	21.4773			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	53.4800	16.2000	37.2800	0.1800	6.7104			(29a)
Wall to CA	29.6300	2.1200	27.5100	0.1671	4.5961			(29a)
External Roof 1	77.6000		77.6000	0.1000	7.7600			(30)
Total net area of external elements Aum(A, m2)			160.7100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.2821			(33)
Party Wall 1			25.9500	0.0000	0.0000			(32)
Party Floor 1			77.6000					(32d)
Party Ceilings 1			77.6000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.5436	(36)
Total fabric heat loss					(33) + (36) =		59.8257	(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	17.6575	17.4535	17.2494	16.2291	16.0250	15.0047	15.0047	14.8006	15.4128	16.0250	16.4331	16.8413	(38)

Heat transfer coeff

	77.4833	77.2792	77.0751	76.0548	75.8507	74.8304	74.8304	74.6264	75.2386	75.8507	76.2589	76.6670	(39)
Average = Sum(39)m / 12 =												76.0038	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9985	0.9959	0.9932	0.9801	0.9775	0.9643	0.9643	0.9617	0.9696	0.9775	0.9827	0.9880	(40)
HLP (average)												0.9794	(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	2.4157 (42)
Average daily hot water use (litres/day)	91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	179.3794	157.7449	164.8170	146.5687	142.7789	126.3516	120.1805	133.4837	133.7520	152.0411	162.2499	174.6659	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	179.3794	157.7449	164.8170	146.5687	142.7789	126.3516	120.1805	133.4837	133.7520	152.0411	162.2499	174.6659	(64)
								Total per year (kWh/year) = Sum(64)m =				1794.0135	(64)
Heat gains from water heating, kWh/month	73.6676	65.1169	68.8256	62.3056	61.4979	55.5835	53.9839	58.4073	58.0441	64.5776	67.5196	72.1003	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1702	17.0268	13.8471	10.4832	7.8363	6.6157	7.1485	9.2919	12.4716	15.8356	18.4824	19.7030	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)	99.0155	96.9002	92.5075	86.5356	82.6585	77.1992	72.5590	78.5044	80.6168	86.7978	93.7773	96.9090	(72)
Total internal gains	391.7735	389.7390	376.5615	355.2929	333.7060	312.8692	299.3040	305.1685	316.0657	337.5434	362.2327	380.7420	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1000	11.2829	0.4000	0.7000	0.7700	17.7337	(75)
Southeast	8.1000	36.7938	0.4000	0.7000	0.7700	57.8297	(77)

Solar gains	75.5634	134.6029	199.8155	273.8061	330.6227	338.7609	322.2199	278.2225	225.1851	152.9834	91.5803	63.9724	(83)
Total gains	467.3369	524.3419	576.3770	629.0991	664.3287	651.6301	621.5239	583.3910	541.2508	490.5268	453.8129	444.7144	(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, nil,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.5491	69.7327	69.9174	70.8553	71.0460	72.0147	72.0147	72.2116	71.6240	71.0460	70.6657	70.2896	
alpha	5.6366	5.6488	5.6612	5.7237	5.7364	5.8010	5.8010	5.8141	5.7749	5.7364	5.7110	5.6860	
util living area	0.9979	0.9956	0.9885	0.9611	0.8759	0.6977	0.5234	0.5770	0.8341	0.9742	0.9955	0.9984	(86)
MIT	19.9700	20.1008	20.3175	20.6058	20.8456	20.9696	20.9951	20.9917	20.9153	20.6114	20.2407	19.9475	(87)
Th 2	20.0846	20.0868	20.0890	20.1000	20.1022	20.1132	20.1132	20.1154	20.1088	20.1022	20.0978	20.0934	(88)
util rest of house	0.9973	0.9941	0.9844	0.9470	0.8333	0.6160	0.4213	0.4719	0.7662	0.9620	0.9937	0.9979	(89)
MIT 2	18.7047	18.8970	19.2132	19.6315	19.9489	20.0927	20.1113	20.1118	20.0403	19.6467	19.1100	18.6784	(90)
Living area fraction										fLA = Living area / (4) =		0.4253	(91)
MIT	19.2428	19.4089	19.6828	20.0459	20.3303	20.4656	20.4871	20.4860	20.4124	20.0570	19.5909	19.2181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2428	19.4089	19.6828	20.0459	20.3303	20.4656	20.4871	20.4860	20.4124	20.0570	19.5909	19.2181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9927	0.9821	0.9459	0.8452	0.6497	0.4649	0.5169	0.7914	0.9613	0.9924	0.9972	(94)
Useful gains	465.6568	520.5047	566.0699	595.0909	561.4950	423.3921	288.9729	301.5338	428.3716	471.5279	450.3466	443.4906	(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	1157.8135	1121.2369	1016.0636	847.6956	654.6116	438.9256	290.8749	304.9224	474.9331	717.3185	952.5406	1151.3913	(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	514.9646	403.6921	334.7953	181.8754	69.2788	0.0000	0.0000	0.0000	0.0000	182.8682	361.5797	526.6781	(98)
Space heating												2575.7321	(98)
Space heating per m2											(98) / (4) =	33.1924	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	1.0000	(303a)
Fraction of total space heat from community Boilers	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2575.7321	(98)
Space heat from Boilers = (98) x 1.00 x 1.00 x 1.05	2704.5187	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1794.0135	(64)
Water heat from Boilers = (64) x 1.00 x 1.00 x 1.05	1883.7142	(310a)
Electricity used for heat distribution	45.8823	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	130.1740	(330a)
Total electricity for the above, kWh/year	130.1740	(331)
Electricity for lighting (calculated in Appendix L)	338.5518	(332)
Total delivered energy for all uses	5056.9587	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			89.5000	(367a)
Space heating from Boilers	5126.5171	0.2160	1107.3277	(367)
Electrical energy for heat distribution	45.8823	0.5190	23.8129	(372)
Total CO2 associated with community systems			1131.1406	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1131.1406	(376)
Pumps and fans	130.1740	0.5190	67.5603	(378)
Energy for lighting	338.5518	0.5190	175.7084	(379)
Total CO2, kg/year			1374.4093	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7100	(384)

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

DER		17.7100	ZC1
Total Floor Area	TFA	77.6000	
Assumed number of occupants	N	2.4157	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3686	ZC2
CO2 emissions from cooking, equation (L16)		2.2806	ZC3
Total CO2 emissions		36.3592	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.3592	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.6000 (1b)	x	2.5000 (2b)	=	194.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.0000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1546	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4046	(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) =	0.3439	(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													
	0.4385	0.4299	0.4213	0.3783	0.3697	0.3267	0.3267	0.3181	0.3439	0.3697	0.3869	0.4041	(22b)
Effective ac	0.5962	0.5924	0.5888	0.5716	0.5684	0.5534	0.5534	0.5506	0.5591	0.5684	0.5749	0.5817	(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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.2000	1.3258	21.4773			(27)
External Wall	53.4800	16.2000	37.2800	0.1800	6.7104			(29a)
Wall to CA	29.6300	2.1200	27.5100	0.1800	4.9518			(29a)
External Roof 1	77.6000		77.6000	0.1300	10.0880			(30)
Total net area of external elements Aum(A, m2)			160.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3475			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.4278	(36)
Total fabric heat loss					(33) + (36) =		63.7753	(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	38.1657	37.9267	37.6924	36.5919	36.3860	35.4275	35.4275	35.2500	35.7967	36.3860	36.8025	37.2380	(38)
Heat transfer coeff													
	101.9410	101.7020	101.4677	100.3672	100.1613	99.2028	99.2028	99.0253	99.5720	100.1613	100.5778	101.0133	(39)
Average = Sum(39)m / 12 =												100.3662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3137	1.3106	1.3076	1.2934	1.2907	1.2784	1.2784	1.2761	1.2831	1.2907	1.2961	1.3017	(40)
HLP (average)												1.2934	(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	2.4157	(42)
Average daily hot water use (litres/day)	91.5740	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	176.9994	155.5952	162.4369	144.2655	140.3989	124.0484	117.8004	131.1037	131.4488	149.6611	159.9467	172.2859	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	176.9994	155.5952	162.4369	144.2655	140.3989	124.0484	117.8004	131.1037	131.4488	149.6611	159.9467	172.2859	(64)
Total per year (kWh/year) = Sum(64)m =												1765.9907	(64)
Heat gains from water heating, kWh/month	71.7635	63.3972	66.9215	60.4630	59.5939	53.7409	52.0799	56.5032	56.2015	62.6736	65.6770	70.1963	(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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1702	17.0268	13.8471	10.4832	7.8363	6.6157	7.1485	9.2919	12.4716	15.8356	18.4824	19.7030	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)	96.4564	94.3410	89.9483	83.9765	80.0993	74.6401	69.9999	75.9452	78.0576	84.2387	91.2181	94.3499	(72)
Total internal gains	392.2143	390.1799	377.0023	355.7338	334.1468	313.3100	299.7448	305.6093	316.5065	337.9842	362.6735	381.1828	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1000	11.2829	0.6300	0.7000	0.7700	27.9305	(75)
Southeast	8.1000	36.7938	0.6300	0.7000	0.7700	91.0819	(77)

Solar gains	119.0124	211.9995	314.7094	431.2447	520.7308	533.5484	507.4964	438.2005	354.6665	240.9489	144.2389	100.7566	(83)
Total gains	511.2267	602.1794	691.7117	786.9784	854.8776	846.8584	807.2412	743.8098	671.1730	578.9331	506.9124	481.9394	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8628	52.9871	53.1094	53.6918	53.8021	54.3220	54.3220	54.4193	54.1205	53.8021	53.5793	53.3483	
alpha	4.5242	4.5325	4.5406	4.5795	4.5868	4.6215	4.6215	4.6280	4.6080	4.5868	4.5720	4.5566	
util living area	0.9970	0.9932	0.9825	0.9470	0.8543	0.6879	0.5258	0.5862	0.8312	0.9688	0.9938	0.9977	(86)
MIT	19.5983	19.7779	20.0686	20.4466	20.7627	20.9381	20.9857	20.9769	20.8473	20.4326	19.9458	19.5677	(87)
Th 2	19.8301	19.8325	19.8349	19.8460	19.8481	19.8578	19.8578	19.8596	19.8541	19.8481	19.8439	19.8395	(88)
util rest of house	0.9959	0.9908	0.9762	0.9271	0.8015	0.5890	0.3968	0.4536	0.7512	0.9532	0.9913	0.9969	(89)
MIT 2	17.9814	18.2446	18.6669	19.2086	19.6217	19.8183	19.8529	19.8506	19.7351	19.2009	18.4983	17.9432	(90)
Living area fraction									fLA = Living area / (4) =			0.4253	(91)
MIT	18.6690	18.8967	19.2630	19.7351	20.1069	20.2945	20.3346	20.3296	20.2081	19.7247	19.1139	18.6340	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6690	18.8967	19.2630	19.7351	20.1069	20.2945	20.3346	20.3296	20.2081	19.7247	19.1139	18.6340	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9882	0.9721	0.9248	0.8147	0.6290	0.4521	0.5104	0.7790	0.9510	0.9890	0.9957	(94)
Useful gains	508.3744	595.0810	672.4280	727.7891	696.5060	532.6387	364.9352	379.6287	522.8245	550.5850	501.3227	479.8550	(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	1464.7917	1423.4883	1295.0326	1087.4849	842.0470	564.9085	370.4861	389.1303	608.1933	913.9423	1208.3294	1458.0256	(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	711.5745	556.6897	463.2179	258.9810	108.2825	0.0000	0.0000	0.0000	0.0000	270.3378	509.0449	727.7589	(98)
Space heating												3605.8870	(98)
Space heating per m2										(98) / (4) =		46.4676	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3856.5637	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	711.5745	556.6897	463.2179	258.9810	108.2825	0.0000	0.0000	0.0000	0.0000	270.3378	509.0449	727.7589	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	761.0422	595.3900	495.4202	276.9850	115.8102	0.0000	0.0000	0.0000	0.0000	289.1314	544.4330	778.3517	(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	176.9994	155.5952	162.4369	144.2655	140.3989	124.0484	117.8004	131.1037	131.4488	149.6611	159.9467	172.2859	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.1457	87.9247	87.4555	86.3574	84.1312	79.8000	79.8000	79.8000	79.8000	86.3731	87.6889	88.2353	(217)
Fuel for water heating, kWh/month	200.8031	176.9642	185.7367	167.0563	166.8809	155.4491	147.6196	164.2904	164.7228	173.2727	182.4025	195.2573	(219)
Water heating fuel used												2080.4555	(219)

Annual totals kWh/year		
Space heating fuel - main system	3856.5637	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	338.5518	(232)
Total delivered energy for all uses	6350.5710	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3856.5637	0.2160	833.0178	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2080.4555	0.2160	449.3784	(264)
Space and water heating			1282.3961	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	338.5518	0.5190	175.7084	(268)
Total CO2, kg/m2/year			1497.0295	(272)
Emissions per m2 for space and water heating			16.5257	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2643	(272b)
Emissions per m2 for pumps and fans			0.5016	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5257 * 1.00) + 2.2643 + 0.5016, rounded to 2 d.p.			19.2900	(273)

Appendix C

SBEM BRUKL Worksheets – *Be Lean*

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Tesco Osterley Commercial Areas

As designed

Date: Thu Jun 25 13:30:31 2020

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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	46.2
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	46.2
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	35.1
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	0.26	1.4	04 Block D Ground Floor - GP Surgery_W_8
Floor	0.25	0.09	0.25	01 Block B Ground Floor - Library_F_4
Roof	0.25	0.12	0.12	00 Block B Lower Ground Floor - Retail_R_5
Windows***, roof windows, and rooflights	2.2	1.4	1.4	04 Block D Ground Floor - GP Surgery_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = 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	5

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	>0.95

1- ASHP & Boiler

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	4.2	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* 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- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	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
04 Block D Ground Floor - GP Surgery	-	-	-	1.5	-	-	-	-	-	0.85	0.5
04 Block D Ground Floor - Gym and Pool	-	-	-	1.5	-	-	-	-	-	0.85	0.5
04 Block D Ground Floor - Shower and Changing Rooms	-	-	-	-	-	-	-	-	-	-	N/A
04 Block D Ground Floor 3 - Concierge	-	-	-	1.5	-	-	-	-	-	0.85	0.5
00 Block B Lower Ground Floor - Retail	-	-	-	1.5	-	-	-	-	-	0.85	0.5
01 Block B Ground Floor - Library	-	-	-	1.5	-	-	-	-	-	0.85	0.5
00 Block B Lower Ground Floor 3 - Cafe	-	-	-	1.5	-	-	-	-	-	0.85	0.5
00 Block B Lower Ground Floor 3 - Pub	-	-	-	1.5	-	-	-	-	-	0.85	0.5
00 Block B Lower Ground Floor 3 - Hall	-	-	-	1.5	-	-	-	-	-	0.85	0.5
01 Block B Ground Floor 3 - Transport Hub	-	-	-	1.5	-	-	-	-	-	0.85	0.5

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
04 Block D Ground Floor - GP Surgery	120	-	-	588

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
04 Block D Ground Floor - Gym and Pool	-	120	-	852
04 Block D Ground Floor - Shower and Changing Rooms	-	120	-	45
04 Block D Ground Floor 3 - Concierge	120	-	-	2437
04 Block D Ground Floor 3 - Lobby	-	120	-	46
00 Block B Lower Ground Floor - Retail	-	100	100	6449
01 Block B Ground Floor - Library	120	-	-	987
00 Block B Lower Ground Floor 3 - Cafe	-	120	100	550
00 Block B Lower Ground Floor 3 - Pub	-	120	100	683
00 Block B Lower Ground Floor 3 - Hall	-	120	-	891
01 Block B Ground Floor 3 - Transport Hub	120	-	-	826

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?
04 Block D Ground Floor - GP Surgery	NO (-22.8%)	NO
04 Block D Ground Floor - Gym and Pool	NO (-37.1%)	NO
04 Block D Ground Floor - Shower and Changing Rooms	N/A	N/A
04 Block D Ground Floor 3 - Concierge	NO (-32.7%)	NO
04 Block D Ground Floor 3 - Lobby	N/A	N/A
00 Block B Lower Ground Floor - Retail	NO (-59.5%)	NO
01 Block B Ground Floor - Library	NO (-47.8%)	NO
00 Block B Lower Ground Floor 3 - Cafe	NO (-73.8%)	NO
00 Block B Lower Ground Floor 3 - Pub	NO (-39.8%)	NO
00 Block B Lower Ground Floor 3 - Hall	NO (-81.2%)	NO
01 Block B Ground Floor 3 - Transport Hub	NO (-40.1%)	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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	3162.9	3162.9
External area [m^2]	6240.4	6240.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	1534.88	1974.58
Average U-value [W/m^2K]	0.25	0.32
Alpha value* [%]	11.26	9.75

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
23	**A1/A2 Retail/Financial and Professional services**
21	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
21	**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
7	**D1 Non-residential Institutions: Community/Day Centre**
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
9	**D1 Non-residential Institutions: Education**
3	**D1 Non-residential Institutions: Primary Health Care Building**
	D1 Non-residential Institutions: Crown and County Courts
15	**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	5.73	8.1
Cooling	9.49	14.57
Auxiliary	11.47	6.87
Lighting	15.07	35.63
Hot water	72.28	72.21
Equipment*	52.61	52.61
TOTAL**	**114.05**	**137.38**

* 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]	175.12	212.74
Primary energy* [kWh/m^2]	203.04	268.82
Total emissions [kg/m^2]	35.1	46.2

* 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	17.5	157.6	5.7	9.5	11.5	0.85	4.62	0.91	6.5
	Notional	23.9	188.9	8.1	14.6	6.9	0.82	3.6	----	----

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	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.19	04 Block D Ground Floor - GP Surgery_P_15
Floor	0.2	0.06	04 Block D Ground Floor - Gym and Pool_S_3
Roof	0.15	0.11	04 Block D Ground Floor - GP Surgery_R_5
Windows, roof windows, and rooflights	1.5	1.4	04 Block D Ground Floor - GP Surgery_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = 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
$m^3/(h.m^2)$ at 50 Pa	5	5

Appendix D
Overheating Mitigation Report

HODKINSON

St Edward Homes Ltd

Tesco Osterley

Overheating Mitigation Strategy Report

Final

Author: **Chiara Fratter**
Author BArch, MSc (Hons), CEng MCIBSE
Date: September 2020

DOCUMENT CONTROL RECORD
REPORT STATUS: FINAL

Version	Date	Reason for issue	Author	Checked by	Approved for Issue by Project Manager
v.1	30.06.20	Draft	CFR	KP	CS
v.2	10.07.20	Final Draft	CFR	KP	CS
v.3	24.07.20	Final	CFR	KP	CS
v.4	29.07.20	Final (minor update)	CFR	KP	CS
v.5	04.09.2020	Final	CFR	KP	DS

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We are able to advise at all stages of projects from planning applications to handover.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for quality and construction efficiency.

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Executive Summary

This overheating mitigation strategy report sets out the required measures and the commitment to achieve compliance with overheating planning requirements to minimise the risk of overheating in homes in support of the Outline Application of the Tesco Osterley, by St Edward Homes Limited, in the London Borough of Hounslow.

The document outlines how the development has taken all available steps at this stage of design to address overheating, and how would ensure compliance with CIBSE TM59 overheating criteria later as part of each Future Reserved Matters applications for the proposed Tesco Osterley scheme.

This document acknowledges the importance of considering overheating since early stage of the design as there are design decisions which can significantly contribute to increase the risk of overheating and it would be difficult to incorporate design changes afterwards. It made use of the recently published Good Home Alliance GHA Early Stage Overheating Risk Tool to identify key risks factors and effective mitigation measures that can be used by the future detailed design stages of the Tesco Osterley scheme to control overheating.

The proposed overheating mitigation strategy is intended to consider as many passive features as feasible at this stage of the design and to inform on mitigation measures that can be looked into at the detailed design to balance out site constraints found by the GHA and dwelling characteristics.

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1. INTRODUCTION

Site and Context

1.1 This overheating mitigation strategy report has been completed by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, in support of the Outline Application at Tesco Osterley by St. Edward Homes Limited in the London Borough Hounslow.

1.2 The proposed development site is located at Tesco Osterley, Syon Lane, Isleworth, TW7 5NZ as shown in Figure 1.

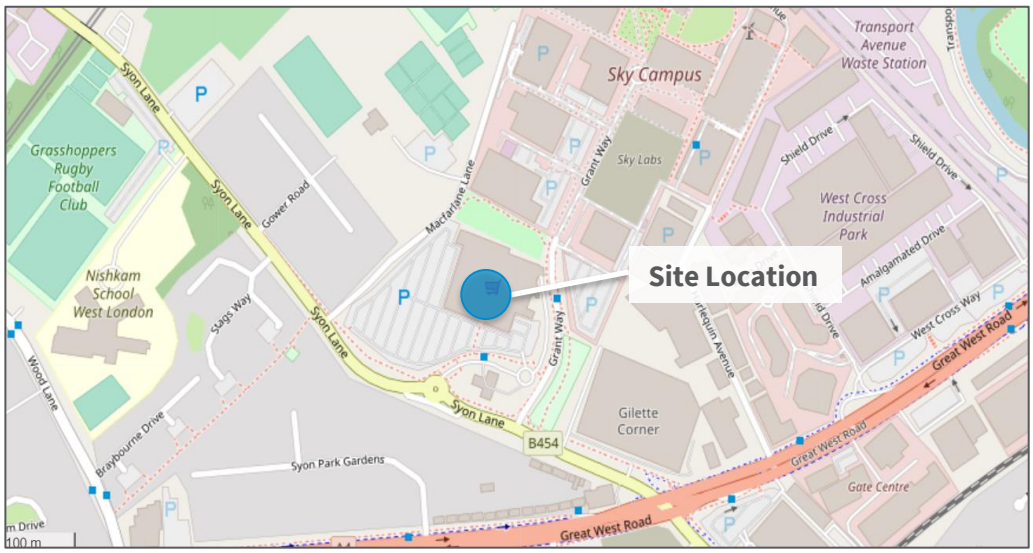

Figure 1. Site Location (Source: OpenStreetMap© 2020).

Proposed Development

1.3 The Proposed Development is described as follows:

"Outline planning application with all matters reserved except access for the demolition of existing building and car park and erection of buildings to provide residential homes, plus flexible non-residential space comprising commercial, business and service space, and/or learning and non-residential institution space, and/or local community space, and/or public house/drinking establishment, and/or a mobility hub, along with associated access, bus turning, car and cycle parking, and landscaping arrangements."

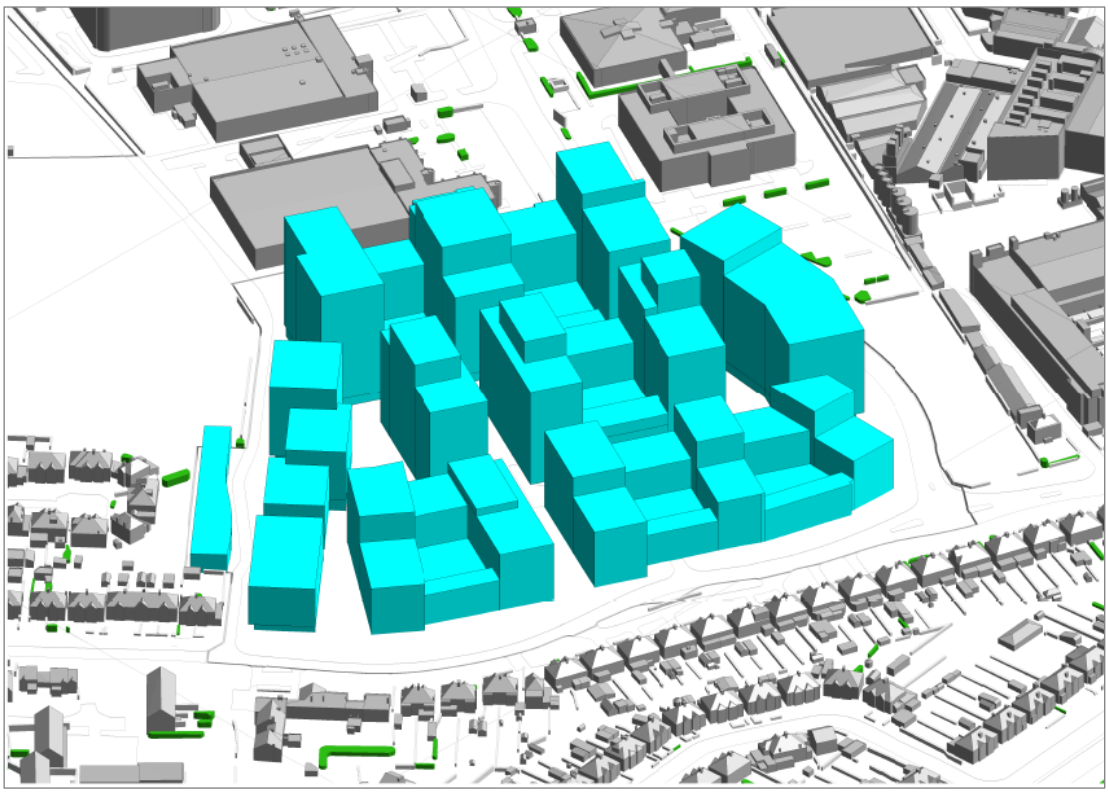

Figure 2. Illustrative 3D south view of the proposed development (Source: JTP Architects, 29.06.20)

Overheating and Thermal Comfort

1.4 This document acknowledges the importance of considering overheating from an early stage as there are design decisions which can significantly contribute to increase the risk of overheating and it would be difficult to incorporate design changes afterwards.

1.5 Overheating has become a major concern in high-density homes. This is usually caused by a combination of factors including high levels of solar gain, use of full height glazing, high levels of insulation and poor natural ventilation especially in single aspect apartments and heat loss from communal heating systems.

1.6 The proposed overheating mitigation strategy has been developed following design principle of the Cooling Hierarchy (Draft London Plan Policy SI4 *Managing Heat Risk*) and estimating the risk using the new GHA Early Stage Overheating Risk Tool in line with the updated GLA Energy Assessment Guidance (April 2020).

2. OVERHEATING MITIGATION STRATEGY

2.1 This section outlines the design principles as well as internal design discussions that the design team carried out to ensure that the risk of overheating is mitigated at early stage design. This also set out key factors that could be incorporated into detailed design stage for the proposed Tesco Osterley development.

Design Principles

2.2 A series of overheating workshops/discussions have been undertaken during the design process to provide the design team with guidance on how to mitigate the risk of overheating at this stage and avoid design changes post submission when it could be difficult to incorporate them.

2.3 During the workshop it was also extensively explained the CIBSE TM59 methodology and criteria used to carry out dynamic overheating assessment as well as the mandatory compliance with *moderately warm summer* condition (DSY1), with attention to key design factors that can lead to increase the risk of overheating.

2.4 To minimise the risk of overheating the design team looked at the following design features from the Cooling Hierarchy, on the basis that the scheme is only submitted as outline application:

> Proportion of glazed area should be kept below 35% of total façade area (Glazing Ratio) to avoid excess glazing that can severely contribute to overheating risk;

> Utilising external shadings devices (balconies, overhangs etc.), increase windows reveals, and solar control glass specifications (g values) to control the solar radiation entering the spaces;

> Minimising the use of single aspects units where possible and make sure that good levels of ventilation are provided for all units to reduce risk of overheating;

> Maximising windows openability to enhance natural ventilation, by looking at raise windows sill height to enable for fully openable windows; and

> Consideration of site context characteristics that can limit the use of natural ventilation as a main mean of tackling risk of overheating, to include noise, air quality, security, and crime factors.

Good Home Alliance (GHA): Early Stage Overheating Risk Tool

2.5 The recently published GLA Energy Assessment Guidance (April 2020) introduces the GHA Overheating Risk Tool which aims to encourage sufficient consideration to estimate the risk of overheating in new homes since early design. This tool uses a holistic consideration of overheating which looks at the link between site constraints and design features. For instance, a very noisy site

can limit reliance on window openings and therefore on the use of natural ventilation to control overheating.

2.6 The tool is based on the London Plan Cooling Hierarchy approach and seeks to prioritize passive features and reduce the need of active cooling in line with London Plan policy. The use of the GHA overheating tool is flexible and it can be applied at the overall scheme as well as to specific building or dwelling type based on level of detailed available.

2.7 As results of the assessment the scoresheet provides a score which categorises the level of risk in Low, Medium, and High. In case of low-risk levels the team should commit to maintain the proposed design features throughout design development to ensure that risk of overheating is mitigated. For Medium and High-risk levels, the tool may help the team to identify opportunities to reduce risk factors and improve mitigation factors that can be investigated through more detailed tools such as dynamic thermal modelling.

2.8 The GHA Overheating Risk Tool should be used as a design tool to recognize key factors that can lead to overheating risk and find possible mitigation measures to be investigated at future design stages.

2.9 The results of the early stage overheating assessment for the proposed Tesco Osterley scheme using the GHA tool indicate that currently the development falls under high risk of overheating (Figure A1). This is mainly caused by a combination of specific characteristics of the site. Its geographical location at the edge of London, and its proximity to a busy road such as Syon Lane to the south of the scheme can contribute to increase the likelihood of overheating. In addition, the nature of the proposed scheme comprises blocks of flats (type of dwelling more prone to overheating), and utilizes a communal heating network to supply heat.

2.10 However, the future reserved matters applications will seek to reduce the high risk of overheating as far as possible by incorporating the following mitigation features which will need to be confirmed at detailed design stage by dynamic thermal modelling:

> Targeting glazing ratio of less than 35% of total façade area;

> Designing windows to be openable beyond minimum purge ventilation requirements (e.g. double -up the openable areas);

> Incorporating effective external shading on exposed facades (south, west and east orientations) to ensure as a minimum shade for half of the day;

> Incorporating acoustic mitigation measures to minimise noise nuisance and allow windows to be open to control overheating based on the level of external noise;

> Use of high internal ceiling (>2.8m) and use thermal mass of exposed surfaces such as ceiling or walls where possible;

> Making sure the heat losses from the communal heating network system are minimise and they do not contribute to risk of overheating in the communal corridors by prioritizing low-temperature systems and increase pipes insulation; and

> Controlling the external conditions of the development by using blue or green infrastructures, lighter surfaces that reflect more heat and trees to provide shade at glazed surfaces.

2.11 Despite the fact that applying all the above measures the GHA tool will still indicate a high-risk level, the total score is significantly reduced from a score of 22 for the baseline scenario (Figure A1) where any mitigation are employed to a score of 12 which is the threshold figure of the High-risk category in the improved scenario (Figure A2). A detailed TM59 overheating assessment is intended to be carried out for each Future Reserved Matters Application to include any additional relevant assessments required to value the proposed overheating strategy (E.g. noise, air quality assessments etc.).

3. CONCLUSION

3.1 This Overheating Mitigation Strategy Report sets out how the proposed development has taken all available steps at this stage of design to address overheating, and how it will be later considered as part of the future Reserved Matters applications.

3.2 An early stage overheating assessment for the whole scheme has been carried out using the Good Home Alliance (GHA) overheating risk tool as requested by the GLA new Energy Assessment Guidance (2020). The tool identifies that the site will be at high risk of overheating. The GHA scoresheet has also been used be the team as a design tool to pinpoint effective key mitigation measures that could be incorporated at detailed design stage to reduce the risk of overheating.

3.3 Furthermore, there is the commitment to undertake detailed dynamic thermal modelling in line with the CIBSE TM59 from representative dwellings for each future Reserved Matters Application of the proposed Tesco Osterley scheme. This will also include consideration of site constraints such as external noise level from the adjacent Syon Lane and the Heathrow flight path above the site to value the overheating strategy.

Appendices

Appendix D1

GHA Overheating Risk Tool scoresheet

Appendix D1

GHA Overheating Risk Tool scoresheet

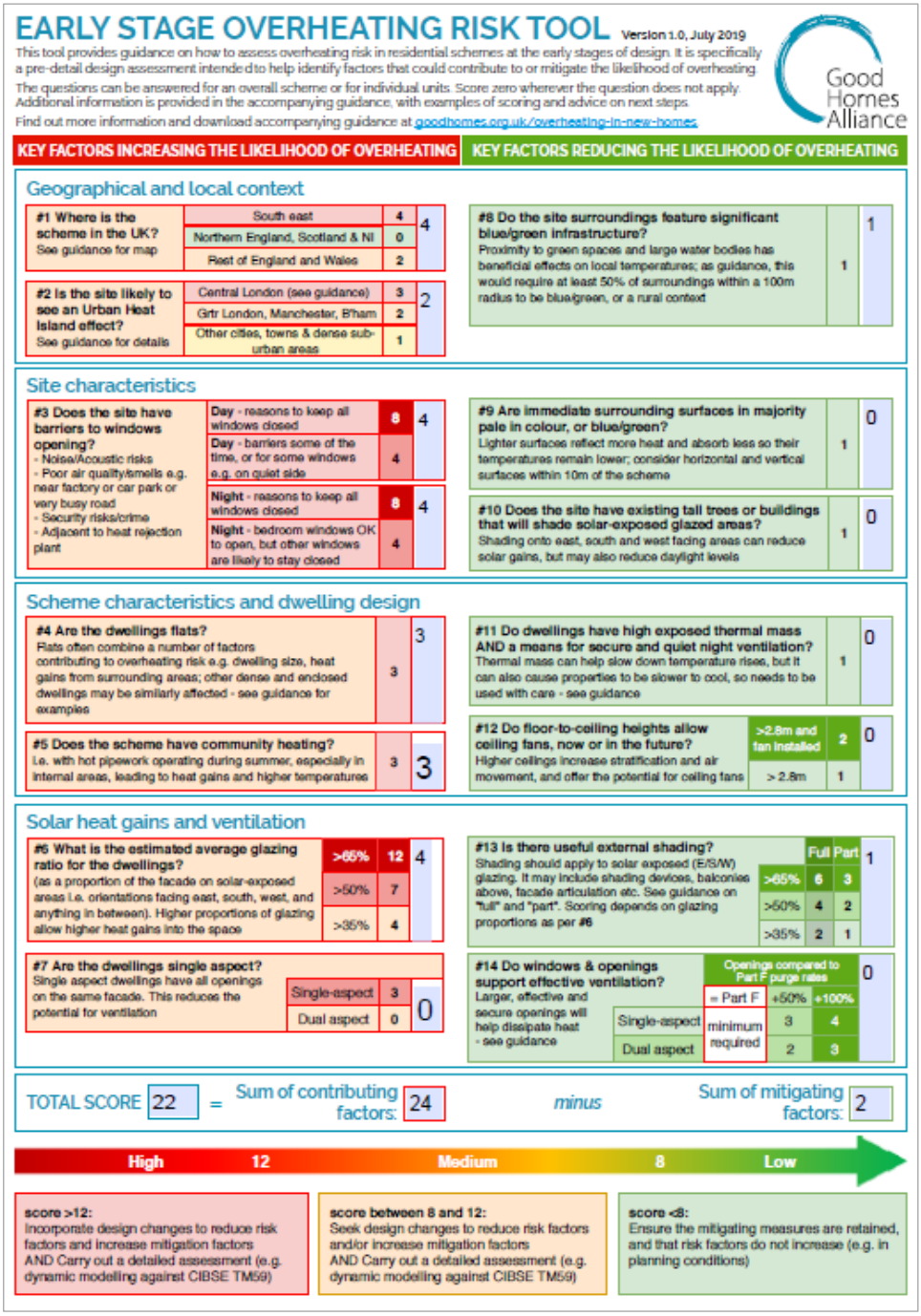

Figure C1.1: GHA Overheating Risk Tool scoresheet for the baseline scenario.

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes

Good Homes Alliance

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map

South east	4	4
Northern England, Scotland & NI	0	
Rest of England and Wales	2	

#2 Is the site likely to see an Urban Heat Island effect? See guidance for details

Central London (see guidance)	3	2
Grtr London, Manchester, B'ham	2	
Other cities, towns & dense sub-urban areas	1	

#8 Do the site surroundings feature significant blue/green infrastructure?
Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context

1 | 1

Site characteristics

#3 Does the site have barriers to windows opening?
- Noise/Acoustic risks
- Poor air quality/smells e.g. near factory or car park or very busy road
- Security risks/crime
- Adjacent to heat rejection plant

Day - reasons to keep all windows closed	8	4
Day - barriers some of the time, or for some windows e.g. on quiet side	4	
Night - reasons to keep all windows closed	8	4
Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green?
Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme

1 | 1

#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas?
Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels

1 | 0

Scheme characteristics and dwelling design

#4 Are the dwellings flats?
Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples

3 | 3

#5 Does the scheme have community heating?
i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures

3 | 0

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation?
Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance

1 | 0

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future?
Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans

>2.8m and fan installed	2	0
> 2.8m	1	

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings?
(as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space

>65%	12	0
>50%	7	
>35%	4	

#7 Are the dwellings single aspect?
Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation

Single-aspect	3	0
Dual aspect	0	

#13 Is there useful external shading?
Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6

	Full	Part	0
>65%	6	3	
>50%	4	2	
>35%	2	1	

#14 Do windows & openings support effective ventilation?
Larger, effective and secure openings will help dissipate heat - see guidance

	Openings compared to Part F purge rates		3
	= Part F	+50%	+100%
Single-aspect	minimum required	3	4
Dual aspect		2	3

TOTAL SCORE **12** = Sum of contributing factors: **17** *minus* Sum of mitigating factors: **5**

High 12 **Medium** 8 **Low**

score >12:
Incorporate design changes to reduce risk factors and increase mitigation factors
AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score between 8 and 12:
Seek design changes to reduce risk factors and/or increase mitigation factors
AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score <8:
Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

Figure C1.2: GHA Overheating Risk Tool scoresheet for the improved scenario.

Appendix E

Whole Life Cycle Assessment Report

HODKINSON

Whole Life Cycle Carbon Emissions Review

St Edward Homes Ltd

Tesco Osterley

Final

Zeta Watkins
BSc (Hons), MSc, CEnv, MIEMA

September 2020

DOCUMENT CONTROL RECORD
REPORT STATUS: FINAL

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v.1	01.07.2020	Draft	ZW	CS	CS
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v.4	29.07.2020	Final (minor update)	ZW	CS	CS
v.5	04.09.2020	Final (minor update)	MV	ZW	DS

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3. DEVELOPMENT OVERVIEW 6
4. METHODOLOGY 7
5. WHOLE LIFE CYCLE CARBON REVIEW 8
6. EARLY RECOMMENDATIONS 10
7. CONCLUSION 11

1. INTRODUCTION

1.1 This Framework Whole Life Cycle Carbon Emissions (WLCCE) review has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by St Edward Homes Ltd.

1.2 This is an initial review of the development at Tesco Osterley, based on the best available information. The development is being submitted in outline only so many design decisions are yet to be made. This means that a WLCCE assessment (in line with the draft GLA guidance) is unable to be done at this stage. As the design progresses a further review could take place.

1.3 This high-level review will aim to help St Edward Homes Ltd and the design team understand, at an early stage, the lifetime consequences of current design decisions on embodied carbon.

2. POLICY AND REGULATIONS

The London Plan

2.1 It is anticipated that the **Intend to Publish New London Plan** will be adopted in summer 2020, although the policies are already carrying weight with the Greater London Authority (GLA). This includes Policy SI 2:

2.2 **Policy SI 2 Minimising Greenhouse Gas Emissions, states:**

'Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions:

Operational carbon emissions will make up a declining proportion of a development's whole life-cycle carbon emissions as operational carbon targets become more stringent. To fully capture a development's carbon impact, a whole life-cycle approach is needed to capture its unregulated emissions (i.e. those associated with cooking and small appliances), its embodied emissions (i.e. those associated with raw material extraction, manufacture and transport of building materials and construction) and emissions associated with maintenance, repair and replacement as well as dismantling, demolition and eventual material disposal). Whole life-cycle carbon emission assessments are therefore required for development proposals referable to the Mayor. Major non-referable development should calculate unregulated emissions and are encouraged to undertake whole life-cycle carbon assessments. The approach to whole life-cycle carbon emissions assessments, including

when they should take place, what they should contain and how information should be reported, will be set out in guidance'.

2.3 The above policy notes that all referable schemes will be required to carry out a WLCCE assessment at the outset of the project, with reporting required at pre-application, planning and post-completion stages once the draft London Plan is adopted.

2.4 This assessment would form a part of the concept design and inform the design and material choices through the course of the project rather than appear as an afterthought later in the design.

2.5 Although not appropriate for Tesco Osterley at present, due to the very early stage of the development, a review of the design from a carbon perspective is a positive step.

Local Policy: London Borough of Hounslow

2.6 The London Borough of Hounslow's Local Plan was adopted in 2015. The following policies are considered relevant to this Statement:

2.7 **Policy EQ1 - Energy and carbon reduction** requires all development to meet the carbon emission reduction requirements set out in the London Plan.

2.8 **Policy EQ2 - Sustainable design and construction** expects development proposals to:

> Incorporate established principles for sustainable design and construction as set out in the London Plan, including passive solar design, water efficiency standards, sustainable drainage, the reuse and recycling of construction materials, green roofs and urban greening.

> Be assessed against the standards for sustainable design and construction and submit relevant documentation to demonstrate that minimum specified levels are met or meet any national standards that subsequently supersede these.

> All developments over 500 sqm should be assessed against BREEAM standards and meet a rating of 'Excellent' as a minimum.

> All residential developments should meet the standards for sustainable design and construction set out in the London Plan, including any 'optional' Building Regulations requirements it adopts.

> Prepare a sustainability statement, where major developments are proposed.

2.9 **Policy EQ3 - Flood risk and surface water management** require development proposals to prepare flood risk assessments. Flood resistance, resilience measures, and sustainable drainage systems should be incorporated while avoiding non-permeable hard standings.

2.10 **Policy EQ7 - Sustainable waste management** requires suitable arrangements for waste management, including the location, size and design of waste and recycling facilities, and transport access.

Guidance Documents

2.11 Preliminary guidance has been released by the Greater London Authority (GLA); it outlines how to prepare a WLCCE assessment which should accompany all referable planning applications in line with London Plan Policy SI 2.

2.12 In addition, the following guidance is available to conduct assessments:

> **BS EN 15978:2011 -** *Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method.*

> **ISO 14040:2006 -** *Environmental management — Life cycle assessment — Principles and framework.*

> **RICS Professional Statement Whole life carbon assessment:2017 -** *Whole life carbon assessment for the built environment.*

3. DEVELOPMENT OVERVIEW

Site Location

3.1 The proposed development site at Tesco Osterley in the London Borough of Hounslow is located at Syon Lane, Isleworth, TW7 5NZ as shown in Figure 1 below.

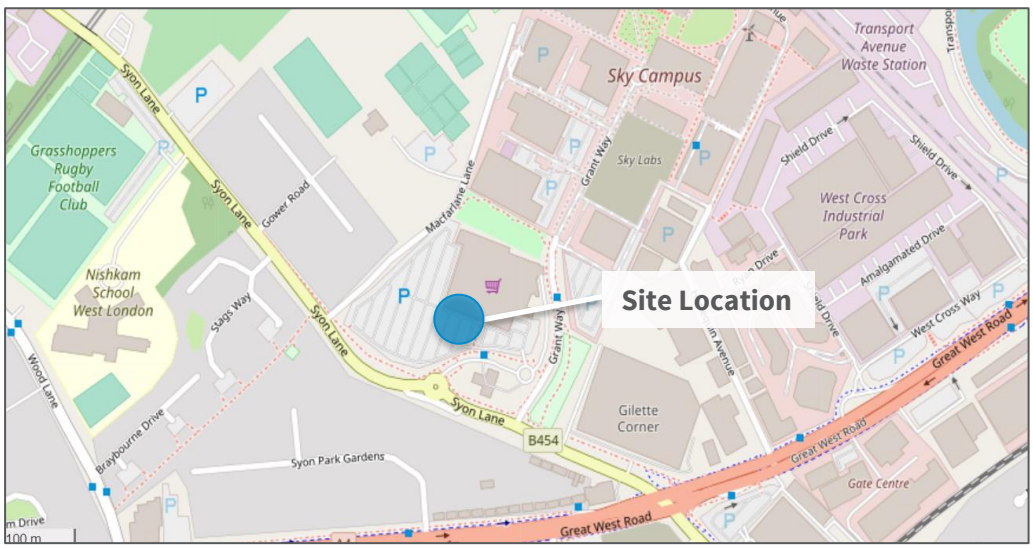


Figure 1: Site Location – OpenStreetMap© 2020

Proposed Development

3.2 The proposed development is described as follows:

"Outline planning application with all matters reserved except access for the demolition of existing building and car park and erection of buildings to provide residential homes, plus flexible non-residential space comprising commercial, business and service space, and/or learning and non-residential institution space, and/or local community space, and/or public house/drinking establishment, and/or a mobility hub, along with associated access, bus turning, car and cycle parking, and landscaping arrangements."

3.3 The scheme is being submitted in outline only which means that many design decisions are yet to be made. To undertake a WLCCE assessment, that is able to give tangible results, a level of detail in the design is required. As this has not yet been progressed at Tesco Osterley an interim review has been undertaken instead.

4. METHODOLOGY

4.1 This is an initial review of the development at Tesco Osterley, based on the best available information. The development is being submitted in outline only so many design decisions are yet to be made. This means that a WLCCE assessment (in line with the draft GLA guidance) is unable to be done at this stage.

4.2 A review will be done at high level, outlining areas of the design that would perform well in a WLCCE assessment and those elements which would require some more thought. A series of early considerations will also be made for the design team to consider as the project progresses.

4.3 Operational energy is the inputted energy required for all heating and power needs. It can be split into two variants:

> **Regulated Emission** - which are assessed using the Government's approved methodology for Building Regulations Part L compliance, the Standard Assessment Procedure (SAP) and

> **Unregulated** – energy use as a direct result of user behaviour. This includes cooking, white goods (fridges, washing machines etc), and plug in electrical loads (televisions, laptops, lamps etc).

4.4 If a future WLCCE assessment is undertaken the above variants will be included. For clarity, as unregulated energy demands are largely reliant on the behaviour of occupants, they would be considered a fixed entity in the calculations.

Study Period

4.5 The reference study period (RSP) for domestic projects should be set at 60 years, this is based on the principles outlined in BS EN 15978: 2011, section 7.3.

4.6 RSPs are fixed to enable comparability between whole life carbon results for different projects. It ensures that the assessment is representative of typical service life of different building elements.

5. WHOLE LIFE CYCLE CARBON REVIEW

5.1 As noted above, this is an initial review based on the best available information which will need to be updated as the project progresses.

5.2 This section covers the initial observations made on the current design based on key themes which can be considered at this early stage. These include green infrastructure, building materials, building heights and form and zero carbon.

Green Infrastructure

5.3 It is known that green roofs will be installed, these are considered effective in the reduction of CO_2 (when greater than 1000m^2 in size) because of their ability to reduce energy consumption of buildings and sequester carbon in plants and substrate.

5.4 The installation of green roofs typically contains less embodied energy than that of traditional roof systems. Typical roof systems have an expected lifespan of 30 years (RICS Guidance), the implementation of a green roof extends the roof's lifetime beyond this.

5.5 The landscaping strategy is currently proposed to be a mix of both soft and hard landscaping. In order to reduce the embodied carbon of the hard landscaping any demolished concrete should be crushed on-site and potentially used a subbase to reduce the overall embodied carbon of the landscaping.

Building Materials

5.6 A significant amount of concrete is expected. Early conversations should be had with the structural engineer to avoid over-engineering.

5.7 Gypsum should be considered for internal walls, as these assemblies are designed so that they can be used again.

5.8 It is known that buildings with very small glazing ratios will produce much more carbon than buildings with larger glazing rations. The optimum glazing ratio is therefore considered to be between 30 and 50%. A target glazing ratio of < 35% of the total façade area is targeted for overheating purposes which is in line with this optimum ratio.

Building Heights and Form

5.9 The heights at this development vary across the site, as demonstrated in Figure 2 below:

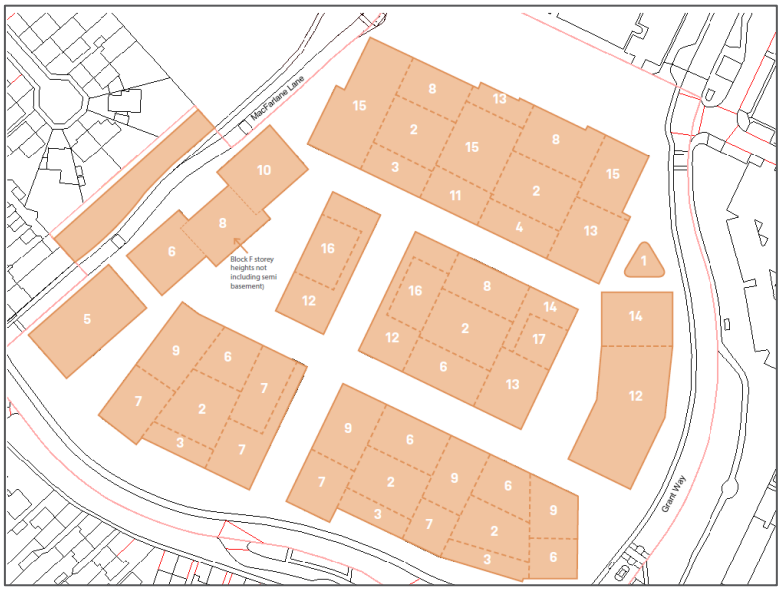


Figure 2: Building Heights (JTP Architects, 29/06/2020)

5.10 High-rise buildings gain efficiency in the ratio of envelope to gross floor area because while each floor will typically have a similar amount of façade, the environmental impact of the roof and ground floor is divided by the number of floors – the more floors the better in this respect.

5.11 The avoidance of overly complex building forms and junction designs across the site offers a more consistent and reliable standard of construction which will assist in air tightness and reducing the impact of heat loss through thermal bridges.

Zero Carbon

5.12 Major residential developments are subject to an additional offset payment to meet a 100% reduction in Regulated CO_2 emissions to achieve the standard of Zero Carbon. This payment is made to the local borough's Carbon Offsetting Fund and is expected to be allocated to carbon reduction savings elsewhere in the borough.

5.13 As set out in the Energy Statement provided by Hodkinson Consultancy the site is meeting the Greater London Authorities (GLA) definition of Net Zero Carbon. Based on this, the operational emissions can be set as zero for the first thirty years when finalising the assessment once the design is more progressed.

6. EARLY RECOMMENDATIONS

6.1 A set of early recommendations are set out below. These should be considered as the design progresses to ensure that embodied carbon savings are maximised. These are based on embodied carbon and life cycle only and must be considered alongside other design considerations:

> To maximise the opportunities arising from the potential demolition of the existing site, a pre-demolition audit should be undertaken. This will identify and quantify the materials to encourage and maximise reuse and recycling.; for example, all demolished concrete can be crushed on-site and used onsite as hard core, fill, or in landscaping.

> Using concrete as a finish can reduce the need for other materials. In addition, exposed areas of concrete can optimise the thermal mass performance. Thermal mass, with adequate ventilation, can be used to control daytime peak temperatures of a space and therefore reduce or minimise the need for air-conditioning. The areas where this can be done would need to be carefully considered. The durability of concrete also offers further savings through a reduction in the need for maintenance and repair (compared to a painted finish for example).

> The transportation of materials from the manufacturing facility to the building site adds to the carbon of the development. Buying from local sources reduces the emissions produced during transportation, once further details of manufacturers and their locations are known the whole life carbon assessment can be updated to reflect this.

> The façade is under constant wear from the environment, can lead to frequent repairs and maintenance. By using durable materials, this not only reduces the cost and frequency of refurbishment but also reduces the use of material replacement and its associated carbon footprint.

> Innovative cement mixes are now increasingly available, using a mixture that is 95% ground granulated furnace slag (GGBS) and 5% as the activator can save up to 90% in emissions. This cement mixture could be used for building elements such as piles, floors, walls, and reinforced foundations.

> Consideration of offsite fabrication, and standard sizes to reduce building complexity and embodied energy use in production.

> Recycled aggregates should only be considered within the design when they are locally available, otherwise transportation impacts exceed the intended benefits.

7. CONCLUSION

7.1 This Framework Whole Life Cycle Carbon Emissions (WLCCE) review has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by St Edward Homes Ltd.

7.2 This is an initial review of the development at Tesco Osterley, based on the best available information. The development is being submitted in outline only so many design decisions are yet to be made. This means that a WLCCE assessment (in line with the draft GLA guidance) is unable to be done at this stage. As the design progresses a further review will need to take place.

7.3 This high-level review will aim to help St Edward and the design team understand, at an early stage, the lifetime consequences of current design decisions on embodied carbon.

7.4 Initial high-level observations have been made and are generally positive with recommendations made to aid the continuing design.

Appendix F

Correspondence with Sky Campus

From: Mollie Mills OBrien
To: Kingston, Patrick (Real Estate Manager)
Cc: Bentley, Sarah (Programme Head); Chris Beard; Duncan Matthews
Subject: Sky/Berkeley - Energy Query

Morning Patrick,

I hope you had a good week of leave last week. We discussed having a catch-up this week, would Wednesday pm work?

I also have a query with regards to our proposed energy strategy on the Tesco site. As part of the planning application site as a residential led mixed-use development which will contain a heat network, we are investigating whether there are any available heat suppliers in the area.

Would you please be able to review the below questions and come back to me.

We are required to investigate the possibility of connecting into existing networks but very much appreciate this may not be possible.

- Capacity: We require peak capacity of 5.8MW of heat. Please can you confirm whether you have sufficient excess capacity available?;
- Service Requirement: We require a 100% availability. Please confirm that whether you are able to provide this?
- Low Carbon: We require a low carbon supply. Please can you therefore confirm the carbon intensity (in kg of CO2 per KWh) of your heat. Ideally this would be provided using SAP10.1 carbon factors so as to align with the planning strategy

If you have any questions, please do let me know.

Many thanks,

Mollie

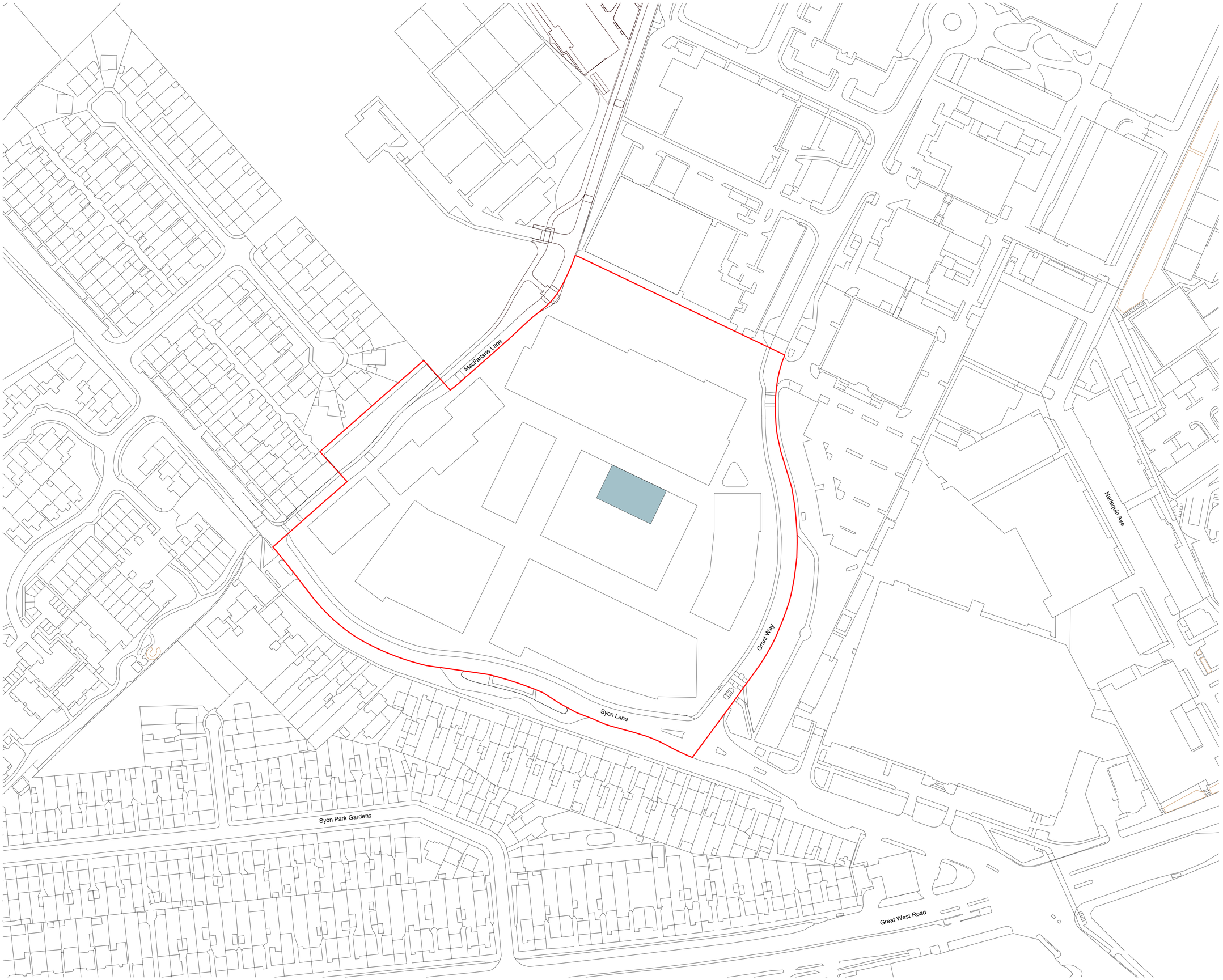
Mollie Mills O'Brien MRICS
Development Manager

BH02	SE-02	2020

Berkeley Homes (Urban Renaissance) Limited
Chelsea Bridge Wharf | 380 Queenstown Road | London | SW11 8PE
Telephone: 020 7346 7940 Mobile: 07976 423 883

Appendix G

Proposed Energy Centre Location



Notes

Do not scale from this drawing.
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All construction information should be taken from figured dimensions only.
Any discrepancies between drawings, specifications and site conditions must be brought to the attention of the supervising officer.
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KEY_PP_Proposed Site Levels

- Application Boundary
- Zone for Energy Centre Located at Ground Level (FFL 23.3m AOD)
- Development Parcel

Rev	Date	Description	Drawn	Chkd
01	27/05/20	Design Freeze	EA	IF/RT

Drawing Status

Outline Planning Application

Client

St Edward

JTP Studios, Unit 5
The Rum Warehouse
Pennington Street
London, E1W 2AP
+44 (0) 20 7017 1780
www.jtp.co.uk

Project

Tesco Osterley

Drawing Title

Parameter Plan
Energy Centre Location

Scale @A1 1 : 1000 Job Ref. 01754

Drawing No. JTP-DR-MP-PP-011 Revision.

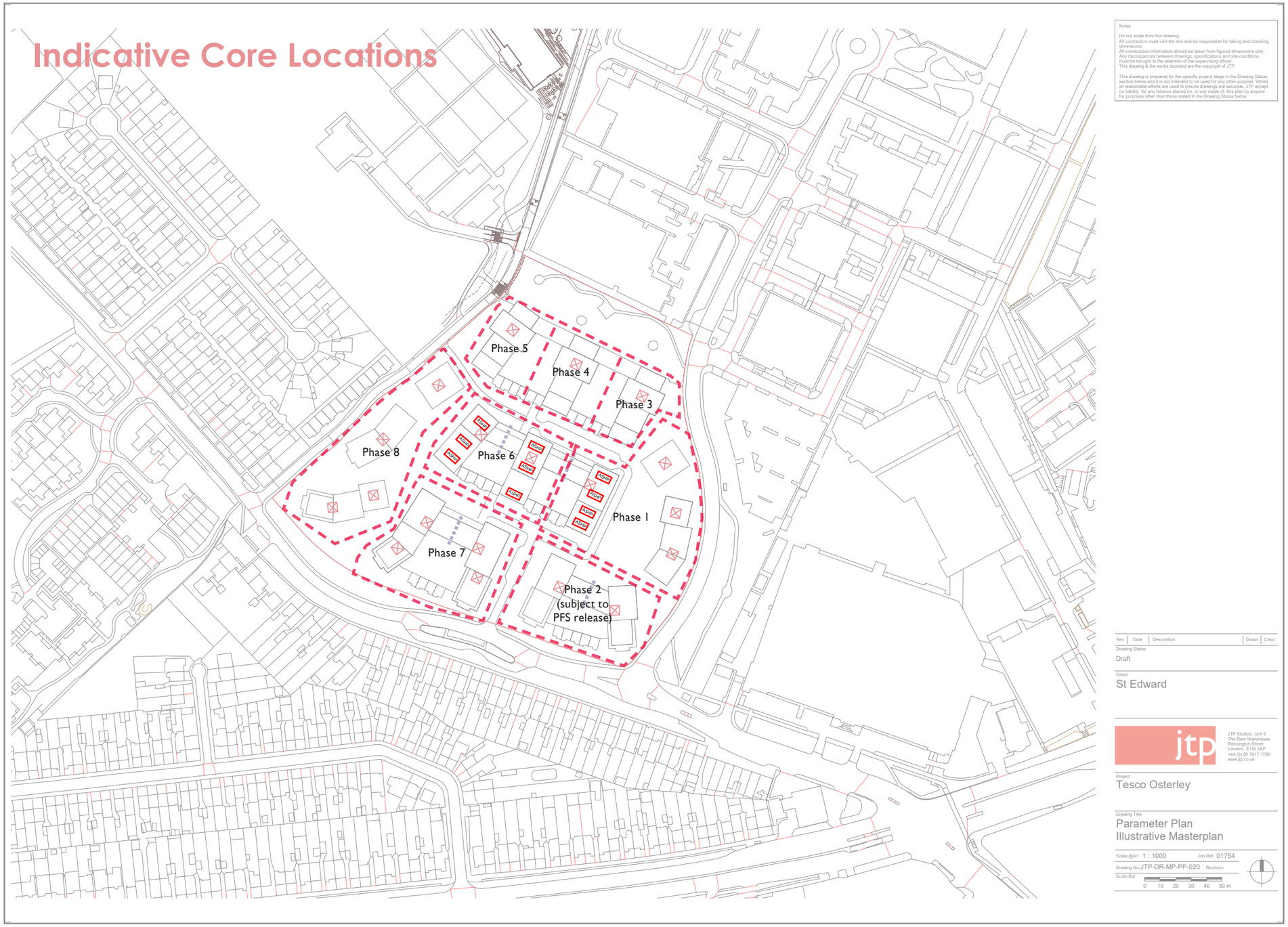
Scale Bar

0 50 100 150 200 250 mm

Appendix H

Indicative Heat Network Schematic and Heat Pump Locations (Buro Happold)

THE BISCUIT WORKS -
PHASING



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Rev	Date	Description	Drawn	Chkd

Drawing Status
Draft

Client
St Edward

jtp
JTP Studios, Unit 5
The Rum Warehouse
Pennington Street
London, E1W 2AP
+44 (0) 20 7017 1780
www.jtp.co.uk

Project
Tesco Osterley

Drawing Title
Parameter Plan
Illustrative Masterplan

Scale @A1 1 : 1000 Job Ref. 01754

Drawing No. JTP-DR-MP-PP-020 Revision.

Scale Bar
0 10 20 30 40 50 m

TESCO OSTERLEY Heating & Cooling Schematic

Roof

Primary
CHW
Pumps

Secondary
CHW Pumps

Heat Recovery
ASHP
(Commercial)

8°C

13°C

ASHPs (Heating
Only, Residential)
at roof level

30°C

50°C

Mixed use
Commercial Space
3000m2

Residential Blocks

Energy Centre

To Building
DHW Storage

55°C

65°C

Boilers

Secondary
LTHW
Pumps

Primary
LTHW
Pumps

Appendix I

SAP TER/DER Worksheets – *Be Clean*

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 001 A2 - 1B2P	**Issued on Date**	15/12/2020
Assessment Reference	1B2P Be Clean	**Prop Type Ref**	Exposed Floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	83 B	**DER**	14.17	**TER**	28.60
Environmental	91 B	**% DER<TER**	50.46		
CO_2 Emissions (t/year)	0.61	**DFEE**	42.82	**TFEE**	52.53
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.48		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 56 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 28.60 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.17 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.8 kWh/m²/yrOK

2 Fabric U-values
Element          Average              Highest
External wall    0.17 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall       0.00 (max. 0.20)      -                        OK
Floor            0.10 (max. 0.25)     0.10 (max. 0.70)          OK
Roof             (no roof)
Openings         1.26 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK


Hot water controls:                  No cylinderstat


7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.42
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing North:                6.98 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Exposed floor U-value                0.10 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h
Photovoltaic array                   0.14 kW
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	55.6000 (1b)	x	2.5000 (2b)	=	139.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
Door			2.1200	0.8200	1.7384			(26)
Exposed			55.6000	0.1000	5.5600			(28b)
External Wall	17.5000	6.9800	10.5200	0.1800	1.8936			(29a)
Wall to Stairwell	17.5000	2.1200	15.3800	0.1671	2.5695			(29a)
Total net area of external elements Aum(A, m2)			90.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.0153			(33)
Party Wall 1			39.7500	0.0000	0.0000			(32)
Party Ceilings 1			55.6000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2246	(36)
Total fabric heat loss (33) + (36) =	30.2399	(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	11.9936	11.8603	11.7270	11.0604	10.9271	10.2605	10.2605	10.1272	10.5272	10.9271	11.1937	11.4603	(38)
Heat transfer coeff	42.2335	42.1002	41.9669	41.3003	41.1670	40.5005	40.5005	40.3671	40.7671	41.1670	41.4336	41.7002	(39)
Average = Sum(39)m / 12 =												41.2670	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7596	0.7572	0.7548	0.7428	0.7404	0.7284	0.7284	0.7260	0.7332	0.7404	0.7452	0.7500	(40)
HLP (average)												0.7422	(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	1.8549 (42)
Average daily hot water use (litres/day)	78.2543 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.0797	82.9495	79.8194	76.6892	73.5590	70.4289	70.4289	73.5590	76.6892	79.8194	82.9495	86.0797	(44)
Energy conte	127.6537	111.6468	115.2095	100.4424	96.3769	83.1659	77.0654	88.4337	89.4899	104.2919	113.8427	123.6258	(45)
Energy content (annual)											Total = Sum(45)m =	1231.2445	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	19.1481	16.7470	17.2814	15.0664	14.4565	12.4749	11.5598	13.2651	13.4235	15.6438	17.0764	18.5439	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	157.6514	138.7415	145.2071	129.4724	126.3746	112.1959	107.0631	118.4314	118.5199	134.2895	142.8727	153.6235	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	157.6514	138.7415	145.2071	129.4724	126.3746	112.1959	107.0631	118.4314	118.5199	134.2895	142.8727	153.6235	(64)
								Total per year (kWh/year) = Sum(64)m =				1584.4432	(64)
Heat gains from water heating, kWh/month	66.4430	58.7983	62.3053	56.6211	56.0435	50.8767	49.6224	53.4024	52.9794	58.6752	61.0767	65.1037	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8446	14.0730	11.4449	8.6645	6.4768	5.4680	5.9084	7.6800	10.3080	13.0884	15.2761	16.2849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.7305	163.4087	159.1796	150.1762	138.8111	128.1295	120.9935	119.3152	123.5444	132.5478	143.9129	154.5945	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	(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)	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	(71)
Water heating gains (Table 5)	89.3051	87.4975	83.7437	78.6404	75.3272	70.6621	66.6968	71.7774	73.5825	78.8645	84.8288	87.5050	(72)
Total internal gains	317.7039	315.8030	305.1920	288.3050	271.4389	255.0833	244.4224	249.5963	258.2587	275.3244	294.8415	309.2082	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9800	10.6334	0.4000	0.7000	0.7700	14.4019	(74)
Solar gains	14.4019	27.5227	46.7678	75.1210	101.1949	108.3322	101.1419	80.2432	56.2300	32.7622	17.7665	12.0061	(83)
Total gains	332.1058	343.3257	351.9597	363.4260	372.6339	363.4155	345.5644	329.8395	314.4887	308.0866	312.6081	321.2143	(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, n1,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	91.4230	91.7125	92.0038	93.4887	93.7914	95.3350	95.3350	95.6498	94.7115	93.7914	93.1879	92.5921	
alpha	7.0949	7.1142	7.1336	7.2326	7.2528	7.3557	7.3557	7.3767	7.3141	7.2528	7.2125	7.1728	
util living area	0.9975	0.9961	0.9914	0.9706	0.8904	0.6951	0.5138	0.5594	0.8254	0.9724	0.9944	0.9980	(86)
MIT	20.3198	20.3890	20.5275	20.7318	20.9068	20.9880	20.9988	20.9978	20.9603	20.7653	20.5166	20.3077	(87)
Th 2	20.2885	20.2906	20.2927	20.3032	20.3053	20.3158	20.3158	20.3179	20.3116	20.3053	20.3011	20.2969	(88)
util rest of house	0.9967	0.9948	0.9885	0.9603	0.8555	0.6284	0.4350	0.4784	0.7667	0.9606	0.9923	0.9974	(89)
MIT 2	19.3716	19.4742	19.6771	19.9772	20.2104	20.3074	20.3153	20.3169	20.2792	20.0284	19.6687	19.3606	(90)
Living area fraction										fLA = Living area / (4) =		0.5737	(91)
MIT	19.9157	19.9991	20.1650	20.4102	20.6100	20.6979	20.7074	20.7076	20.6699	20.4512	20.1552	19.9040	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9157	19.9991	20.1650	20.4102	20.6100	20.6979	20.7074	20.7076	20.6699	20.4512	20.1552	19.9040	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9942	0.9879	0.9621	0.8718	0.6663	0.4802	0.5250	0.7987	0.9635	0.9918	0.9969	(94)
Useful gains	330.8324	341.3392	347.7021	349.6423	324.8536	242.1595	165.9537	173.1507	251.1759	296.8363	310.0514	320.2228	(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	659.5035	635.6727	573.4779	475.3742	366.7961	246.9670	166.3531	173.8852	267.8376	405.5445	540.9239	654.8598	(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	244.5313	197.7921	167.9771	90.5269	31.2052	0.0000	0.0000	0.0000	0.0000	80.8790	166.2282	248.9699	(98)
Space heating												1228.1098	(98)
Space heating per m2											(98) / (4) =	22.0883	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1228.1098	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	1596.5428	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1584.4432	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2059.7762	(310b)
Electricity used for heat distribution	36.5632	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	89.0295	(330a)
Total electricity for the above, kWh/year	89.0295	(331)
Electricity for lighting (calculated in Appendix L)	279.8198	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.14 * 951 * 1.00) =	-106.4690	(333)
Total delivered energy for all uses	3918.6992	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1218.7730	0.5190	632.5432	(368)
Electrical energy for heat distribution	36.5632	0.5190	18.9763	(372)
Total CO2 associated with community systems			651.5195	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			651.5195	(376)
Pumps and fans	89.0295	0.5190	46.2063	(378)
Energy for lighting	279.8198	0.5190	145.2265	(379)
Energy saving/generation technologies				
PV Unit	-106.4690	0.5190	-55.2574	(380)
Total CO2, kg/year			787.6948	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1700	(384)

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

DER		14.1700	ZC1
Total Floor Area	TFA	55.6000	
Assumed number of occupants	N	1.8549	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.2371	ZC2
CO2 emissions from cooking, equation (L16)		2.9410	ZC3
Total CO2 emissions		34.3480	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.3480	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.6000 (1b)	x	2.5000 (2b)	=	139.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.0000	(5)

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2. Ventilation rate
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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1439	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3939	(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) =	0.3053	(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													
	0.3892	0.3816	0.3739	0.3358	0.3282	0.2900	0.2900	0.2824	0.3053	0.3282	0.3434	0.3587	(22b)
Effective ac	0.5757	0.5728	0.5699	0.5564	0.5538	0.5420	0.5420	0.5399	0.5466	0.5538	0.5590	0.5643	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
Exposed			55.6000	0.1300	7.2280			(28b)
External Wall	17.5000	6.9800	10.5200	0.1800	1.8936			(29a)
Wall to Stairwell	17.5000	2.1200	15.3800	0.1800	2.7684			(29a)
Total net area of external elements Aum(A, m2)			90.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.2638			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6435	(36)
Total fabric heat loss					(33) + (36) =		32.9073	(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	26.4093	26.2743	26.1421	25.5210	25.4048	24.8638	24.8638	24.7636	25.0722	25.4048	25.6399	25.8856	(38)
Heat transfer coeff													
	59.3165	59.1816	59.0494	58.4283	58.3121	57.7711	57.7711	57.6709	57.9795	58.3121	58.5472	58.7929	(39)
Average = Sum(39)m / 12 =												58.4277	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0668	1.0644	1.0620	1.0509	1.0488	1.0390	1.0390	1.0372	1.0428	1.0488	1.0530	1.0574	(40)
HLP (average)												1.0509	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8549	(42)
Average daily hot water use (litres/day)	78.2543	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	86.0797	82.9495	79.8194	76.6892	73.5590	70.4289	70.4289	73.5590	76.6892	79.8194	82.9495	86.0797	(44)
Energy conte	127.6537	111.6468	115.2095	100.4424	96.3769	83.1659	77.0654	88.4337	89.4899	104.2919	113.8427	123.6258	(45)
Energy content (annual)										Total = Sum(45)m =		1231.2445	(45)
Distribution loss (46)m = 0.15 x (45)m													
	19.1481	16.7470	17.2814	15.0664	14.4565	12.4749	11.5598	13.2651	13.4235	15.6438	17.0764	18.5439	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	155.2714	136.5918	142.8271	127.1692	123.9945	109.8927	104.6831	116.0514	116.2167	131.9095	140.5695	151.2435	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	155.2714	136.5918	142.8271	127.1692	123.9945	109.8927	104.6831	116.0514	116.2167	131.9095	140.5695	151.2435	(64)
Total per year (kWh/year) = Sum(64)m =												1556.4204	(64)
Heat gains from water heating, kWh/month	64.5390	57.0785	60.4013	54.7785	54.1394	49.0341	47.7184	51.4984	51.1368	56.7712	59.2341	63.1997	(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	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	92.7459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.8446	14.0730	11.4449	8.6645	6.4768	5.4680	5.9084	7.6800	10.3080	13.0884	15.2761	16.2849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.7305	163.4087	159.1796	150.1762	138.8111	128.1295	120.9935	119.3152	123.5444	132.5478	143.9129	154.5945	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	32.2746	(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)	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	-74.1967	(71)
Water heating gains (Table 5)	86.7460	84.9383	81.1845	76.0813	72.7681	68.1029	64.1376	69.2182	71.0234	76.3053	82.2696	84.9459	(72)
Total internal gains	318.1448	316.2438	305.6328	288.7458	271.8798	255.5242	244.8633	250.0372	258.6995	275.7653	295.2824	309.6491	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9800	10.6334	0.6300	0.7000	0.7700	22.6829	(74)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	22.6829	43.3482	73.6592	118.3156	159.3820	170.6231	159.2985	126.3830	88.5623	51.6004	27.9823	18.9096	(83)
Total gains	340.8277	359.5920	379.2920	407.0614	431.2618	426.1473	404.1618	376.4202	347.2618	327.3657	323.2647	328.5587	(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	65.0933	65.2417	65.3878	66.0829	66.2146	66.8347	66.8347	66.9508	66.5945	66.2146	65.9487	65.6731	
alpha	5.3396	5.3494	5.3592	5.4055	5.4143	5.4556	5.4556	5.4634	5.4396	5.4143	5.3966	5.3782	
util living area	0.9978	0.9966	0.9929	0.9779	0.9231	0.7794	0.6094	0.6704	0.8978	0.9833	0.9959	0.9982	(86)
MIT	19.8843	19.9800	20.1766	20.4686	20.7518	20.9352	20.9864	20.9777	20.8479	20.5104	20.1542	19.8665	(87)
Th 2	20.0280	20.0300	20.0320	20.0412	20.0429	20.0509	20.0509	20.0524	20.0478	20.0429	20.0394	20.0358	(88)
util rest of house	0.9971	0.9954	0.9902	0.9688	0.8902	0.6958	0.4879	0.5490	0.8418	0.9748	0.9942	0.9976	(89)
MIT 2	18.5381	18.6793	18.9672	19.3947	19.7843	20.0045	20.0455	20.0423	19.9152	19.4594	18.9409	18.5177	(90)
Living area fraction — fLA = Living area / (4) =												0.5737	(91)
MIT	19.3105	19.4255	19.6611	20.0108	20.3394	20.5385	20.5853	20.5790	20.4504	20.0624	19.6370	19.2915	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3105	19.4255	19.6611	20.0108	20.3394	20.5385	20.5853	20.5790	20.4504	20.0624	19.6370	19.2915	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9945	0.9889	0.9685	0.9017	0.7412	0.5580	0.6189	0.8683	0.9750	0.9933	0.9970	(94)
Useful gains	339.5769	357.6086	375.0926	394.2385	388.8534	315.8762	225.5105	232.9696	301.5354	319.1946	321.0881	327.5676	(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	890.3692	859.6451	777.1566	649.1876	503.7821	343.0724	230.2349	241.0069	368.1901	551.7701	734.0067	887.2764	(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	409.7895	337.3685	299.1356	183.5633	85.5070	0.0000	0.0000	0.0000	0.0000	173.0362	297.3014	416.4234	(98)
Space heating												2202.1248	(98)
Space heating per m2 — (98) / (4) =												39.6066	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2355.2136	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	409.7895	337.3685	299.1356	183.5633	85.5070	0.0000	0.0000	0.0000	0.0000	173.0362	297.3014	416.4234	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	438.2775	360.8219	319.9311	196.3244	91.4513	0.0000	0.0000	0.0000	0.0000	185.0654	317.9694	445.3726	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	155.2714	136.5918	142.8271	127.1692	123.9945	109.8927	104.6831	116.0514	116.2167	131.9095	140.5695	151.2435	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.2840	87.1330	86.7413	85.7921	83.8461	79.8000	79.8000	79.8000	79.8000	85.5387	86.7652	87.3785	(217)
Fuel for water heating, kWh/month	177.8921	156.7624	164.6586	148.2294	147.8836	137.7101	131.1818	145.4278	145.6349	154.2104	162.0114	173.0901	(219)
Water heating fuel used												1844.6928	(219)

Annual totals kWh/year

Space heating fuel - main system	2355.2136	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	279.8198	(232)
Total delivered energy for all uses	4554.7262	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2355.2136	0.2160	508.7261	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1844.6928	0.2160	398.4536	(264)
Space and water heating			907.1798	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	279.8198	0.5190	145.2265	(268)
Total CO2, kg/m2/year			1091.3312	(272)
Emissions per m2 for space and water heating			16.3162	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.6120	(272b)
Emissions per m2 for pumps and fans			0.7001	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3162 * 1.55) + 2.6120 + 0.7001, rounded to 2 d.p.			28.6000	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 002 D2 - 3B5P	**Issued on Date**	15/12/2020
Assessment Reference	3B5P Be Clean	**Prop Type Ref**	Exposed Floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	84 B	**DER**	13.20	**TER**	23.00
Environmental	90 B	**% DER<TER**	42.60		
CO_2 Emissions (t/year)	0.90	**DFEE**	41.14	**TFEE**	45.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.85		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 87 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 23.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.20 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)45.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	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 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.44
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing South East: 16.35 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Exposed floor U-value 0.10 W/m²K
Door U-value 0.82 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	86.6000 (1b)	x	2.5000 (2b)	=	216.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:		0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		77.3500 (23c)

Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			16.3500	1.3258	21.6761			(27)
Door			2.1200	0.8200	1.7384			(26)
Exposed			86.6000	0.1000	8.6600			(28b)
External Wall	33.9000	16.3500	17.5500	0.1800	3.1590			(29a)
Wall to Stairwell	29.8500	2.1200	27.7300	0.1671	4.6328			(29a)
Total net area of external elements Aum(A, m2)			150.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8664			(33)
Party Wall 1			36.0000	0.0000	0.0000			(32)
Party Ceilings 1			86.6000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.2458 (36)
Total fabric heat loss	(33) + (36) =	53.1122 (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	18.6806	18.4730	18.2654	17.2272	17.0195	15.9814	15.9814	15.7737	16.3966	17.0195	17.4348	17.8501	(38)
Heat transfer coeff	71.7928	71.5852	71.3775	70.3393	70.1317	69.0935	69.0935	68.8859	69.5088	70.1317	70.5470	70.9622	(39)
Average = Sum(39)m / 12 =												70.2874	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8290	0.8266	0.8242	0.8122	0.8098	0.7978	0.7978	0.7954	0.8026	0.8098	0.8146	0.8194	(40)
HLP (average)												0.8116	(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	2.5763 (42)
Average daily hot water use (litres/day)	95.3863 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9249	101.1095	97.2940	93.4786	89.6631	85.8477	85.8477	89.6631	93.4786	97.2940	101.1095	104.9249	(44)
Energy conte	155.6006	136.0893	140.4320	122.4320	117.4764	101.3732	93.9372	107.7943	109.0817	127.1242	138.7660	150.6909	(45)
Energy content (annual)											Total = Sum(45)m =	1500.7977	(45)
Distribution loss (46)m = 0.15 x (45)m													

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	23.3401	20.4134	21.0648	18.3648	17.6215	15.2060	14.0906	16.1691	16.3623	19.0686	20.8149	22.6036	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	185.5983	163.1840	170.4297	151.4620	147.4741	130.4032	123.9349	137.7920	138.1117	157.1219	167.7960	180.6886	(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	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h	185.5983	163.1840	170.4297	151.4620	147.4741	130.4032	123.9349	137.7920	138.1117	157.1219	167.7960	180.6886	(64)
										Total per year (kWh/year) = Sum(64)m =		1853.9964	(64)
Heat gains from water heating, kWh/month	75.7354	66.9254	70.6918	63.9327	63.0591	56.9306	55.2323	59.8398	59.4937	66.2670	69.3637	74.1029	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0367	18.6846	15.1953	11.5038	8.5993	7.2599	7.8445	10.1966	13.6859	17.3774	20.2820	21.6214	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6818	235.0963	229.0118	216.0586	199.7076	184.3400	174.0734	171.6589	177.7434	190.6965	207.0476	222.4152	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	(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)	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	(71)
Water heating gains (Table 5)	101.7948	99.5914	95.0158	88.7954	84.7568	79.0703	74.2369	80.4298	82.6301	89.0685	96.3385	99.6006	(72)
Total internal gains	417.1572	415.0163	400.8669	378.0018	354.7076	332.3141	317.7988	323.9293	335.7034	358.7864	385.3120	405.2812	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	16.3500	36.7938	0.4000	0.7000	0.7700	116.7304	(77)
Solar gains	116.7304	198.8351	272.0548	337.0891	377.5679	374.8376	361.3834	331.1844	294.5779	219.7551	139.8161	99.8969	(83)
Total gains	533.8877	613.8514	672.9218	715.0909	732.2756	707.1516	679.1823	655.1137	630.2812	578.5415	525.1281	505.1781	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, n1,m (see Table 9a)													
tau	83.7673	84.0103	84.2547	85.4982	85.7514	87.0399	87.0399	87.3022	86.5198	85.7514	85.2466	84.7477	
alpha	6.5845	6.6007	6.6170	6.6999	6.7168	6.8027	6.8027	6.8201	6.7680	6.7168	6.6831	6.6498	
util living area	0.9973	0.9926	0.9789	0.9326	0.8149	0.6155	0.4466	0.4819	0.7284	0.9476	0.9928	0.9981	(86)
MIT	20.2323	20.3740	20.5663	20.7871	20.9359	20.9919	20.9992	20.9987	20.9763	20.7906	20.4695	20.2061	(87)
Th 2	20.2283	20.2303	20.2324	20.2427	20.2448	20.2552	20.2552	20.2573	20.2510	20.2448	20.2407	20.2365	(88)
util rest of house	0.9965	0.9904	0.9724	0.9126	0.7692	0.5481	0.3716	0.4051	0.6618	0.9277	0.9902	0.9975	(89)
MIT 2	19.1966	19.4042	19.6822	19.9969	20.1839	20.2499	20.2549	20.2567	20.2333	20.0083	19.5520	19.1648	(90)
Living area fraction										fLA = Living area / (4) =		0.4031	(91)
MIT	19.6141	19.7951	20.0386	20.3154	20.4870	20.5490	20.5549	20.5558	20.5328	20.3236	19.9219	19.5846	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6141	19.7951	20.0386	20.3154	20.4870	20.5490	20.5549	20.5558	20.5328	20.3236	19.9219	19.5846	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9887	0.9704	0.9147	0.7847	0.5751	0.4018	0.4361	0.6877	0.9301	0.9888	0.9968	(94)
Useful gains	531.5170	606.9419	653.0224	654.1085	574.5959	406.6810	272.9254	285.7060	433.4623	538.1008	519.2214	503.5588	(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	1099.4423	1066.2712	966.3501	802.9546	616.2494	411.0388	273.2592	286.2760	447.1366	681.9357	904.5452	1091.7259	(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	422.5364	308.6693	233.1158	107.1691	30.9902	0.0000	0.0000	0.0000	0.0000	107.0132	277.4331	437.5963	(98)
Space heating												1924.5235	(98)
Space heating per m2											(98) / (4) =	22.2231	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1924.5235	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	2501.8806	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1853.9964	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2410.1953	(310b)
Electricity used for heat distribution	49.1208	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	145.2715	(330a)
Total electricity for the above, kWh/year	145.2715	(331)
Electricity for lighting (calculated in Appendix L)	371.5144	(332)
Total delivered energy for all uses	5428.8618	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1637.3586	0.5190	849.7891	(368)
Electrical energy for heat distribution	49.1208	0.5190	25.4937	(372)
Total CO2 associated with community systems			875.2828	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			875.2828	(376)
Pumps and fans	145.2715	0.5190	75.3959	(378)
Energy for lighting	371.5144	0.5190	192.8160	(379)
Total CO2, kg/year			1143.4947	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2000	(384)

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

DER		13.2000	ZC1
Total Floor Area	TFA	86.6000	
Assumed number of occupants	N	2.5763	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.9217	ZC2
CO2 emissions from cooking, equation (L16)		2.0881	ZC3
Total CO2 emissions		31.2099	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.2099	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	86.6000 (1b)	x	2.5000 (2b)	=	216.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.5000	(5)

---

2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =							30.0000 / (5) =	0.1386	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.3886	(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) =	0.3011	(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													
	0.3840	0.3764	0.3689	0.3313	0.3237	0.2861	0.2861	0.2786	0.3011	0.3237	0.3388	0.3538	(22b)
Effective ac	0.5737	0.5708	0.5680	0.5549	0.5524	0.5409	0.5409	0.5388	0.5453	0.5524	0.5574	0.5626	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.3500	1.3258	21.6761			(27)
Exposed			86.6000	0.1300	11.2580			(28b)
External Wall	33.9000	16.3500	17.5500	0.1800	3.1590			(29a)
Wall to Stairwell	29.8500	2.1200	27.7300	0.1800	4.9914			(29a)
Total net area of external elements Aum(A, m2)			150.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2045			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1385	(36)
Total fabric heat loss					(33) + (36) =		55.3430	(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	40.9887	40.7842	40.5838	39.6423	39.4662	38.6462	38.6462	38.4943	38.9620	39.4662	39.8225	40.1951	(38)
Heat transfer coeff	96.3318	96.1273	95.9268	94.9853	94.8092	93.9892	93.9892	93.8373	94.3050	94.8092	95.1655	95.5381	(39)
Average = Sum(39)m / 12 =												94.9845	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1124	1.1100	1.1077	1.0968	1.0948	1.0853	1.0853	1.0836	1.0890	1.0948	1.0989	1.1032	(40)
HLP (average)												1.0968	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5763	(42)
Average daily hot water use (litres/day)	95.3863	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9249	101.1095	97.2940	93.4786	89.6631	85.8477	85.8477	89.6631	93.4786	97.2940	101.1095	104.9249	(44)
Energy conte	155.6006	136.0893	140.4320	122.4320	117.4764	101.3732	93.9372	107.7943	109.0817	127.1242	138.7660	150.6909	(45)
Energy content (annual)										Total = Sum(45)m =		1500.7977	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.3401	20.4134	21.0648	18.3648	17.6215	15.2060	14.0906	16.1691	16.3623	19.0686	20.8149	22.6036	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	183.2183	161.0343	168.0496	149.1588	145.0941	128.1000	121.5549	135.4120	135.8085	154.7419	165.4928	178.3086	(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	(63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h	183.2183	161.0343	168.0496	149.1588	145.0941	128.1000	121.5549	135.4120	135.8085	154.7419	165.4928	178.3086	(64)

Total per year (kWh/year) = Sum(64)m = 1825.9736 (64)

Heat gains from water heating, kWh/month	73.8313	65.2057	68.7878	62.0901	61.1550	55.0880	53.3283	57.9357	57.6511	64.3629	67.5211	72.1989	(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	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	128.8132	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0367	18.6846	15.1953	11.5038	8.5993	7.2599	7.8445	10.1966	13.6859	17.3774	20.2820	21.6214	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6818	235.0963	229.0118	216.0586	199.7076	184.3400	174.0734	171.6589	177.7434	190.6965	207.0476	222.4152	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	35.8813	(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)	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	-103.0506	(71)
Water heating gains (Table 5)	99.2357	97.0323	92.4567	86.2362	82.1976	76.5111	71.6778	77.8706	80.0710	86.5093	93.7793	97.0415	(72)
Total internal gains	417.5981	415.4571	401.3078	378.4426	355.1485	332.7549	318.2397	324.3701	336.1442	359.2272	385.7528	405.7220	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	16.3500	36.7938	0.6300	0.7000	0.7700	183.8504	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	183.8504	313.1653	428.4864	530.9154	594.6695	590.3692	569.1789	521.6155	463.9601	346.1143	220.2104	157.3376	(83)
Total gains	601.4485	728.6224	829.7941	909.3580	949.8180	923.1241	887.4185	845.9856	800.1043	705.3415	605.9632	563.0597	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4289	62.5617	62.6925	63.3139	63.4315	63.9849	63.9849	64.0884	63.7706	63.4315	63.1940	62.9476	
alpha	5.1619	5.1708	5.1795	5.2209	5.2288	5.2657	5.2657	5.2726	5.2514	5.2288	5.2129	5.1965	
util living area	0.9961	0.9891	0.9710	0.9199	0.8067	0.6261	0.4615	0.5029	0.7426	0.9436	0.9907	0.9972	(86)
MIT	19.8975	20.0966	20.3604	20.6574	20.8734	20.9741	20.9956	20.9932	20.9379	20.6490	20.2091	19.8585	(87)
Th 2	19.9907	19.9927	19.9945	20.0034	20.0051	20.0128	20.0128	20.0143	20.0098	20.0051	20.0017	19.9982	(88)
util rest of house	0.9948	0.9857	0.9617	0.8945	0.7518	0.5401	0.3604	0.3990	0.6612	0.9201	0.9871	0.9963	(89)
MIT 2	18.5302	18.8204	19.1998	19.6165	19.8875	19.9965	20.0113	20.0116	19.9644	19.6157	18.9922	18.4789	(90)

Living area fraction fLA = Living area / (4) = 0.4031 (91)

MIT	19.0814	19.3349	19.6677	20.0361	20.2849	20.3906	20.4081	20.4073	20.3569	20.0322	19.4827	19.0350	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0814	19.3349	19.6677	20.0361	20.2849	20.3906	20.4081	20.4073	20.3569	20.0322	19.4827	19.0350	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9827	0.9579	0.8955	0.7684	0.5740	0.4013	0.4410	0.6915	0.9209	0.9846	0.9950	(94)
Useful gains	597.3658	716.0106	794.8928	814.2945	729.8484	529.9017	356.1219	373.1127	553.2735	649.5301	596.6274	560.2493	(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	1423.9191	1387.5846	1263.1334	1057.7676	813.9311	544.2543	357.9188	376.0366	590.0550	894.2602	1178.4109	1417.3122	(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	614.9556	451.2977	348.3709	175.3007	62.5576	0.0000	0.0000	0.0000	0.0000	182.0792	418.8841	637.6548	(98)

Space heating 2891.1006 (98)
Space heating per m2 (98) / (4) = 33.3845 (99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3092.0862	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	614.9556	451.2977	348.3709	175.3007	62.5576	0.0000	0.0000	0.0000	0.0000	182.0792	418.8841	637.6548	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	657.7066	482.6714	372.5892	187.4873	66.9065	0.0000	0.0000	0.0000	0.0000	194.7371	448.0044	681.9837	(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	183.2183	161.0343	168.0496	149.1588	145.0941	128.1000	121.5549	135.4120	135.8085	154.7419	165.4928	178.3086	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.7977	87.4174	86.7163	85.2454	82.7474	79.8000	79.8000	79.8000	79.8000	85.2486	87.1892	87.9237	(217)
Fuel for water heating, kWh/month	208.6824	184.2130	193.7924	174.9758	175.3459	160.5263	152.3244	169.6892	170.1861	181.5184	189.8088	202.7991	(219)

Water heating fuel used	2163.8616	(219)
Annual totals kWh/year		
Space heating fuel - main system	3092.0862	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	371.5144	(232)
Total delivered energy for all uses	5702.4621	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3092.0862	0.2160	667.8906	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2163.8616	0.2160	467.3941	(264)
Space and water heating			1135.2847	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	371.5144	0.5190	192.8160	(268)
Total CO2, kg/m2/year			1367.0257	(272)
Emissions per m2 for space and water heating			13.1095	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2265	(272b)
Emissions per m2 for pumps and fans			0.4495	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.1095 * 1.55) + 2.2265 + 0.4495, rounded to 2 d.p.			23.0000	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 003 E1 - 1B1P	**Issued on Date**	15/12/2020
Assessment Reference	1B1P Be Clean	**Prop Type Ref**	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	80 C	**DER**	19.93	**TER**	35.48
Environmental	89 B	**% DER<TER**	43.82		
CO_2 Emissions (t/year)	0.65	**DFEE**	59.39	**TFEE**	56.20
General Requirements Compliance	Fail	**% DFEE<TFEE**	-5.68		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

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

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

Mid-floor flat, total floor area 40 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 35.48 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.93 kgCO□/m²OK
-----------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)59.4 kWh/m²/yrFail
Excess energy =3.2 kWh/m²/yr  (5.7%)
-----------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.17 (max. 0.30)        0.18 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           (no floor)
Roof            (no roof)
Openings        1.32 (max. 2.00)        1.40 (max. 3.30)          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                                 10.0                                          OK
-----------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Community heating scheme                      -

Secondary heating system:               None
-----------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                          OK
Primary pipework insulated:             No primary pipework
-----------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Charging system linked to use of community heating, programmer and at least two room statsOK


Hot water controls:                     No cylinderstat


-----------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                           OK
-----------------------------------------------------------------------------------------------
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                     0.42
Maximum                                 1.5                                           OK
MVHR efficiency:                        91%
Minimum:                                70%                                           OK
-----------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Midlands):            Medium                                        OK
Based on:
Overshading:                            Average
Windows facing North East:              2.55 m², No overhang
Windows facing North West:              10.75 m², No overhang
Air change rate:                        2.00 ach
Blinds/curtains:                        None
-----------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Door U-value                            0.82 W/m²K
Air permeability                        3.0 m³/m²h



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	40.3000	(1b)	x 2.5000	(2b) =	100.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	40.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		100.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			13.3000	1.3258	17.6326			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	22.8300	13.3000	9.5300	0.1800	1.7154			(29a)
Wall to CA	40.7500	2.1200	38.6300	0.1671	6.4539			(29a)
Total net area of external elements Aum(A, m2)			63.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.5402			(33)
Party Wall 1			14.0500	0.0000	0.0000			(32)
Party Floor 1			40.3000					(32d)
Party Ceilings 1			40.3000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.4248 (36)
Total fabric heat loss (33) + (36) =	35.9650 (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	8.6932	8.5966	8.4999	8.0168	7.9202	7.4371	7.4371	7.3404	7.6303	7.9202	8.1134	8.3067	(38)
Heat transfer coeff	44.6582	44.5616	44.4650	43.9818	43.8852	43.4021	43.4021	43.3055	43.5953	43.8852	44.0785	44.2717	(39)

Average = Sum(39)m / 12 = 43.9577 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1081	1.1057	1.1033	1.0914	1.0890	1.0770	1.0770	1.0746	1.0818	1.0890	1.0938	1.0986	(40)
HLP (average)												1.0908	(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	1.4143 (42)
Average daily hot water use (litres/day)	67.7904 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.5694	71.8578	69.1462	66.4346	63.7230	61.0113	61.0113	63.7230	66.4346	69.1462	71.8578	74.5694	(44)
Energy conte	110.5843	96.7177	99.8040	87.0116	83.4897	72.0452	66.7605	76.6087	77.5236	90.3463	98.6201	107.0950	(45)
Energy content (annual)										Total = Sum(45)m =		1066.6067	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	16.5876	14.5077	14.9706	13.0517	12.5235	10.8068	10.0141	11.4913	11.6285	13.5519	14.7930	16.0642	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	140.5820	123.8124	129.8017	116.0416	113.4874	101.0753	96.7582	106.6064	106.5536	120.3440	127.6501	137.0927	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	140.5820	123.8124	129.8017	116.0416	113.4874	101.0753	96.7582	106.6064	106.5536	120.3440	127.6501	137.0927	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.8054	(64)
Heat gains from water heating, kWh/month	60.7674	53.8344	57.1830	52.1554	51.7585	47.1791	46.1960	49.4705	49.0006	54.0383	56.0152	59.6072	(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	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	70.7166	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.9021	9.6832	7.8749	5.9618	4.4565	3.7624	4.0654	5.2843	7.0926	9.0057	10.5110	11.2051	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	122.2887	123.5576	120.3599	113.5522	104.9587	96.8821	91.4864	90.2174	93.4152	100.2228	108.8163	116.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	30.0717	(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)	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	-56.5733	(71)
Water heating gains (Table 5)	81.6767	80.1107	76.8589	72.4380	69.5678	65.5265	62.0914	66.4927	68.0564	72.6321	77.7989	80.1173	(72)
Total internal gains	259.0824	257.5665	249.3086	236.1670	223.1980	210.3859	201.8581	206.2094	212.7792	226.0756	241.3412	252.4303	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5500	11.2829	0.4000	0.7000	0.7700	5.5828	(75)
Northwest	10.7500	11.2829	0.4000	0.7000	0.7700	23.5354	(81)

Solar gains	29.1182	59.2710	106.7876	175.3758	235.7395	251.3233	235.1078	187.4307	130.1223	72.4339	36.6383	23.7794	(83)
Total gains	288.2007	316.8375	356.0961	411.5428	458.9376	461.7092	436.9659	393.6400	342.9015	298.5096	277.9794	276.2098	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.6673	62.8032	62.9397	63.6310	63.7711	64.4810	64.4810	64.6249	64.1952	63.7711	63.4916	63.2144	
alpha	5.1778	5.1869	5.1960	5.2421	5.2514	5.2987	5.2987	5.3083	5.2797	5.2514	5.2328	5.2143	
util living area	0.9955	0.9919	0.9790	0.9263	0.7870	0.5847	0.4340	0.4992	0.7810	0.9600	0.9912	0.9964	(86)
MIT	19.9224	20.0528	20.3040	20.6444	20.8894	20.9816	20.9968	20.9937	20.9222	20.5997	20.2061	19.8978	(87)
Th 2	19.9942	19.9961	19.9981	20.0079	20.0099	20.0197	20.0197	20.0216	20.0157	20.0099	20.0059	20.0020	(88)
util rest of house	0.9941	0.9892	0.9719	0.9024	0.7306	0.5024	0.3389	0.3966	0.7024	0.9420	0.9878	0.9952	(89)
MIT 2	18.5689	18.7599	19.1234	19.6037	19.9085	20.0083	20.0186	20.0192	19.9568	19.5550	18.9911	18.5387	(90)
Living area fraction										fLA = Living area / (4) =		0.7983	(91)
MIT	19.6494	19.7920	20.0658	20.4344	20.6915	20.7852	20.7995	20.7971	20.7274	20.3890	19.9610	19.6236	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6494	19.7920	20.0658	20.4344	20.6915	20.7852	20.7995	20.7971	20.7274	20.3890	19.9610	19.6236	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9886	0.9725	0.9135	0.7706	0.5672	0.4147	0.4784	0.7611	0.9497	0.9876	0.9947	(94)
Useful gains	286.3107	313.2227	346.2888	375.9537	353.6380	261.8856	181.2286	188.3141	260.9810	283.5029	274.5364	274.7371	(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	685.4748	663.6102	603.2032	507.3047	394.5932	268.4512	182.2659	190.4171	288.9242	429.5917	566.8942	682.8289	(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	296.9781	235.4604	191.1443	94.5727	30.4707	0.0000	0.0000	0.0000	0.0000	108.6900	210.4976	303.6203	(98)
Space heating												1471.4342	(98)
Space heating per m2											(98) / (4) =	36.5120	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1471.4342	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	1912.8644	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1419.8054	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	1845.7470	(310b)
Electricity used for heat distribution	37.5861	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	64.5304	(330a)
Total electricity for the above, kWh/year	64.5304	(331)
Electricity for lighting (calculated in Appendix L)	192.5349	(332)
Total delivered energy for all uses	4015.6767	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1252.8705	0.5190	650.2398	(368)
Electrical energy for heat distribution	37.5861	0.5190	19.5072	(372)
Total CO2 associated with community systems			669.7470	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			669.7470	(376)
Pumps and fans	64.5304	0.5190	33.4913	(378)
Energy for lighting	192.5349	0.5190	99.9256	(379)
Total CO2, kg/year			803.1638	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			19.9300	(384)

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

DER		19.9300	ZC1
Total Floor Area	TFA	40.3000	
Assumed number of occupants	N	1.4143	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.9816	ZC2
CO2 emissions from cooking, equation (L16)		3.7951	ZC3
Total CO2 emissions		41.7067	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		41.7067	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			40.3000 (1b)	x	2.5000 (2b)	=	100.7500 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	40.3000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	100.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =							20.0000 / (5) =	0.1985	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.4485	(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) =	0.3476	(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	0.4432	0.4345	0.4258	0.3824	0.3737	0.3302	0.3302	0.3215	0.3476	0.3737	0.3910	0.4084	(22b)
Effective ac	0.5982	0.5944	0.5907	0.5731	0.5698	0.5545	0.5545	0.5517	0.5604	0.5698	0.5765	0.5834	(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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			7.9600	1.3258	10.5530			(27)
External Wall	22.8300	7.9600	14.8700	0.1800	2.6766			(29a)
Wall to CA	40.7500	2.1200	38.6300	0.1800	6.9534			(29a)
Total net area of external elements Aum(A, m2)			63.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.3030			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3077	(36)
Total fabric heat loss						(33) + (36) =	27.6107	(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	19.8889	19.7621	19.6378	19.0541	18.9449	18.4365	18.4365	18.3423	18.6323	18.9449	19.1658	19.3968	(38)
Heat transfer coeff	47.4996	47.3728	47.2485	46.6648	46.5556	46.0472	46.0472	45.9530	46.2430	46.5556	46.7765	47.0075	(39)
Average = Sum(39)m / 12 =												46.6643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1787	1.1755	1.1724	1.1579	1.1552	1.1426	1.1426	1.1403	1.1475	1.1552	1.1607	1.1664	(40)
HLP (average)												1.1579	(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												1.4143	(42)
Average daily hot water use (litres/day)												67.7904	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.5694	71.8578	69.1462	66.4346	63.7230	61.0113	61.0113	63.7230	66.4346	69.1462	71.8578	74.5694	(44)
Energy conte	110.5843	96.7177	99.8040	87.0116	83.4897	72.0452	66.7605	76.6087	77.5236	90.3463	98.6201	107.0950	(45)
Energy content (annual)										Total = Sum(45)m =		1066.6067	(45)
Distribution loss (46)m = 0.15 x (45)m	16.5876	14.5077	14.9706	13.0517	12.5235	10.8068	10.0141	11.4913	11.6285	13.5519	14.7930	16.0642	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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                4.3553     3.9338     4.3553     4.2148     4.3553     4.2148     4.3553     4.3553     4.2148     4.3553     4.2148     4.3553 (56)
If cylinder contains dedicated solar storage
                4.3553     3.9338     4.3553     4.2148     4.3553     4.2148     4.3553     4.3553     4.2148     4.3553     4.2148     4.3553 (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
              138.2020   121.6627   127.4217   113.7384   111.1074    98.7720    94.3782   104.2263   104.2504   117.9640   125.3468   134.7127 (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 (63)
                                                                                        Solar input (sum of months) = Sum(63)m =       0.0000 (63)
Output from w/h
              138.2020   121.6627   127.4217   113.7384   111.1074    98.7720    94.3782   104.2263   104.2504   117.9640   125.3468   134.7127 (64)
                                                                                          Total per year (kWh/year) = Sum(64)m =   1391.7826 (64)
Heat gains from water heating, kWh/month
               58.8634    52.1146    55.2790    50.3128    49.8545    45.3365    44.2920    47.5665    47.1580    52.1343    54.1726    57.7032 (65)
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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m          70.7166    70.7166    70.7166    70.7166    70.7166    70.7166    70.7166    70.7166    70.7166    70.7166    70.7166    70.7166 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               10.9938     9.7646     7.9411     6.0119     4.4940     3.7940     4.0996     5.3288     7.1522     9.0814    10.5993    11.2993 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              122.2887   123.5576   120.3599   113.5522   104.9587    96.8821    91.4864    90.2174    93.4152   100.2228   108.8163   116.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               30.0717    30.0717    30.0717    30.0717    30.0717    30.0717    30.0717    30.0717    30.0717    30.0717    30.0717    30.0717 (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)
              -56.5733   -56.5733   -56.5733   -56.5733   -56.5733   -56.5733   -56.5733   -56.5733   -56.5733   -56.5733   -56.5733   -56.5733 (71)
Water heating gains (Table 5)
               79.1175    77.5516    74.2997    69.8789    67.0087    62.9673    59.5323    63.9335    65.4973    70.0730    75.2397    77.5581 (72)
Total internal gains
              259.6149   258.0887   249.8156   236.6579   223.6763   210.8584   202.3332   206.6946   213.2796   226.5922   241.8703   252.9654 (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
-------------------------------------------------------------------------------------------------------
Northeast                               1.5300            11.2829          0.6300          0.7000           0.7700           5.2758 (75)
Northwest                               6.4300            11.2829          0.6300          0.7000           0.7700          22.1720 (81)
-------------------------------------------------------------------------------------------------------

Solar gains    27.4478    55.8707   100.6613   165.3148   222.2155   236.9053   221.6200   176.6781   122.6574    68.2785    34.5364    22.4152 (83)
Total gains   287.0627   313.9595   350.4770   401.9727   445.8919   447.7636   423.9532   383.3727   335.9370   294.8707   276.4068   275.3806 (84)
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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            58.9186    59.0763    59.2317    59.9726    60.1133    60.7770    60.7770    60.9016    60.5197    60.1133    59.8294    59.5354
alpha           4.9279     4.9384     4.9488     4.9982     5.0076     5.0518     5.0518     5.0601     5.0346     5.0076     4.9886     4.9690
util living area
                0.9957     0.9926     0.9820     0.9394     0.8210     0.6286     0.4718     0.5389     0.8121     0.9656     0.9919     0.9965 (86)

MIT            19.8237    19.9537    20.2087    20.5648    20.8443    20.9691    20.9940    20.9888    20.8921    20.5356    20.1254    19.8027 (87)
Th 2           20.4107    20.4122    20.4138    20.4210    20.4224    20.4287    20.4287    20.4299    20.4263    20.4224    20.4196    20.4168 (88)
util rest of house
                0.9950     0.9914     0.9787     0.9285     0.7923     0.5805     0.4129     0.4767     0.7718     0.9575     0.9903     0.9959 (89)
MIT 2          19.2988    19.4296    19.6841    20.0385    20.2995    20.4089    20.4258    20.4242    20.3487    20.0151    19.6071    19.2828 (90)
Living area fraction                                                                                fLA = Living area / (4) =        0.7983 (91)
MIT            19.7178    19.8480    20.1029    20.4586    20.7344    20.8561    20.8794    20.8749    20.7825    20.4306    20.0209    19.6978 (92)
Temperature adjustment                                                                                                              0.6000
adjusted MIT   20.3178    20.4480    20.7029    21.0586    21.3344    21.4561    21.4794    21.4749    21.3825    21.0306    20.6209    20.2978 (93)
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8. Space heating requirement
-------------------------------------------------------------------------------------------------------

                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9949     0.9914     0.9804     0.9404     0.8360     0.6646     0.5197     0.5880     0.8353     0.9660     0.9909     0.9958 (94)
Useful gains  285.5919   311.2710   343.6066   378.0108   372.7640   297.5855   220.3160   225.4407   280.6132   284.8445   273.8846   274.2243 (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
              760.8378   736.5511   671.0639   567.3784   448.5350   315.7047   224.6819   233.2071   336.7647   485.6041   632.4585   756.7189 (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
              353.5829   285.7882   243.6282   136.3447    56.3736     0.0000     0.0000     0.0000     0.0000   149.3651   258.1732   358.9760 (98)
Space heating                                                                                                                    1842.2319 (98)
Space heating per m2                                                                                        (98) / (4) =          45.7130 (99)
```

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-------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------
Not applicable
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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-------------------------------------------------------------------------------------------------------
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 %)                                                                            88.5000 (206)
Efficiency of secondary/supplementary heating system, %                                                                      0.0000 (208)
Space heating requirement                                                                                                 2081.6180 (211)

                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Space heating requirement
              353.5829   285.7882   243.6282   136.3447    56.3736     0.0000     0.0000     0.0000     0.0000   149.3651   258.1732   358.9760 (98)
Space heating efficiency (main heating system 1)
               88.5000    88.5000    88.5000    88.5000    88.5000     0.0000     0.0000     0.0000     0.0000    88.5000    88.5000    88.5000 (210)
Space heating fuel (main heating system)
              399.5287   322.9246   275.2861   154.0618    63.6990     0.0000     0.0000     0.0000     0.0000   168.7741   291.7211   405.6226 (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
              138.2020   121.6627   127.4217   113.7384   111.1074    98.7720    94.3782   104.2263   104.2504   117.9640   125.3468   134.7127 (64)
Efficiency of water heater                                                                                                  74.8000 (216)
(217)m         82.1958    81.9976    81.4966    80.2773    78.0894    74.8000    74.8000    74.8000    74.8000    80.4235    81.6812    82.2880 (217)
Fuel for water heating, kWh/month
              168.1376   148.3735   156.3522   141.6819   142.2822   132.0482   126.1740   139.3400   139.3722   146.6786   153.4587   163.7087 (219)
Water heating fuel used                                                                                                   1757.6078 (219)
Annual totals kWh/year
Space heating fuel - main system                                                                                          2081.6180 (211)
Space heating fuel - secondary                                                                                               0.0000 (215)

Electricity for pumps and fans:
   central heating pump                                                                                                     39.0000 (230c)
   main heating flue fan                                                                                                    45.0000 (230e)
Total electricity for the above, kWh/year                                                                                   84.0000 (231)
Electricity for lighting (calculated in Appendix L)                                                                        194.1534 (232)
Total delivered energy for all uses                                                                                       4117.3792 (238)
```

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-------------------------------------------------------------------------------------------------------
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                                    2081.6180              0.2160            449.6295 (261)
Space heating - secondary                                           0.0000              0.0000              0.0000 (263)
Water heating (other fuel)                                       1757.6078              0.2160            379.6433 (264)
Space and water heating                                                                                   829.2728 (265)
Pumps and fans                                                     84.0000              0.5190             43.5960 (267)
Energy for lighting                                               194.1534              0.5190            100.7656 (268)
Total CO2, kg/m2/year                                                                                     973.6344 (272)
Emissions per m2 for space and water heating                                                               20.5775 (272a)
Fuel factor (electricity)                                                                                   1.5500
Emissions per m2 for lighting                                                                               2.5004 (272b)
Emissions per m2 for pumps and fans                                                                         1.0818 (272c)
Target Carbon Dioxide Emission Rate (TER) = (20.5775 * 1.55) + 2.5004 + 1.0818, rounded to 2 d.p.          35.4800 (273)
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 004 C1 - 1B2P	Issued on Date	15/12/2020
Assessment Reference	1B2P Be Clean	Prop Type Ref	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	84 B	DER	12.83	TER	22.75
Environmental	92 A	% DER<TER	43.61		
CO_2 Emissions (t/year)	0.55	DFEE	30.57	TFEE	31.39
General Requirements Compliance	Pass	% DFEE<TFEE	2.61		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 50 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.75 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.83 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)31.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.6 kWh/m²/yrOK

2 Fabric U-values
Element          Average              Highest
External wall    0.17 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall       0.00 (max. 0.20)     -                         OK
Floor            (no floor)
Roof             (no roof)
Openings         1.26 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                  No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.42
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing South East:           6.98 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	50.4000 (1b)	x	2.5000 (2b)	=	126.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:		0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		77.3500 (23c)

Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	18.0800	6.9800	11.1000	0.1800	1.9980			(29a)
Wall to Stairwell	20.0500	2.1200	17.9300	0.1671	2.9955			(29a)
Total net area of external elements Aum(A, m2)			38.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.9857			(33)
Party Wall 1			34.3500	0.0000	0.0000			(32)
Party Floor 1			50.4000					(32d)
Party Ceilings 1			50.4000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.6066 (36)
Total fabric heat loss	(33) + (36) =	21.5923 (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	10.8719	10.7510	10.6302	10.0260	9.9051	9.3009	9.3009	9.1801	9.5426	9.9051	10.1468	10.3885	(38)
Heat transfer coeff	32.4642	32.3434	32.2225	31.6183	31.4975	30.8933	30.8933	30.7724	31.1349	31.4975	31.7392	31.9808	(39)

Average = Sum(39)m / 12 =	31.5881 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6441	0.6417	0.6393	0.6273	0.6249	0.6130	0.6130	0.6106	0.6178	0.6249	0.6297	0.6345	(40)
HLP (average)												0.6267	(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	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	3.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0212 (51)
Volume factor from Table 2a	3.4200 (52)
Temperature factor from Table 2b	1.0000 (53)
Enter (49) or (54) in (55)	0.2173 (55)

Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	151.7225	133.5560	139.8562	124.8073	121.8983	108.3332	103.4838	114.3241	114.3635	129.4456	137.5852	147.8816	(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	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h	151.7225	133.5560	139.8562	124.8073	121.8983	108.3332	103.4838	114.3241	114.3635	129.4456	137.5852	147.8816	(64)
										Total per year (kWh/year) = Sum(64)m =		1527.2573	(64)
Heat gains from water heating, kWh/month	64.4716	57.0741	60.5261	55.0700	54.5551	49.5923	48.4323	52.0367	51.5974	57.0646	59.3186	63.1946	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.2147	12.6253	10.2676	7.7732	5.8106	4.9055	5.3006	6.8899	9.2477	11.7420	13.7047	14.6097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(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)	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)	86.6554	84.9317	81.3523	76.4861	73.3267	68.8783	65.0972	69.9418	71.6631	76.6997	82.3870	84.9389	(72)
Total internal gains	297.6711	295.8967	286.0823	270.4675	254.9261	239.7798	229.8516	234.7469	242.7032	258.4884	276.5577	289.8075	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.4000	0.7000	0.7700	49.8335	(77)
Solar gains	49.8335	84.8850	116.1433	143.9072	161.1880	160.0224	154.2787	141.3864	125.7586	93.8160	59.6891	42.6471	(83)
Total gains	347.5047	380.7817	402.2256	414.3747	416.1141	399.8022	384.1302	376.1333	368.4618	352.3043	336.2468	332.4546	(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, n1,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	107.8111	108.2139	108.6197	110.6954	111.1200	113.2933	113.2933	113.7382	112.4139	111.1200	110.2739	109.4405	
alpha	8.1874	8.2143	8.2413	8.3797	8.4080	8.5529	8.5529	8.5825	8.4943	8.4080	8.3516	8.2960	
util living area	0.9904	0.9782	0.9460	0.8544	0.6926	0.4939	0.3538	0.3763	0.5805	0.8584	0.9733	0.9928	(86)
MIT	20.5937	20.6956	20.8218	20.9412	20.9903	20.9995	21.0000	21.0000	20.9981	20.9482	20.7655	20.5739	(87)
Th 2	20.3904	20.3926	20.3947	20.4054	20.4076	20.4183	20.4183	20.4205	20.4140	20.4076	20.4033	20.3990	(88)
util rest of house	0.9878	0.9726	0.9332	0.8269	0.6522	0.4493	0.3071	0.3289	0.5323	0.8264	0.9655	0.9908	(89)
MIT 2	19.8520	19.9994	20.1769	20.3416	20.3989	20.4180	20.4183	20.4205	20.4127	20.3540	20.1091	19.8308	(90)
Living area fraction										fLA = Living area / (4) =		0.5843	(91)
MIT	20.2854	20.4062	20.5537	20.6920	20.7445	20.7578	20.7582	20.7591	20.7548	20.7012	20.4926	20.2650	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2854	20.4062	20.5537	20.6920	20.7445	20.7578	20.7582	20.7591	20.7548	20.7012	20.4926	20.2650	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9873	0.9728	0.9368	0.8406	0.6754	0.4754	0.3344	0.3566	0.5605	0.8429	0.9668	0.9903	(94)
Useful gains	343.0886	370.4195	376.7955	348.3103	281.0556	190.0605	128.4532	134.1272	206.5107	296.9437	325.0798	329.2276	(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	518.9528	501.5233	452.8472	372.8433	284.8786	190.2344	128.4605	134.1396	207.1958	318.1621	425.0713	513.7715	(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	130.8430	88.1018	56.5825	17.6637	2.8444	0.0000	0.0000	0.0000	0.0000	15.7865	71.9939	137.3007	(98)
Space heating												521.1163	(98)
Space heating per m2											(98) / (4) =	10.3396	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303b)
Fraction of total space heat from community Heat pump	1.0000 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.3000 (306)
Space heating:	
Annual space heating requirement	521.1163 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	677.4512 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1527.2573 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	1985.4345 (310b)
Electricity used for heat distribution	26.6289 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)	
mechanical ventilation fans (SFP = 0.5250)	80.7030 (330a)
Total electricity for the above, kWh/year	80.7030 (331)
Electricity for lighting (calculated in Appendix L)	251.0355 (332)
Total delivered energy for all uses	2994.6243 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	887.6286	0.5190	460.6792	(368)
Electrical energy for heat distribution	26.6289	0.5190	13.8204	(372)
Total CO2 associated with community systems			474.4996	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			474.4996	(376)
Pumps and fans	80.7030	0.5190	41.8849	(378)
Energy for lighting	251.0355	0.5190	130.2874	(379)
Total CO2, kg/year			646.6719	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8300	(384)

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

DER		12.8300	ZC1
Total Floor Area	TFA	50.4000	
Assumed number of occupants	N	1.7019	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4332	ZC2
CO2 emissions from cooking, equation (L16)		3.1715	ZC3
Total CO2 emissions		33.4347	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.4347	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.5000 (2b)	=	126.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.4000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.0000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =							20.0000 / (5) =	0.1587	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.4087	(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) =	0.3168	(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													
	0.4039	0.3960	0.3880	0.3484	0.3405	0.3009	0.3009	0.2930	0.3168	0.3405	0.3564	0.3722	(22b)
Effective ac	0.5816	0.5784	0.5753	0.5607	0.5580	0.5453	0.5453	0.5429	0.5502	0.5580	0.5635	0.5693	(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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			6.9800	1.3258	9.2538			(27)
External Wall	18.0800	6.9800	11.1000	0.1800	1.9980			(29a)
Wall to Stairwell	20.0500	2.1200	17.9300	0.1800	3.2274			(29a)
Total net area of external elements Aum(A, m2)			38.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.5992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6645	(36)
Total fabric heat loss						(33) + (36) =	20.2637	(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	24.1812	24.0495	23.9204	23.3142	23.2007	22.6727	22.6727	22.5749	22.8761	23.2007	23.4302	23.6701	(38)
Heat transfer coeff													
	44.4449	44.3132	44.1841	43.5778	43.4644	42.9364	42.9364	42.8386	43.1398	43.4644	43.6939	43.9338	(39)
Average = Sum(39)m / 12 =												43.5773	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8818	0.8792	0.8767	0.8646	0.8624	0.8519	0.8519	0.8500	0.8559	0.8624	0.8669	0.8717	(40)
HLP (average)												0.8646	(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												1.7019	(42)
Average daily hot water use (litres/day)												74.6197	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	149.3424	131.4063	137.4762	122.5041	119.5183	106.0300	101.1038	111.9440	112.0603	127.0656	135.2820	145.5016	(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	(63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h	149.3424	131.4063	137.4762	122.5041	119.5183	106.0300	101.1038	111.9440	112.0603	127.0656	135.2820	145.5016	(64)

Total per year (kWh/year) = Sum(64)m = 1499.2345 (64)

Heat gains from water heating, kWh/month	62.5676	55.3544	58.6221	53.2274	52.6511	47.7497	46.5283	50.1327	49.7548	55.1606	57.4760	61.2905	(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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.2147	12.6253	10.2676	7.7732	5.8106	4.9055	5.3006	6.8899	9.2477	11.7420	13.7047	14.6097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(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)	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)	84.0963	82.3726	78.7931	73.9269	70.7676	66.3191	62.5380	67.3826	69.1039	74.1406	79.8278	82.3798	(72)
Total internal gains	298.1120	296.3375	286.5231	270.9084	255.3670	240.2206	230.2924	235.1877	243.1440	258.9292	276.9986	290.2484	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)

Solar gains	78.4878	133.6938	182.9257	226.6538	253.8711	252.0353	242.9889	222.6835	198.0698	147.7601	94.0103	67.1692	(83)
Total gains	376.5998	430.0313	469.4488	497.5622	509.2381	492.2559	473.2813	457.8713	441.2138	406.6894	371.0089	357.4176	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7492	78.9833	79.2140	80.3160	80.5256	81.5160	81.5160	81.7020	81.1316	80.5256	80.1027	79.6653	
alpha	6.2499	6.2656	6.2809	6.3544	6.3684	6.4344	6.4344	6.4468	6.4088	6.3684	6.3402	6.3110	
util living area	0.9929	0.9829	0.9577	0.8878	0.7478	0.5524	0.3985	0.4293	0.6560	0.9054	0.9824	0.9947	(86)
MIT	20.2784	20.4301	20.6253	20.8318	20.9539	20.9943	20.9994	20.9990	20.9838	20.8352	20.5229	20.2490	(87)
Th 2	20.1830	20.1852	20.1874	20.1977	20.1996	20.2086	20.2086	20.2102	20.2051	20.1996	20.1957	20.1916	(88)
util rest of house	0.9907	0.9780	0.9458	0.8594	0.6970	0.4867	0.3272	0.3562	0.5879	0.8751	0.9765	0.9930	(89)
MIT 2	19.2280	19.4481	19.7257	20.0114	20.1578	20.2050	20.2083	20.2098	20.1936	20.0229	19.5916	19.1922	(90)

Living area fraction fLA = Living area / (4) = 0.5843 (91)

MIT	19.8418	20.0219	20.2513	20.4908	20.6230	20.6662	20.6706	20.6710	20.6554	20.4976	20.1358	19.8097	(92)

Temperature adjustment 0.0000

adjusted MIT	19.8418	20.0219	20.2513	20.4908	20.6230	20.6662	20.6706	20.6710	20.6554	20.4976	20.1358	19.8097	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9896	0.9768	0.9469	0.8704	0.7246	0.5249	0.3689	0.3989	0.6271	0.8873	0.9760	0.9921	(94)
Useful gains	372.6862	420.0689	444.5171	433.0955	368.9784	258.4016	174.5941	182.6658	276.7012	360.8582	362.0868	354.5931	(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	690.7526	670.0989	607.5912	505.1003	387.8338	260.4609	174.7756	182.9630	282.7967	430.1914	569.5834	685.7942	(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	236.6414	168.0202	121.3271	51.8434	14.0284	0.0000	0.0000	0.0000	0.0000	51.5839	149.3976	246.4136	(98)

Space heating 1039.2555 (98)

Space heating per m2 (98) / (4) = 20.6201 (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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1111.5033	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	236.6414	168.0202	121.3271	51.8434	14.0284	0.0000	0.0000	0.0000	0.0000	51.5839	149.3976	246.4136	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	253.0924	179.7007	129.7616	55.4475	15.0037	0.0000	0.0000	0.0000	0.0000	55.1700	159.7835	263.5440	(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	149.3424	131.4063	137.4762	122.5041	119.5183	106.0300	101.1038	111.9440	112.0603	127.0656	135.2820	145.5016	(64)

Efficiency of water heater 79.8000 (216)

(217)m	86.0365	85.4705	84.4826	82.7078	80.8036	79.8000	79.8000	79.8000	79.8000	82.6206	85.0789	86.2085	(217)
Fuel for water heating, kWh/month	173.5804	153.7445	162.7271	148.1168	147.9121	132.8697	126.6964	140.2808	140.4264	153.7942	159.0077	168.7787	(219)

Water heating fuel used	1807.9348	(219)
Annual totals kWh/year		
Space heating fuel - main system	1111.5033	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	251.0355	(232)
Total delivered energy for all uses	3245.4735	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1111.5033	0.2160	240.0847	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.9348	0.2160	390.5139	(264)
Space and water heating			630.5986	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0355	0.5190	130.2874	(268)
Total CO2, kg/m2/year			799.8110	(272)
Emissions per m2 for space and water heating			12.5119	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.5851	(272b)
Emissions per m2 for pumps and fans			0.7723	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5119 * 1.55) + 2.5851 + 0.7723, rounded to 2 d.p.			22.7500	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 005 D2 - 2B3P	**Issued on Date**	15/12/2020
Assessment Reference	2B3P Be Clean	**Prop Type Ref**	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	84 B	**DER**	12.93	**TER**	22.08
Environmental	91 B	**% DER<TER**	41.44		
CO_2 Emissions (t/year)	0.66	**DFEE**	34.72	**TFEE**	34.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	0.65		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 62 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.08 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.93 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)34.7 kWh/m²/yrOK

2 Fabric U-values
Element          Average              Highest
External wall    0.17 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall       0.00 (max. 0.20)     -                         OK
Floor            (no floor)
Roof             (no roof)
Openings         1.31 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                  No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.42
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing South East:           10.98 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	62.2000 (1b)	x	2.5000 (2b)	=	155.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	155.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.3500 (23c)

Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			10.9800	1.3258	14.5568			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	24.6800	10.9800	13.7000	0.1800	2.4660			(29a)
Wall to CA	36.7000	2.1200	34.5800	0.1671	5.7772			(29a)
Total net area of external elements Aum(A, m2)			61.3800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.5385			(33)
Party Wall 1			19.9500	0.0000	0.0000			(32)
Party Floor 1			62.2000					(32d)
Party Ceilings 1			62.2000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.8756	(36)
Total fabric heat loss (33) + (36) =	32.4141	(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	13.4173	13.2681	13.1190	12.3733	12.2242	11.4785	11.4785	11.3294	11.7768	12.2242	12.5225	12.8207	(38)
Heat transfer coeff	45.8313	45.6822	45.5331	44.7874	44.6383	43.8926	43.8926	43.7434	44.1909	44.6383	44.9365	45.2348	(39)
Average = Sum(39)m / 12 =												44.7501	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7368	0.7344	0.7320	0.7201	0.7177	0.7057	0.7057	0.7033	0.7105	0.7177	0.7225	0.7272	(40)
HLP (average)												0.7195	(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	2.0431 (42)
Average daily hot water use (litres/day)	82.7237 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.9961	87.6872	84.3782	81.0693	77.7603	74.4514	74.4514	77.7603	81.0693	84.3782	87.6872	90.9961	(44)
Energy conte	134.9446	118.0234	121.7896	106.1791	101.8814	87.9159	81.4670	93.4846	94.6011	110.2484	120.3448	130.6866	(45)
Energy content (annual)										Total = Sum(45)m =		1301.5665	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	20.2417	17.7035	18.2684	15.9269	15.2822	13.1874	12.2200	14.0227	14.1902	16.5373	18.0517	19.6030	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	164.9423	145.1181	151.7873	135.2091	131.8791	116.9459	111.4647	123.4823	123.6311	140.2461	149.3748	160.6843	(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	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h	164.9423	145.1181	151.7873	135.2091	131.8791	116.9459	111.4647	123.4823	123.6311	140.2461	149.3748	160.6843	(64)
									Total per year (kWh/year) = Sum(64)m =			1654.7651	(64)
Heat gains from water heating, kWh/month	68.8672	60.9185	64.4932	58.5286	57.8737	52.4561	51.0859	55.0818	54.6789	60.6558	63.2387	67.4515	(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	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3014	14.4788	11.7749	8.9144	6.6636	5.6257	6.0788	7.9014	10.6053	13.4658	15.7166	16.7545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.4593	180.3112	175.6446	165.7099	153.1692	141.3827	133.5086	131.6568	136.3234	146.2580	158.7987	170.5852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	(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)	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	(71)
Water heating gains (Table 5)	92.5635	90.6526	86.6844	81.2897	77.7873	72.8556	68.6639	74.0346	75.9429	81.5266	87.8315	90.6606	(72)
Total internal gains	340.9708	339.0891	327.7505	309.5606	291.2667	273.5106	261.8979	267.2394	276.5181	294.8970	315.9934	331.6469	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.9800	36.7938	0.4000	0.7000	0.7700	78.3914	(77)
Solar gains	78.3914	133.5296	182.7011	226.3755	253.5594	251.7258	242.6905	222.4101	197.8266	147.5787	93.8949	67.0867	(83)
Total gains	419.3622	472.6187	510.4515	535.9360	544.8260	525.2364	504.5884	489.6495	474.3447	442.4756	409.8882	398.7336	(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, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	94.2465	94.5542	94.8639	96.4433	96.7655	98.4094	98.4094	98.7449	97.7452	96.7655	96.1232	95.4894	
alpha	7.2831	7.3036	7.3243	7.4296	7.4510	7.5606	7.5606	7.5830	7.5163	7.4510	7.4082	7.3660	
util living area	0.9943	0.9855	0.9610	0.8862	0.7354	0.5326	0.3826	0.4107	0.6343	0.9017	0.9844	0.9959	(86)
MIT	20.4311	20.5594	20.7226	20.8903	20.9762	20.9981	20.9999	20.9998	20.9934	20.8931	20.6379	20.4064	(87)
Th 2	20.3084	20.3105	20.3126	20.3232	20.3253	20.3358	20.3358	20.3379	20.3316	20.3253	20.3210	20.3168	(88)
util rest of house	0.9926	0.9814	0.9504	0.8599	0.6902	0.4784	0.3249	0.3517	0.5764	0.8731	0.9793	0.9946	(89)
MIT 2	19.5493	19.7359	19.9685	20.2014	20.3037	20.3346	20.3358	20.3378	20.3269	20.2105	19.8589	19.5203	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	19.9796	20.1377	20.3365	20.5375	20.6319	20.6584	20.6598	20.6608	20.6521	20.5436	20.2390	19.9527	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9796	20.1377	20.3365	20.5375	20.6319	20.6584	20.6598	20.6608	20.6521	20.5436	20.2390	19.9527	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9802	0.9508	0.8687	0.7112	0.5048	0.3531	0.3805	0.6045	0.8830	0.9785	0.9938	(94)
Useful gains	415.8660	463.2708	485.3603	465.5864	387.4602	265.1504	178.1515	186.3072	286.7410	390.7268	401.0867	396.2751	(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	718.6169	696.0934	630.0160	521.2142	398.7032	265.9169	178.1956	186.3833	289.5432	443.8633	590.4205	712.5690	(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	225.2467	156.4568	107.6239	40.0520	8.3648	0.0000	0.0000	0.0000	0.0000	39.5336	136.3203	235.3227	(98)
Space heating												948.9207	(98)
Space heating per m2											(98) / (4) =	15.2560	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	948.9207	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	1233.5969	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1654.7651	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2151.1946	(310b)
Electricity used for heat distribution	33.8479	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	99.5978	(330a)
Total electricity for the above, kWh/year	99.5978	(331)
Electricity for lighting (calculated in Appendix L)	287.8882	(332)
Total delivered energy for all uses	3772.2775	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1128.2639	0.5190	585.5689	(368)
Electrical energy for heat distribution	33.8479	0.5190	17.5671	(372)
Total CO2 associated with community systems			603.1360	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			603.1360	(376)
Pumps and fans	99.5978	0.5190	51.6912	(378)
Energy for lighting	287.8882	0.5190	149.4140	(379)
Total CO2, kg/year			804.2412	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9300	(384)

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

DER		12.9300	ZC1
Total Floor Area	TFA	62.2000	
Assumed number of occupants	N	2.0431	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0018	ZC2
CO2 emissions from cooking, equation (L16)		2.7015	ZC3
Total CO2 emissions		32.6333	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6333	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.2000 (1b)	x	2.5000 (2b)	=	155.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	155.5000	(5)

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2. Ventilation rate
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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =							20.0000 / (5) =	0.1286	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.3786	(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) =	0.2934	(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													
	0.3741	0.3668	0.3594	0.3228	0.3154	0.2788	0.2788	0.2714	0.2934	0.3154	0.3301	0.3448	(22b)
Effective ac	0.5700	0.5673	0.5646	0.5521	0.5497	0.5389	0.5389	0.5368	0.5431	0.5497	0.5545	0.5594	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			10.9800	1.3258	14.5568			(27)
External Wall	24.6800	10.9800	13.7000	0.1800	2.4660			(29a)
Wall to CA	36.7000	2.1200	34.5800	0.1800	6.2244			(29a)
Total net area of external elements Aum(A, m2)			61.3800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.3672			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2265	(36)
Total fabric heat loss						(33) + (36) =	30.5937	(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	29.2487	29.1092	28.9726	28.3305	28.2104	27.6512	27.6512	27.5477	27.8666	28.2104	28.4534	28.7075	(38)
Heat transfer coeff													
	59.8424	59.7030	59.5663	58.9243	58.8041	58.2449	58.2449	58.1414	58.4603	58.8041	59.0471	59.3012	(39)
Average = Sum(39)m / 12 =												58.9237	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9621	0.9599	0.9577	0.9473	0.9454	0.9364	0.9364	0.9347	0.9399	0.9454	0.9493	0.9534	(40)
HLP (average)												0.9473	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0431	(42)
Average daily hot water use (litres/day)	82.7237	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	90.9961	87.6872	84.3782	81.0693	77.7603	74.4514	74.4514	77.7603	81.0693	84.3782	87.6872	90.9961	(44)
Energy conte	134.9446	118.0234	121.7896	106.1791	101.8814	87.9159	81.4670	93.4846	94.6011	110.2484	120.3448	130.6866	(45)
Energy content (annual)										Total = Sum(45)m =		1301.5665	(45)
Distribution loss (46)m = 0.15 x (45)m													
	20.2417	17.7035	18.2684	15.9269	15.2822	13.1874	12.2200	14.0227	14.1902	16.5373	18.0517	19.6030	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	162.5623	142.9684	149.4073	132.9059	129.4991	114.6427	109.0847	121.1022	121.3279	137.8661	147.0716	158.3043	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	162.5623	142.9684	149.4073	132.9059	129.4991	114.6427	109.0847	121.1022	121.3279	137.8661	147.0716	158.3043	(64)
Total per year (kWh/year) = Sum(64)m =												1626.7423	(64)
Heat gains from water heating, kWh/month	66.9632	59.1988	62.5892	56.6860	55.9697	50.6135	49.1819	53.1778	52.8363	58.7517	61.3961	65.5474	(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	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	102.1552	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3014	14.4788	11.7749	8.9144	6.6636	5.6257	6.0788	7.9014	10.6053	13.4658	15.7166	16.7545	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.4593	180.3112	175.6446	165.7099	153.1692	141.3827	133.5086	131.6568	136.3234	146.2580	158.7987	170.5852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	33.2155	(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)	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	-81.7242	(71)
Water heating gains (Table 5)	90.0043	88.0934	84.1252	78.7305	75.2281	70.2965	66.1047	71.4755	73.3837	78.9674	85.2723	88.1014	(72)
Total internal gains	341.4116	339.5299	328.1913	310.0014	291.7075	273.9515	262.3387	267.6803	276.9589	295.3378	316.4342	332.0877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.9800	36.7938	0.6300	0.7000	0.7700	123.4665	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	123.4665	210.3092	287.7542	356.5413	399.3560	396.4681	382.2376	350.2959	311.5769	232.4364	147.8844	105.6616	(83)
Total gains	464.8782	549.8391	615.9455	666.5428	691.0635	670.4196	644.5763	617.9761	588.5358	527.7742	464.3186	437.7493	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.1803	72.3489	72.5149	73.3050	73.4548	74.1600	74.1600	74.2921	73.8868	73.4548	73.1525	72.8391	
alpha	5.8120	5.8233	5.8343	5.8870	5.8970	5.9440	5.9440	5.9528	5.9258	5.8970	5.8768	5.8559	
util living area	0.9937	0.9831	0.9557	0.8820	0.7395	0.5484	0.3966	0.4311	0.6606	0.9099	0.9844	0.9954	(86)
MIT	20.1598	20.3420	20.5696	20.8038	20.9438	20.9919	20.9990	20.9984	20.9771	20.7940	20.4301	20.1223	(87)
Th 2	20.1150	20.1169	20.1188	20.1275	20.1291	20.1367	20.1367	20.1381	20.1337	20.1291	20.1258	20.1224	(88)
util rest of house	0.9918	0.9781	0.9431	0.8516	0.6855	0.4778	0.3193	0.3512	0.5874	0.8793	0.9789	0.9940	(89)
MIT 2	19.0036	19.2677	19.5909	19.9117	20.0786	20.1317	20.1363	20.1374	20.1176	19.9079	19.4037	18.9547	(90)
Living area fraction									fLA = Living area / (4) =			0.4879	(91)
MIT	19.5678	19.7919	20.0684	20.3470	20.5008	20.5514	20.5572	20.5575	20.5370	20.3403	19.9045	19.5244	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5678	19.7919	20.0684	20.3470	20.5008	20.5514	20.5572	20.5575	20.5370	20.3403	19.9045	19.5244	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9759	0.9422	0.8598	0.7093	0.5120	0.3571	0.3903	0.6223	0.8876	0.9772	0.9928	(94)
Useful gains	460.3340	536.5619	580.3572	573.1107	490.1850	343.2866	230.1610	241.1717	366.2698	468.4276	453.7421	434.5791	(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	913.6608	889.0911	808.2212	674.5066	517.5216	346.6400	230.4891	241.7235	376.3087	572.7706	756.0681	908.7555	(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	337.2751	236.8996	169.5308	73.0051	20.3384	0.0000	0.0000	0.0000	0.0000	77.6312	217.6747	352.7873	(98)
Space heating												1485.1423	(98)
Space heating per m2											(98) / (4) =	23.8769	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1588.3875	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	337.2751	236.8996	169.5308	73.0051	20.3384	0.0000	0.0000	0.0000	0.0000	77.6312	217.6747	352.7873	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	360.7221	253.3686	181.3164	78.0803	21.7523	0.0000	0.0000	0.0000	0.0000	83.0280	232.8072	377.3126	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	162.5623	142.9684	149.4073	132.9059	129.4991	114.6427	109.0847	121.1022	121.3279	137.8661	147.0716	158.3043	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.7183	86.1523	85.1514	83.2915	81.1016	79.8000	79.8000	79.8000	79.8000	83.3501	85.8581	86.8913	(217)
Fuel for water heating, kWh/month	187.4601	165.9484	175.4607	159.5672	159.6752	143.6625	136.6976	151.7572	152.0399	165.4061	171.2962	182.1866	(219)
Water heating fuel used												1951.1576	(219)

Annual totals kWh/year		
Space heating fuel - main system	1588.3875	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	287.8882	(232)
Total delivered energy for all uses	3902.4333	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1588.3875	0.2160	343.0917	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1951.1576	0.2160	421.4500	(264)
Space and water heating			764.5417	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	287.8882	0.5190	149.4140	(268)
Total CO2, kg/m2/year			952.8807	(272)
Emissions per m2 for space and water heating			12.2917	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4022	(272b)
Emissions per m2 for pumps and fans			0.6258	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.2917 * 1.55) + 2.4022 + 0.6258, rounded to 2 d.p.			22.0800	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 006 E2 - 2B4P	**Issued on Date**	15/12/2020
Assessment Reference	2B4P Be Clean	**Prop Type Ref**	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	84 B	**DER**	13.60	**TER**	22.40
Environmental	90 B	**% DER<TER**	39.28		
CO_2 Emissions (t/year)	0.81	**DFEE**	40.90	**TFEE**	40.67
General Requirements Compliance	Fail	**% DFEE<TFEE**	-0.58		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

Mid-floor flat, total floor area 75 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.60 kgCO□/m²OK
-----------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)40.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.9 kWh/m²/yrFail
Excess energy =0.2 kWh/m²/yr  (0.5%)
-----------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.17 (max. 0.30)        0.18 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           (no floor)
Roof            (no roof)
Openings        1.34 (max. 2.00)        1.40 (max. 3.30)          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                                 10.0                                          OK
-----------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Community heating scheme                      -

Secondary heating system:               None
-----------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                          OK
Primary pipework insulated:             No primary pipework
-----------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Charging system linked to use of community heating, programmer and at least two room statsOK


Hot water controls:                     No cylinderstat


-----------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                           OK
-----------------------------------------------------------------------------------------------
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                     0.44
Maximum                                 1.5                                           OK
MVHR efficiency:                        91%
Minimum:                                70%                                           OK
-----------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Midlands):            Medium                                        OK
Based on:
Overshading:                            Average
Windows facing North East:              6.00 m², No overhang
Windows facing South East:              12.90 m², No overhang
Air change rate:                        2.00 ach
Blinds/curtains:                        None
-----------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Door U-value                            0.82 W/m²K
Air permeability                        3.0 m³/m²h



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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	75.0000 (1b)	x	2.5000 (2b)	=	187.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.3500 (23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			18.9000	1.3258	25.0568			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	46.0800	18.9000	27.1800	0.1800	4.8924			(29a)
Wall to CA	30.6800	2.1200	28.5600	0.1671	4.7715			(29a)
Total net area of external elements Aum(A, m2)			76.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.4591			(33)
Party Wall 1			20.0500	0.0000	0.0000			(32)
Party Floor 1			75.0000					(32d)
Party Ceilings 1			75.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1164	(36)
Total fabric heat loss						(33) + (36) =	46.5755	(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	17.0659	16.8687	16.6714	15.6853	15.4881	14.5020	14.5020	14.3047	14.8964	15.4881	15.8825	16.2770	(38)
Heat transfer coeff	63.6414	63.4442	63.2470	62.2608	62.0636	61.0775	61.0775	60.8802	61.4719	62.0636	62.4580	62.8525	(39)

Average = Sum(39)m / 12 = 62.2115 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8486	0.8459	0.8433	0.8301	0.8275	0.8144	0.8144	0.8117	0.8196	0.8275	0.8328	0.8380	(40)
HLP (average)												0.8295	(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 2.3612 (42)
Average daily hot water use (litres/day) 90.2775 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3053	95.6942	92.0831	88.4720	84.8609	81.2498	81.2498	84.8609	88.4720	92.0831	95.6942	99.3053	(44)
Energy conte	147.2668	128.8005	132.9106	115.8747	111.1845	95.9438	88.9060	102.0210	103.2394	120.3156	131.3339	142.6201	(45)
Energy content (annual)											Total = Sum(45)m =	1420.4168	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	22.0900	19.3201	19.9366	17.3812	16.6777	14.3916	13.3359	15.3031	15.4859	18.0473	19.7001	21.3930	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	177.2645	155.8952	162.9083	144.9047	141.1822	124.9738	118.9037	132.0186	132.2694	150.3133	160.3639	172.6178	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	177.2645	155.8952	162.9083	144.9047	141.1822	124.9738	118.9037	132.0186	132.2694	150.3133	160.3639	172.6178	(64)
								Total per year (kWh/year) = Sum(64)m =				1773.6154	(64)
Heat gains from water heating, kWh/month	72.9644	64.5019	68.1909	61.7524	60.9670	55.1253	53.5594	57.9201	57.5511	64.0031	66.8925	71.4193	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	118.0579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6035	16.5235	13.4378	10.1733	7.6046	6.4202	6.9372	9.0173	12.1029	15.3675	17.9361	19.1206	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	208.6751	210.8404	205.3837	193.7670	179.1030	165.3209	156.1136	153.9482	159.4049	171.0216	185.6856	199.4678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	34.8058	(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)	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	-94.4463	(71)
Water heating gains (Table 5)	98.0704	95.9850	91.6545	85.7672	81.9449	76.5630	71.9884	77.8496	79.9321	86.0256	92.9063	95.9937	(72)
Total internal gains	383.7664	381.7663	368.8934	348.1248	327.0699	306.7214	293.4566	299.2324	309.8573	330.8321	354.9454	372.9994	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.0000	11.2829	0.4000	0.7000	0.7700	13.1361	(75)
Southeast	12.9000	36.7938	0.4000	0.7000	0.7700	92.0992	(77)

Solar gains	105.2353	183.6179	262.8236	345.0772	404.2463	409.1223	391.1919	345.8567	291.1210	206.0617	126.8422	89.5453	(83)
Total gains	489.0016	565.3842	631.7170	693.2020	731.3162	715.8437	684.6485	645.0891	600.9784	536.8939	481.7876	462.5447	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.8388	82.0932	82.3492	83.6535	83.9193	85.2742	85.2742	85.5505	84.7270	83.9193	83.3893	82.8660	
alpha	6.4559	6.4729	6.4899	6.5769	6.5946	6.6849	6.6849	6.7034	6.6485	6.5946	6.5593	6.5244	
util living area	0.9964	0.9902	0.9705	0.9012	0.7474	0.5417	0.3921	0.4332	0.6838	0.9337	0.9905	0.9974	(86)
MIT	20.2374	20.3881	20.5968	20.8290	20.9593	20.9958	20.9996	20.9992	20.9824	20.8082	20.4804	20.2106	(87)
Th 2	20.2115	20.2137	20.2160	20.2273	20.2296	20.2409	20.2409	20.2432	20.2364	20.2296	20.2250	20.2205	(88)
util rest of house	0.9953	0.9872	0.9617	0.8754	0.6979	0.4794	0.3247	0.3624	0.6168	0.9100	0.9871	0.9966	(89)
MIT 2	19.1908	19.4110	19.7110	20.0356	20.1926	20.2383	20.2407	20.2428	20.2236	20.0170	19.5551	19.1589	(90)
Living area fraction										fLA = Living area / (4) =		0.4516	(91)
MIT	19.6634	19.8523	20.1110	20.3939	20.5388	20.5804	20.5834	20.5844	20.5663	20.3743	19.9730	19.6338	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6634	19.8523	20.1110	20.3939	20.5388	20.5804	20.5834	20.5844	20.5663	20.3743	19.9730	19.6338	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9855	0.9604	0.8814	0.7184	0.5075	0.3551	0.3944	0.6464	0.9150	0.9858	0.9958	(94)
Useful gains	486.1965	557.1978	606.6900	610.9998	525.3744	363.2631	243.1424	254.4442	388.4945	491.2561	474.9321	460.6086	(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	977.7515	948.6336	860.8566	715.6183	548.5680	365.2659	243.2979	254.7486	397.4938	606.6294	804.0211	970.0552	(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	365.7169	263.0449	189.0999	75.3253	17.2561	0.0000	0.0000	0.0000	0.0000	85.8378	236.9441	379.0283	(98)
Space heating												1612.2532	(98)
Space heating per m2											(98) / (4) =	21.4967	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1612.2532	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	2095.9291	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1773.6154	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2305.7001	(310b)
Electricity used for heat distribution	44.0163	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	125.8125	(330a)
Total electricity for the above, kWh/year	125.8125	(331)
Electricity for lighting (calculated in Appendix L)	328.5442	(332)
Total delivered energy for all uses	4855.9859	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1467.2097	0.5190	761.4818	(368)
Electrical energy for heat distribution	44.0163	0.5190	22.8445	(372)
Total CO2 associated with community systems			784.3263	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			784.3263	(376)
Pumps and fans	125.8125	0.5190	65.2967	(378)
Energy for lighting	328.5442	0.5190	170.5144	(379)
Total CO2, kg/year			1020.1374	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6000	(384)

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

DER		13.6000	ZC1
Total Floor Area	TFA	75.0000	
Assumed number of occupants	N	2.3612	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4875	ZC2
CO2 emissions from cooking, equation (L16)		2.3422	ZC3
Total CO2 emissions		32.4298	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4298	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.0000 (1b)	x	2.5000 (2b)	=	187.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 75.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =							30.0000 / (5) =	0.1600	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.4100	(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) =	0.3485	(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													
	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.6300	1.3258	22.0473			(27)
External Wall	46.0800	16.6300	29.4500	0.1800	5.3010			(29a)
Wall to CA	30.6800	2.1200	28.5600	0.1800	5.1408			(29a)
Total net area of external elements Aum(A, m2)			76.7600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.6091			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3975	(36)
Total fabric heat loss						(33) + (36) =	41.0066	(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	37.0457	36.8085	36.5760	35.4840	35.2797	34.3286	34.3286	34.1525	34.6949	35.2797	35.6930	36.1251	(38)
Heat transfer coeff													
	78.0523	77.8151	77.5826	76.4906	76.2863	75.3352	75.3352	75.1591	75.7016	76.2863	76.6996	77.1317	(39)
Average = Sum(39)m / 12 =												76.4897	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0407	1.0375	1.0344	1.0199	1.0172	1.0045	1.0045	1.0021	1.0094	1.0172	1.0227	1.0284	(40)
HLP (average)												1.0199	(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	2.3612	(42)
Average daily hot water use (litres/day)	90.2775	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	99.3053	95.6942	92.0831	88.4720	84.8609	81.2498	81.2498	84.8609	88.4720	92.0831	95.6942	99.3053	(44)
Energy conte	147.2668	128.8005	132.9106	115.8747	111.1845	95.9438	88.9060	102.0210	103.2394	120.3156	131.3339	142.6201	(45)
Energy content (annual)										Total = Sum(45)m =		1420.4168	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.0900	19.3201	19.9366	17.3812	16.6777	14.3916	13.3359	15.3031	15.4859	18.0473	19.7001	21.3930	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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                 4.3553     3.9338     4.3553     4.2148     4.3553     4.2148     4.3553     4.3553     4.2148     4.3553     4.2148     4.3553 (56)
If cylinder contains dedicated solar storage
                 4.3553     3.9338     4.3553     4.2148     4.3553     4.2148     4.3553     4.3553     4.2148     4.3553     4.2148     4.3553 (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
               174.8845   153.7455   160.5283   142.6015   138.8022   122.6706   116.5237   129.6386   129.9662   147.9332   158.0606   170.2377 (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 (63)
                                                                                        Solar input (sum of months) = Sum(63)m =       0.0000 (63)
Output from w/h
               174.8845   153.7455   160.5283   142.6015   138.8022   122.6706   116.5237   129.6386   129.9662   147.9332   158.0606   170.2377 (64)
                                                                                          Total per year (kWh/year) = Sum(64)m =   1745.5926 (64)
Heat gains from water heating, kWh/month
                71.0604    62.7822    66.2869    59.9098    59.0630    53.2827    51.6554    56.0161    55.7085    62.0991    65.0499    69.5153 (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          118.0579   118.0579   118.0579   118.0579   118.0579   118.0579   118.0579   118.0579   118.0579   118.0579   118.0579   118.0579 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                18.6058    16.5255    13.4395    10.1745     7.6056     6.4210     6.9381     9.0184    12.1044    15.3693    17.9383    19.1229 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               208.6751   210.8404   205.3837   193.7670   179.1030   165.3209   156.1136   153.9482   159.4049   171.0216   185.6856   199.4678 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                34.8058    34.8058    34.8058    34.8058    34.8058    34.8058    34.8058    34.8058    34.8058    34.8058    34.8058    34.8058 (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)
               -94.4463   -94.4463   -94.4463   -94.4463   -94.4463   -94.4463   -94.4463   -94.4463   -94.4463   -94.4463   -94.4463   -94.4463 (71)
Water heating gains (Table 5)
                95.5112    93.4258    89.0953    83.2080    79.3857    74.0038    69.4293    75.2905    77.3730    83.4665    90.3471    93.4346 (72)
Total internal gains
               384.2095   382.2092   369.3359   348.5669   327.5117   307.1630   293.8983   299.6744   310.2997   331.2748   355.3884   373.4426 (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
-------------------------------------------------------------------------------------------------
Northeast                               5.2800            11.2829           0.6300          0.7000         0.7700           18.2066 (75)
Southeast                              11.3500            36.7938           0.6300          0.7000         0.7700          127.6270 (77)
-------------------------------------------------------------------------------------------------

Solar gains    145.8336   254.4561   364.2211   478.2120   560.2126   566.9713   542.1223   479.2935   403.4370   285.5592   175.7764   124.0906 (83)
Total gains    530.0431   636.6653   733.5570   826.7789   887.7243   874.1343   836.0206   778.9679   713.7366   616.8341   531.1648   497.5332 (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, nil,m (see Table 9a)
                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau             66.7287    66.9321    67.1327    68.0911    68.2735    69.1354    69.1354    69.2974    68.8009    68.2735    67.9056    67.5252
alpha            5.4486     5.4621     5.4755     5.5394     5.5516     5.6090     5.6090     5.6198     5.5867     5.5516     5.5270     5.5017
util living area
                 0.9956     0.9877     0.9643     0.8906     0.7391     0.5426     0.3952     0.4413     0.6925     0.9319     0.9892     0.9968 (86)

MIT             20.0088    20.2023    20.4658    20.7573    20.9316    20.9899    20.9986    20.9974    20.9639    20.7195    20.3069    19.9757 (87)
Th 2            20.0496    20.0522    20.0547    20.0668    20.0691    20.0796    20.0796    20.0816    20.0755    20.0691    20.0645    20.0597 (88)
util rest of house
                 0.9942     0.9838     0.9534     0.8605     0.6826     0.4685     0.3132     0.3545     0.6147     0.9057     0.9852     0.9958 (89)
MIT 2           18.7353    19.0173    19.3948    19.7988    20.0080    20.0735    20.0791    20.0806    20.0499    19.7614    19.1800    18.6946 (90)
Living area fraction                                                                               fLA = Living area / (4) =     0.4516 (91)
MIT             19.3104    19.5524    19.8785    20.2316    20.4251    20.4873    20.4943    20.4946    20.4627    20.1941    19.6889    19.2731 (92)
Temperature adjustment                                                                                                           0.0000
adjusted MIT    19.3104    19.5524    19.8785    20.2316    20.4251    20.4873    20.4943    20.4946    20.4627    20.1941    19.6889    19.2731 (93)


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

                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9927     0.9813     0.9510     0.8664     0.7051     0.5018     0.3503     0.3938     0.6485     0.9097     0.9831     0.9946 (94)
Useful gains   526.1658   624.7291   697.5978   716.2803   625.9183   438.6080   292.8442   306.7376   462.8481   561.1576   522.1976   494.8539 (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
              1171.5971  1140.1794  1037.9383   866.7634   665.6029   443.5237   293.3803   307.7474   481.6630   731.8978   965.5640  1162.6172 (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
               480.2009   346.3826   253.2134   108.3478    29.5253     0.0000     0.0000     0.0000     0.0000   127.0307   319.2238   496.8158 (98)
Space heating                                                                                                                 2160.7404 (98)
Space heating per m2                                                                                        (98) / (4) =     28.8099 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------
Not applicable
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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 %)                                                                                93.5000 (206)
Efficiency of secondary/supplementary heating system, %                                                                          0.0000 (208)
Space heating requirement                                                                                                     2310.9523 (211)

                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Space heating requirement
               480.2009   346.3826   253.2134   108.3478    29.5253     0.0000     0.0000     0.0000     0.0000   127.0307   319.2238   496.8158 (98)
Space heating efficiency (main heating system 1)
                93.5000    93.5000    93.5000    93.5000    93.5000     0.0000     0.0000     0.0000     0.0000    93.5000    93.5000    93.5000 (210)
Space heating fuel (main heating system)
               513.5838   370.4627   270.8164   115.8800    31.5779     0.0000     0.0000     0.0000     0.0000   135.8618   341.4159   531.3538 (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
               174.8845   153.7455   160.5283   142.6015   138.8022   122.6706   116.5237   129.6386   129.9662   147.9332   158.0606   170.2377 (64)
Efficiency of water heater                                                                                                      79.8000 (216)
(217)m          87.3724    86.9173    86.0247    84.0927    81.4900    79.8000    79.8000    79.8000    79.8000    84.4107    86.6522    87.5056 (217)
Fuel for water heating, kWh/month
               200.1599   176.8871   186.6073   169.5766   170.3304   153.7225   146.0197   162.4544   162.8649   175.2542   182.4080   194.5450 (219)
Water heating fuel used                                                                                                       2080.8298 (219)
Annual totals kWh/year
Space heating fuel - main system                                                                                              2310.9523 (211)
Space heating fuel - secondary                                                                                                   0.0000 (215)

Electricity for pumps and fans:
   central heating pump                                                                                                         30.0000 (230c)
   main heating flue fan                                                                                                        45.0000 (230e)
Total electricity for the above, kWh/year                                                                                       75.0000 (231)
Electricity for lighting (calculated in Appendix L)                                                                            328.5844 (232)
Total delivered energy for all uses                                                                                           4795.3665 (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                                                 2310.9523             0.2160          499.1657 (261)
Space heating - secondary                                                        0.0000             0.0000            0.0000 (263)
Water heating (other fuel)                                                    2080.8298             0.2160          449.4592 (264)
Space and water heating                                                                                             948.6249 (265)
Pumps and fans                                                                  75.0000             0.5190           38.9250 (267)
Energy for lighting                                                            328.5844             0.5190          170.5353 (268)
Total CO2, kg/m2/year                                                                                              1158.0852 (272)
Emissions per m2 for space and water heating                                                                         12.6483 (272a)
Fuel factor (electricity)                                                                                             1.5500
Emissions per m2 for lighting                                                                                         2.2738 (272b)
Emissions per m2 for pumps and fans                                                                                   0.5190 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6483 * 1.55) + 2.2738 + 0.5190, rounded to 2 d.p.                    22.4000 (273)
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 007 B1 - 2B4P	Issued on Date	15/12/2020
Assessment Reference	2B4P Be Clean	Prop Type Ref	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	84 B	DER	13.51	TER	23.54
Environmental	90 B	% DER<TER	42.60		
CO_2 Emissions (t/year)	0.85	DFEE	42.13	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	7.28		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 81 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 23.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.51 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)45.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values
Element          Average              Highest
External wall    0.17 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall       0.00 (max. 0.20)     -                         OK
Floor            (no floor)
Roof             (no roof)
Openings         1.33 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                  No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.42
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing North East:           16.25 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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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	80.9000	(1b)	x 2.5000	(2b) =	202.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.9000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	202.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2615	0.2586	0.2557	0.2411	0.2382	0.2237	0.2237	0.2208	0.2295	0.2382	0.2440	0.2498	(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	
Window Double-Glazed (Uw = 1.40)			16.2500	1.3258	21.5436			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	39.7000	16.2500	23.4500	0.1800	4.2210			(29a)
Wall to CA	41.3000	2.1200	39.1800	0.1671	6.5458			(29a)
Total net area of external elements Aum(A, m2)			81.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.0487			(33)
Party Wall 1			26.5000	0.0000	0.0000			(32)
Party Floor 1			80.9000					(32d)
Party Ceilings 1			80.9000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1020	(36)
Total fabric heat loss (33) + (36) =	44.1507	(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	17.4511	17.2571	17.0631	16.0933	15.8993	14.9295	14.9295	14.7355	15.3174	15.8993	16.2873	16.6752	(38)
Heat transfer coeff	61.6018	61.4078	61.2139	60.2440	60.0500	59.0802	59.0802	58.8862	59.4681	60.0500	60.4380	60.8259	(39)

Average = Sum(39)m / 12 = 60.1955 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7615	0.7591	0.7567	0.7447	0.7423	0.7303	0.7303	0.7279	0.7351	0.7423	0.7471	0.7519	(40)
HLP (average)												0.7441	(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	2.4797 (42)
Average daily hot water use (litres/day)	93.0933 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.4026	98.6788	94.9551	91.2314	87.5077	83.7839	83.7839	87.5077	91.2314	94.9551	98.6788	102.4026	(44)
Energy conte	151.8601	132.8178	137.0561	119.4888	114.6523	98.9362	91.6790	105.2030	106.4594	124.0682	135.4301	147.0684	(45)
Energy content (annual)											Total = Sum(45)m =	1464.7193	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	22.7790	19.9227	20.5584	17.9233	17.1979	14.8404	13.7518	15.7804	15.9689	18.6102	20.3145	22.0603	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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													
	181.8578	159.9125	167.0537	148.5188	144.6500	127.9663	121.6767	135.2007	135.4895	154.0659	164.4602	177.0661	(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	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	181.8578	159.9125	167.0537	148.5188	144.6500	127.9663	121.6767	135.2007	135.4895	154.0659	164.4602	177.0661	(64)
										Total per year (kWh/year) = Sum(64)m =		1817.9180	(64)
Heat gains from water heating, kWh/month													
	74.4916	65.8377	69.5693	62.9540	62.1201	56.1203	54.4814	58.9781	58.6218	65.2508	68.2545	72.8984	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.8602	17.6397	14.3455	10.8605	8.1183	6.8539	7.4058	9.6264	12.9205	16.4055	19.1477	20.4122	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.3112	223.6078	217.8206	205.5004	189.9485	175.3318	165.5669	163.2704	169.0576	181.3777	196.9297	211.5464	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	(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)													
	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	(71)
Water heating gains (Table 5)													
	100.1232	97.9727	93.5071	87.4362	83.4947	77.9449	73.2277	79.2717	81.4191	87.7027	94.7980	97.9817	(72)
Total internal gains													
	401.4903	399.4159	385.8690	363.9928	341.7572	320.3263	306.3962	312.3642	323.5929	345.6817	371.0711	390.1360	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.2500	11.2829	0.4000	0.7000	0.7700	35.5768	(75)
Solar gains	35.5768	72.4176	130.4735	214.2750	288.0276	307.0679	287.2558	229.0036	158.9840	88.5001	44.7648	29.0538	(83)
Total gains	437.0671	471.8335	516.3425	578.2678	629.7849	627.3942	593.6520	541.3679	482.5770	434.1818	415.8360	419.1898	(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, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	91.1995	91.4876	91.7775	93.2550	93.5562	95.0920	95.0920	95.4053	94.4717	93.5562	92.9557	92.3629	
alpha	7.0800	7.0992	7.1185	7.2170	7.2371	7.3395	7.3395	7.3604	7.2981	7.2371	7.1970	7.1575	
util living area	0.9987	0.9973	0.9910	0.9543	0.8198	0.5968	0.4373	0.4988	0.7976	0.9769	0.9968	0.9990	(86)
MIT	20.2601	20.3524	20.5300	20.7780	20.9471	20.9953	20.9996	20.9990	20.9681	20.7487	20.4668	20.2451	(87)
Th 2	20.2869	20.2890	20.2911	20.3015	20.3036	20.3142	20.3142	20.3163	20.3099	20.3036	20.2994	20.2952	(88)
util rest of house	0.9982	0.9964	0.9880	0.9397	0.7766	0.5354	0.3695	0.4255	0.7367	0.9667	0.9956	0.9987	(89)
MIT 2	19.2832	19.4196	19.6793	20.0381	20.2531	20.3111	20.3140	20.3158	20.2846	20.0043	19.5953	19.2680	(90)
Living area fraction										fLA = Living area / (4) =		0.4405	(91)
MIT	19.7135	19.8305	20.0540	20.3641	20.5588	20.6125	20.6160	20.6168	20.5857	20.3323	19.9792	19.6984	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7135	19.8305	20.0540	20.3641	20.5588	20.6125	20.6160	20.6168	20.5857	20.3323	19.9792	19.6984	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9956	0.9868	0.9412	0.7932	0.5624	0.3994	0.4579	0.7622	0.9672	0.9949	0.9983	(94)
Useful gains	436.0945	469.7744	509.5330	544.2415	499.5426	352.8315	237.0969	247.8751	367.8201	419.9575	413.6977	418.4846	(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	949.5020	916.8524	829.6949	690.6419	531.9730	355.2218	237.2670	248.3092	385.6910	584.4231	778.3941	942.7066	(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	381.9751	300.4365	238.2005	105.4083	24.1282	0.0000	0.0000	0.0000	0.0000	122.3625	262.5814	390.0212	(98)
Space heating												1825.1136	(98)
Space heating per m2											(98) / (4) =	22.5601	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1825.1136	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	2372.6477	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1817.9180	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2363.2934	(310b)
Electricity used for heat distribution	47.3594	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	129.5411	(330a)
Total electricity for the above, kWh/year	129.5411	(331)
Electricity for lighting (calculated in Appendix L)	350.7375	(332)
Total delivered energy for all uses	5216.2197	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1578.6470	0.5190	819.3178	(368)
Electrical energy for heat distribution	47.3594	0.5190	24.5795	(372)
Total CO2 associated with community systems			843.8973	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			843.8973	(376)
Pumps and fans	129.5411	0.5190	67.2318	(378)
Energy for lighting	350.7375	0.5190	182.0328	(379)
Total CO2, kg/year			1093.1620	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5100	(384)

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

DER		13.5100	ZC1
Total Floor Area	TFA	80.9000	
Assumed number of occupants	N	2.4797	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2107	ZC2
CO2 emissions from cooking, equation (L16)		2.2066	ZC3
Total CO2 emissions		31.9273	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.9273	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.9000 (1b)	x	2.5000 (2b)	=	202.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.2500	(5)

---
2. Ventilation rate
---

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =							30.0000 / (5) =	0.1483	(8)
Pressure test								Yes	
Measured/design AP50								5.0000	
Infiltration rate								0.3983	(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) =	0.3087	(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													
	0.3936	0.3859	0.3782	0.3396	0.3319	0.2933	0.2933	0.2856	0.3087	0.3319	0.3473	0.3627	(22b)
Effective ac	0.5775	0.5745	0.5715	0.5577	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.2500	1.3258	21.5436			(27)
External Wall	39.7000	16.2500	23.4500	0.1800	4.2210			(29a)
Wall to CA	41.3000	2.1200	39.1800	0.1800	7.0524			(29a)
Total net area of external elements Aum(A, m2)			81.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.9370			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7965	(36)
Total fabric heat loss						(33) + (36) =	41.7335	(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	38.5412	38.3404	38.1437	37.2194	37.0465	36.2414	36.2414	36.0924	36.5515	37.0465	37.3963	37.7620	(38)
Heat transfer coeff													
	80.2746	80.0739	79.8771	78.9528	78.7799	77.9749	77.9749	77.8258	78.2850	78.7799	79.1297	79.4955	(39)
Average = Sum(39)m / 12 =												78.9520	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9923	0.9898	0.9874	0.9759	0.9738	0.9638	0.9638	0.9620	0.9677	0.9738	0.9781	0.9826	(40)
HLP (average)												0.9759	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4797	(42)
Average daily hot water use (litres/day)	93.0933	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	102.4026	98.6788	94.9551	91.2314	87.5077	83.7839	83.7839	87.5077	91.2314	94.9551	98.6788	102.4026	(44)
Energy conte	151.8601	132.8178	137.0561	119.4888	114.6523	98.9362	91.6790	105.2030	106.4594	124.0682	135.4301	147.0684	(45)
Energy content (annual)										Total = Sum(45)m =		1464.7193	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.7790	19.9227	20.5584	17.9233	17.1979	14.8404	13.7518	15.7804	15.9689	18.6102	20.3145	22.0603	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage													
	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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													
	179.4777	157.7628	164.6737	146.2156	142.2700	125.6630	119.2967	132.8206	133.1862	151.6859	162.1569	174.6860	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.4777	157.7628	164.6737	146.2156	142.2700	125.6630	119.2967	132.8206	133.1862	151.6859	162.1569	174.6860	(64)
									Total per year (kWh/year) = Sum(64)m =			1789.8952	(64)
Heat gains from water heating, kWh/month													
	72.5876	64.1179	67.6653	61.1114	60.2160	54.2777	52.5774	57.0741	56.7792	63.3468	66.4119	70.9944	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	123.9858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.8602	17.6397	14.3455	10.8605	8.1183	6.8539	7.4058	9.6264	12.9205	16.4055	19.1477	20.4122	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.3112	223.6078	217.8206	205.5004	189.9485	175.3318	165.5669	163.2704	169.0576	181.3777	196.9297	211.5464	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	35.3986	(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)													
	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	-99.1886	(71)
Water heating gains (Table 5)													
	97.5640	95.4136	90.9480	84.8770	80.9355	75.3857	70.6685	76.7125	78.8600	85.1436	92.2388	95.4225	(72)
Total internal gains													
	401.9312	399.8567	386.3098	364.4337	342.1981	320.7671	306.8371	312.8051	324.0338	346.1226	371.5120	390.5769	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.2500	11.2829	0.6300	0.7000	0.7700	56.0335	(75)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	56.0335	114.0577	205.4958	337.4831	453.6435	483.6320	452.4278	360.6807	250.3998	139.3876	70.5046	45.7598	(83)
Total gains	457.9646	513.9145	591.8056	701.9168	795.8416	804.3991	759.2649	673.4858	574.4336	485.5102	442.0166	436.3366	(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, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.9854	70.1609	70.3337	71.1571	71.3133	72.0495	72.0495	72.1875	71.7642	71.3133	70.9980	70.6714	
alpha	5.6657	5.6774	5.6889	5.7438	5.7542	5.8033	5.8033	5.8125	5.7843	5.7542	5.7332	5.7114	
util living area													
	0.9985	0.9967	0.9892	0.9484	0.8145	0.6050	0.4494	0.5252	0.8251	0.9793	0.9968	0.9989	(86)
MIT	19.9442	20.0709	20.3147	20.6527	20.8987	20.9852	20.9977	20.9948	20.9205	20.5876	20.2099	19.9227	(87)
Th 2	20.0898	20.0919	20.0939	20.1034	20.1052	20.1136	20.1136	20.1151	20.1104	20.1052	20.1016	20.0978	(88)
util rest of house													
	0.9980	0.9957	0.9853	0.9307	0.7638	0.5278	0.3602	0.4275	0.7561	0.9693	0.9955	0.9985	(89)
MIT 2	18.6710	18.8575	19.2130	19.6974	20.0099	20.1042	20.1127	20.1130	20.0467	19.6165	19.0681	18.6455	(90)
Living area fraction									fLA = Living area / (4) =			0.4405	(91)
MIT	19.2319	19.3921	19.6984	20.1183	20.4015	20.4923	20.5026	20.5015	20.4317	20.0443	19.5711	19.2082	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2319	19.3921	19.6984	20.1183	20.4015	20.4923	20.5026	20.5015	20.4317	20.0443	19.5711	19.2082	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9945	0.9832	0.9311	0.7817	0.5615	0.3996	0.4707	0.7832	0.9684	0.9945	0.9980	(94)
Useful gains	456.7484	511.0930	581.8757	653.5401	622.0975	451.6392	303.4001	316.9972	449.8712	470.1873	439.5640	435.4503	(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													
	1198.6538	1160.4357	1054.2477	885.7139	685.5003	459.4499	304.3066	319.2000	495.6754	744.0221	986.8368	1193.0819	(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													
	551.9776	436.3583	351.4448	167.1651	47.1717	0.0000	0.0000	0.0000	0.0000	203.7331	394.0364	563.6779	(98)
Space heating												2715.5650	(98)
Space heating per m2											(98) / (4) =	33.5669	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2904.3476	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	551.9776	436.3583	351.4448	167.1651	47.1717	0.0000	0.0000	0.0000	0.0000	203.7331	394.0364	563.6779	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	590.3504	466.6934	375.8768	178.7862	50.4510	0.0000	0.0000	0.0000	0.0000	217.8964	421.4293	602.8641	(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													
	179.4777	157.7628	164.6737	146.2156	142.2700	125.6630	119.2967	132.8206	133.1862	151.6859	162.1569	174.6860	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.6173	87.3885	86.7871	85.1716	82.2206	79.8000	79.8000	79.8000	79.8000	85.6015	87.0953	87.7174	(217)
Fuel for water heating, kWh/month													
	204.8427	180.5303	189.7444	171.6717	173.0345	157.4725	149.4946	166.4419	166.9000	177.2001	186.1834	199.1464	(219)
Water heating fuel used												2122.6626	(219)
Annual totals kWh/year													
Space heating fuel - main system												2904.3476	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.7375	(232)
Total delivered energy for all uses												5452.7477	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2904.3476	0.2160	627.3391	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2122.6626	0.2160	458.4951	(264)
Space and water heating			1085.8342	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.7375	0.5190	182.0328	(268)
Total CO2, kg/m2/year			1306.7920	(272)
Emissions per m2 for space and water heating			13.4219	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2501	(272b)
Emissions per m2 for pumps and fans			0.4811	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4219 * 1.55) + 2.2501 + 0.4811, rounded to 2 d.p.			23.5400	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 008 A2 - 2B4P	**Issued on Date**	15/12/2020
Assessment Reference	2B4P Be Clean	**Prop Type Ref**	Middle floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	85 B	**DER**	11.74	**TER**	19.63
Environmental	91 B	**% DER<TER**	40.18		
CO_2 Emissions (t/year)	0.74	**DFEE**	32.53	**TFEE**	31.97
General Requirements Compliance	Fail	**% DFEE<TFEE**	-1.75		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 77 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 19.63 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.74 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)32.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.5 kWh/m²/yrFail
Excess energy =0.5 kWh/m²/yr  (1.6%)

2 Fabric U-values
Element        Average                 Highest
External wall  0.18 (max. 0.30)        0.18 (max. 0.70)          OK
Party wall     0.00 (max. 0.20)         -                        OK
Floor          (no floor)
Roof           (no roof)
Openings       1.34 (max. 2.00)        1.40 (max. 3.30)          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                                 10.0                                  OK

4 Heating efficiency
Main heating system:                    Community heating scheme              -

Secondary heating system:               None

5 Cylinder insulation
Hot water storage                       Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                        OK
Primary pipework insulated:             No primary pipework

6 Controls
Space heating controls:                 Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                     No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                     0.44
Maximum                                 1.5                                   OK
MVHR efficiency:                        91%
Minimum:                                70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):            Medium                                OK
Based on:
Overshading:                            Average
Windows facing South:                   8.10 m², No overhang
Windows facing South West:              10.13 m², No overhang
Air change rate:                        2.00 ach
Blinds/curtains:                        None

10 Key features
Party wall U-value                      0.00 W/m²K
Door U-value                            0.82 W/m²K
Air permeability                        3.0 m³/m²h
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	76.8000 (1b)	x	2.5000 (2b)	=	192.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			18.2300	1.3258	24.1686			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	40.0000	18.2300	21.7700	0.1800	3.9186			(29a)
Wall to CA	12.8000	2.1200	10.6800	0.1671	1.7843			(29a)
Total net area of external elements Aum(A, m2)			52.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.6099			(33)
Party Wall 1			36.7500	0.0000	0.0000			(32)
Party Floor 1			76.8000					(32d)
Party Ceilings 1			76.8000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.0106	(36)
Total fabric heat loss (33) + (36) =	39.6205	(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	17.4755	17.2735	17.0716	16.0618	15.8598	14.8500	14.8500	14.6480	15.2539	15.8598	16.2637	16.6676	(38)
Heat transfer coeff	57.0959	56.8940	56.6920	55.6822	55.4803	54.4705	54.4705	54.2685	54.8744	55.4803	55.8842	56.2881	(39)

Average = Sum(39)m / 12 = 55.6317 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7434	0.7408	0.7382	0.7250	0.7224	0.7093	0.7093	0.7066	0.7145	0.7224	0.7277	0.7329	(40)
HLP (average)												0.7244	(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	2.3993 (42)
Average daily hot water use (litres/day)	91.1843 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3028	96.6554	93.0080	89.3606	85.7133	82.0659	82.0659	85.7133	89.3606	93.0080	96.6554	100.3028	(44)
Energy conte	148.7461	130.0943	134.2456	117.0386	112.3013	96.9075	89.7991	103.0457	104.2764	121.5241	132.6531	144.0527	(45)
Energy content (annual)										Total = Sum(45)m =		1434.6845	(45)

Distribution loss (46)m = 0.15 x (45)m

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	22.3119	19.5141	20.1368	17.5558	16.8452	14.5361	13.4699	15.4569	15.6415	18.2286	19.8980	21.6079	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage													
	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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													
	178.7438	157.1890	164.2433	146.0686	142.2990	125.9375	119.7967	133.0434	133.3064	151.5218	161.6831	174.0503	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.7438	157.1890	164.2433	146.0686	142.2990	125.9375	119.7967	133.0434	133.3064	151.5218	161.6831	174.0503	(64)
								Total per year (kWh/year) = Sum(64)m =				1787.8832	(64)
Heat gains from water heating, kWh/month													
	73.4562	64.9321	68.6348	62.1394	61.3383	55.4458	53.8563	58.2609	57.8959	64.4049	67.3312	71.8957	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9555	16.8361	13.6920	10.3657	7.7485	6.5416	7.0685	9.1878	12.3319	15.6582	18.2754	19.4823	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.6229	214.8293	209.2693	197.4328	182.4914	168.4485	159.0670	156.8607	162.4206	174.2571	189.1986	203.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	(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)													
	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)													
	98.7315	96.6252	92.2511	86.3047	82.4440	77.0080	72.3876	78.3076	80.4110	86.5658	93.5155	96.6340	(72)
Total internal gains													
	389.3000	387.2806	374.2026	353.0933	331.6740	310.9883	297.5131	303.3462	314.1537	335.4712	359.9796	378.3478	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	8.1000	46.7521	0.4000	0.7000	0.7700	73.4813	(78)
Southwest	10.1300	36.7938	0.4000	0.7000	0.7700	72.3229	(79)

Solar gains	145.8042	243.5361	321.8538	382.1090	414.4761	405.9894	393.6679	370.0578	342.6482	265.9559	173.7266	125.3880	(83)
Total gains	535.1042	630.8167	696.0564	735.2023	746.1501	716.9777	691.1811	673.4040	656.8019	601.4270	533.7062	503.7357	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.4100	93.7416	94.0756	95.7816	96.1303	97.9124	97.9124	98.2768	97.1917	96.1303	95.4355	94.7506	
alpha	7.2273	7.2494	7.2717	7.3854	7.4087	7.5275	7.5275	7.5518	7.4794	7.4087	7.3624	7.3167	
util living area	0.9932	0.9782	0.9388	0.8390	0.6770	0.4851	0.3467	0.3706	0.5725	0.8620	0.9794	0.9953	(86)
MIT	20.4426	20.6050	20.7772	20.9245	20.9856	20.9990	20.9999	20.9999	20.9965	20.9223	20.6634	20.4121	(87)
Th 2	20.3026	20.3049	20.3072	20.3188	20.3211	20.3327	20.3327	20.3350	20.3280	20.3211	20.3165	20.3118	(88)
util rest of house	0.9912	0.9723	0.9241	0.8080	0.6323	0.4351	0.2941	0.3171	0.5184	0.8279	0.9728	0.9939	(89)
MIT 2	19.5612	19.7958	20.0370	20.2377	20.3084	20.3320	20.3326	20.3349	20.3256	20.2407	19.8908	19.5245	(90)
Living area fraction										fLA = Living area / (4) =		0.4583	(91)
MIT	19.9652	20.1667	20.3763	20.5525	20.6188	20.6377	20.6385	20.6397	20.6331	20.5531	20.2449	19.9313	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9652	20.1667	20.3763	20.5525	20.6188	20.6377	20.6385	20.6397	20.6331	20.5531	20.2449	19.9313	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9710	0.9257	0.8191	0.6522	0.4580	0.3182	0.3416	0.5431	0.8402	0.9720	0.9930	(94)
Useful gains	529.7792	612.5171	644.3329	602.1931	486.6093	328.3710	219.9508	230.0369	356.7317	505.3380	518.7837	500.2009	(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	894.4200	868.5809	786.6730	648.8366	494.8177	328.8758	219.9779	230.0825	358.5002	552.2015	734.5917	885.4835	(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	271.2928	172.0749	105.9011	33.5833	6.1070	0.0000	0.0000	0.0000	0.0000	34.8664	155.3817	286.6503	(98)
Space heating												1065.8575	(98)
Space heating per m2											(98) / (4) =	13.8784	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	1065.8575	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	1385.6147	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1787.8832	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2324.2481	(310b)
Electricity used for heat distribution	37.0986	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	128.8320	(330a)
Total electricity for the above, kWh/year	128.8320	(331)
Electricity for lighting (calculated in Appendix L)	334.7598	(332)
Total delivered energy for all uses	4173.4547	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1236.6210	0.5190	641.8063	(368)
Electrical energy for heat distribution	37.0986	0.5190	19.2542	(372)
Total CO2 associated with community systems			661.0605	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			661.0605	(376)
Pumps and fans	128.8320	0.5190	66.8638	(378)
Energy for lighting	334.7598	0.5190	173.7403	(379)
Total CO2, kg/year			901.6646	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			11.7400	(384)

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

DER		11.7400	ZC1
Total Floor Area	TFA	76.8000	
Assumed number of occupants	N	2.3993	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4057	ZC2
CO2 emissions from cooking, equation (L16)		2.2993	ZC3
Total CO2 emissions		30.4450	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.4450	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.8000 (1b)	x	2.5000 (2b)	=	192.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 76.8000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.0000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1563	(8)	
Pressure test		Yes		
Measured/design AP50		5.0000		
Infiltration rate		0.4063	(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) =	0.3453	(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													
	0.4403	0.4316	0.4230	0.3798	0.3712	0.3280	0.3280	0.3194	0.3453	0.3712	0.3885	0.4057	(22b)
Effective ac	0.5969	0.5932	0.5895	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5755	0.5823	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			17.0600	1.3258	22.6174			(27)
External Wall	40.0000	17.0600	22.9400	0.1800	4.1292			(29a)
Wall to CA	12.8000	2.1200	10.6800	0.1800	1.9224			(29a)
Total net area of external elements Aum(A, m2)			52.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.7890			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5713	(36)
Total fabric heat loss						(33) + (36) =	36.3603	(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	37.8209	37.5824	37.3487	36.2508	36.0454	35.0892	35.0892	34.9122	35.4575	36.0454	36.4610	36.8954	(38)
Heat transfer coeff													
	74.1812	73.9427	73.7090	72.6112	72.4058	71.4496	71.4496	71.2725	71.8179	72.4058	72.8213	73.2557	(39)
Average = Sum(39)m / 12 =												72.6102	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9659	0.9628	0.9598	0.9455	0.9428	0.9303	0.9303	0.9280	0.9351	0.9428	0.9482	0.9539	(40)
HLP (average)												0.9454	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3993	(42)
Average daily hot water use (litres/day)												91.1843	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.3028	96.6554	93.0080	89.3606	85.7133	82.0659	82.0659	85.7133	89.3606	93.0080	96.6554	100.3028	(44)
Energy conte	148.7461	130.0943	134.2456	117.0386	112.3013	96.9075	89.7991	103.0457	104.2764	121.5241	132.6531	144.0527	(45)
Energy content (annual)										Total = Sum(45)m =		1434.6845	(45)
Distribution loss (46)m = 0.15 x (45)m	22.3119	19.5141	20.1368	17.5558	16.8452	14.5361	13.4699	15.4569	15.6415	18.2286	19.8980	21.6079	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)
Total storage loss													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	176.3638	155.0393	161.8633	143.7654	139.9190	123.6343	117.4167	130.6634	131.0032	149.1418	159.3799	171.6703	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	176.3638	155.0393	161.8633	143.7654	139.9190	123.6343	117.4167	130.6634	131.0032	149.1418	159.3799	171.6703	(64)
Total per year (kWh/year) = Sum(64)m =												1759.8604	(64)
Heat gains from water heating, kWh/month	71.5522	63.2123	66.7308	60.2968	59.4343	53.6032	51.9523	56.3568	56.0533	62.5009	65.4886	69.9916	(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	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9570	16.8374	13.6931	10.3666	7.7491	6.5421	7.0690	9.1886	12.3329	15.6594	18.2769	19.4839	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	212.6229	214.8293	209.2693	197.4328	182.4914	168.4485	159.0670	156.8607	162.4206	174.2571	189.1986	203.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	(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)	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)	96.1723	94.0660	89.6920	83.7455	79.8849	74.4489	69.8284	75.7484	77.8519	84.0066	90.9563	94.0748	(72)
Total internal gains	389.7423	387.7228	374.6445	353.5350	332.1155	311.4296	297.9545	303.7878	314.5955	335.9132	360.4219	378.7902	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	7.5800	46.7521	0.6300	0.7000	0.7700	108.3033	(78)
Southwest	9.4800	36.7938	0.6300	0.7000	0.7700	106.5995	(79)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	214.9028	358.9514	474.3852	563.1967	610.9034	598.3949	580.2339	545.4343	505.0345	391.9962	256.0580	184.8110	(83)
Total gains	604.6452	746.6741	849.0296	916.7316	943.0188	909.8245	878.1885	849.2221	819.6300	727.9094	616.4799	563.6012	(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	71.8960	72.1279	72.3566	73.4506	73.6590	74.6447	74.6447	74.8302	74.2619	73.6590	73.2387	72.8043	
alpha	5.7931	5.8085	5.8238	5.8967	5.9106	5.9763	5.9763	5.9887	5.9508	5.9106	5.8826	5.8536	
util living area	0.9919	0.9741	0.9321	0.8362	0.6832	0.4985	0.3575	0.3853	0.5923	0.8694	0.9781	0.9944	(86)
MIT	20.1914	20.4136	20.6486	20.8577	20.9630	20.9952	20.9994	20.9991	20.9871	20.8473	20.4805	20.1500	(87)
Th 2	20.1118	20.1145	20.1170	20.1290	20.1313	20.1418	20.1418	20.1437	20.1377	20.1313	20.1267	20.1220	(88)
util rest of house	0.9895	0.9669	0.9146	0.8005	0.6290	0.4335	0.2880	0.3140	0.5233	0.8315	0.9708	0.9926	(89)
MIT 2	19.0469	19.3671	19.6955	19.9774	20.0990	20.1389	20.1416	20.1434	20.1290	19.9734	19.4756	18.9946	(90)
Living area fraction									fLA = Living area / (4) =			0.4583	(91)
MIT	19.5714	19.8467	20.1323	20.3809	20.4950	20.5314	20.5348	20.5356	20.5223	20.3739	19.9362	19.5242	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5714	19.8467	20.1323	20.3809	20.4950	20.5314	20.5348	20.5356	20.5223	20.3739	19.9362	19.5242	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9876	0.9643	0.9149	0.8114	0.6522	0.4632	0.3199	0.3467	0.5545	0.8430	0.9688	0.9911	(94)
Useful gains	597.1174	719.9979	776.8029	743.8777	615.0570	421.4281	280.9266	294.4151	454.5255	613.6082	597.2456	558.5852	(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	1132.8533	1105.2035	1004.8251	833.6414	636.8083	423.7940	281.1381	294.7559	461.2375	707.6874	934.7469	1122.5833	(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	398.5875	258.8582	169.6485	64.6299	16.1830	0.0000	0.0000	0.0000	0.0000	69.9949	243.0010	419.6146	(98)
Space heating												1640.5175	(98)
Space heating per m2											(98) / (4) =	21.3609	(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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1754.5642	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	398.5875	258.8582	169.6485	64.6299	16.1830	0.0000	0.0000	0.0000	0.0000	69.9949	243.0010	419.6146	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	426.2968	276.8537	181.4422	69.1229	17.3080	0.0000	0.0000	0.0000	0.0000	74.8609	259.8941	448.7857	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	176.3638	155.0393	161.8633	143.7654	139.9190	123.6343	117.4167	130.6634	131.0032	149.1418	159.3799	171.6703	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9248	86.1719	84.9392	82.8374	80.7902	79.8000	79.8000	79.8000	79.8000	82.9319	85.9359	87.1089	(217)
Fuel for water heating, kWh/month	202.8924	179.9186	190.5638	173.5512	173.1880	154.9302	147.1388	163.7386	164.1644	179.8365	185.4636	197.0755	(219)
Water heating fuel used												2112.4615	(219)

Annual totals kWh/year		
Space heating fuel - main system	1754.5642	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	334.7862	(232)
Total delivered energy for all uses	4276.8119	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1754.5642	0.2160	378.9859	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2112.4615	0.2160	456.2917	(264)
Space and water heating			835.2776	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	334.7862	0.5190	173.7540	(268)
Total CO2, kg/m2/year			1047.9566	(272)
Emissions per m2 for space and water heating			10.8760	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2624	(272b)
Emissions per m2 for pumps and fans			0.5068	(272c)
Target Carbon Dioxide Emission Rate (TER) = (10.8760 * 1.55) + 2.2624 + 0.5068, rounded to 2 d.p.			19.6300	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

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Property Reference	03 - 009 B3 - 1B2P	**Issued on Date**	15/12/2020
Assessment Reference	1B2P Be Clean	**Prop Type Ref**	Top floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	80 C	**DER**	19.29	**TER**	34.40
Environmental	88 B	**% DER<TER**	43.92		
CO_2 Emissions (t/year)	0.79	**DFEE**	60.04	**TFEE**	71.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.08		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	**Assessor ID**	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 52 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 34.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.29 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)71.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)60.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.40 (max. 3.30)	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 10.0 OK

4 Heating efficiency
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls: No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.42
Maximum 1.5 OK
MVHR efficiency: 91%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Slight OK
Based on:
Overshading: Average
Windows facing North East: 7.98 m², No overhang
Windows facing North West: 3.00 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Door U-value 0.82 W/m²K
Air permeability 3.0 m³/m²h

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	51.6000 (1b)	x	2.5000 (2b)	=	129.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	129.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:		0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		77.3500 (23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			10.9800	1.3258	14.5568			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	42.9000	10.9800	31.9200	0.1800	5.7456			(29a)
Wall to CA	20.1000	2.1200	17.9800	0.1671	3.0039			(29a)
External Roof 1	51.6000		51.6000	0.1000	5.1600			(30)
Total net area of external elements Aum(A, m2)			114.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.2047			(33)
Party Wall 1			22.8000	0.0000	0.0000			(32)
Party Floor 1			51.6000					(32d)
Party Ceilings 1			51.6000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4892	(36)
Total fabric heat loss					(33) + (36) =		44.6939	(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	11.7413	11.6056	11.4700	10.7915	10.6558	9.9773	9.9773	9.8417	10.2487	10.6558	10.9272	11.1986	(38)
Heat transfer coeff	56.4353	56.2996	56.1639	55.4854	55.3497	54.6713	54.6713	54.5356	54.9426	55.3497	55.6211	55.8925	(39)
Average = Sum(39)m / 12 =												55.4515	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0937	1.0911	1.0884	1.0753	1.0727	1.0595	1.0595	1.0569	1.0648	1.0727	1.0779	1.0832	(40)
HLP (average)												1.0746	(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		1.7373 (42)
Average daily hot water use (litres/day)		75.4602 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.0062	79.9878	76.9694	73.9510	70.9326	67.9141	67.9141	70.9326	73.9510	76.9694	79.9878	83.0062	(44)
Energy conte	123.0958	107.6603	111.0958	96.8560	92.9357	80.1964	74.3138	85.2761	86.2946	100.5680	109.7779	119.2117	(45)
Energy content (annual)										Total = Sum(45)m =		1187.2821	(45)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	18.4644	16.1491	16.6644	14.5284	13.9404	12.0295	11.1471	12.7914	12.9442	15.0852	16.4667	17.8818	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	153.0935	134.7550	141.0935	125.8861	122.9334	109.2264	104.3115	115.2738	115.3246	130.5657	138.8079	149.2094	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	153.0935	134.7550	141.0935	125.8861	122.9334	109.2264	104.3115	115.2738	115.3246	130.5657	138.8079	149.2094	(64)
								Total per year (kWh/year) = Sum(64)m =				1540.4808	(64)
Heat gains from water heating, kWh/month	64.9275	57.4728	60.9375	55.4287	54.8993	49.8893	48.7075	52.3525	51.9170	57.4370	59.7252	63.6360	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.5218	12.0099	9.7671	7.3943	5.5274	4.6664	5.0422	6.5541	8.7969	11.1697	13.0367	13.8976	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.3882	152.9591	149.0004	140.5728	129.9344	119.9359	113.2562	111.6853	115.6440	124.0716	134.7100	144.7085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	(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)	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	(71)
Water heating gains (Table 5)	87.2681	85.5250	81.9053	76.9842	73.7893	69.2907	65.4670	70.3662	72.1069	77.2003	82.9516	85.5323	(72)
Total internal gains	301.2371	299.5531	289.7318	274.0104	258.3102	242.9521	232.8246	237.6647	245.6069	261.5007	279.7573	293.1975	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.9800	11.2829	0.4000	0.7000	0.7700	17.4709	(75)
Northwest	3.0000	11.2829	0.4000	0.7000	0.7700	6.5680	(81)

Solar gains	24.0390	48.9320	88.1600	144.7840	194.6181	207.4834	194.0965	154.7360	107.4243	59.7988	30.2473	19.6314	(83)
Total gains	325.2761	348.4851	377.8918	418.7944	452.9282	450.4355	426.9211	392.4007	353.0311	321.2995	310.0046	312.8289	(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, nil,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4946	63.6476	63.8014	64.5815	64.7399	65.5433	65.5433	65.7064	65.2195	64.7399	64.4240	64.1112	
alpha	5.2330	5.2432	5.2534	5.3054	5.3160	5.3696	5.3696	5.3804	5.3480	5.3160	5.2949	5.2741	
util living area	0.9975	0.9959	0.9904	0.9676	0.8903	0.7210	0.5519	0.6173	0.8709	0.9796	0.9952	0.9980	(86)
MIT	19.8635	19.9709	20.1899	20.5089	20.7941	20.9534	20.9908	20.9840	20.8675	20.5184	20.1431	19.8451	(87)
Th 2	20.0060	20.0081	20.0103	20.0211	20.0232	20.0340	20.0340	20.0362	20.0297	20.0232	20.0189	20.0146	(88)
util rest of house	0.9967	0.9945	0.9869	0.9550	0.8487	0.6337	0.4368	0.4989	0.8068	0.9693	0.9933	0.9973	(89)
MIT 2	18.4918	18.6500	18.9701	19.4343	19.8170	20.0025	20.0305	20.0293	19.9188	19.4551	18.9097	18.4712	(90)
Living area fraction										fLA = Living area / (4) =		0.5814	(91)
MIT	19.2893	19.4179	19.6793	20.0591	20.3851	20.5554	20.5889	20.5844	20.4704	20.0733	19.6268	19.2700	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2893	19.4179	19.6793	20.0591	20.3851	20.5554	20.5889	20.5844	20.4704	20.0733	19.6268	19.2700	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9934	0.9855	0.9556	0.8656	0.6827	0.5039	0.5679	0.8388	0.9700	0.9923	0.9966	(94)
Useful gains	323.9256	346.1848	372.3998	400.1862	392.0642	307.5056	215.1405	222.8612	296.1295	311.6545	307.6272	311.7676	(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	845.9259	817.3529	740.1992	619.1653	480.7166	325.5872	218.0757	228.1969	350.0046	524.3423	696.7554	842.2985	(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	388.3682	316.6250	273.6428	157.6650	65.9574	0.0000	0.0000	0.0000	0.0000	158.2397	280.1723	394.7150	(98)
Space heating												2035.3852	(98)
Space heating per m2											(98) / (4) =	39.4454	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	2035.3852	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	2646.0008	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1540.4808	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2002.6250	(310b)
Electricity used for heat distribution	46.4863	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5250)		
mechanical ventilation fans (SFP = 0.5250)	82.6245	(330a)
Total electricity for the above, kWh/year	82.6245	(331)
Electricity for lighting (calculated in Appendix L)	238.7986	(332)
Total delivered energy for all uses	4970.0489	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1549.5419	0.5190	804.2123	(368)
Electrical energy for heat distribution	46.4863	0.5190	24.1264	(372)
Total CO2 associated with community systems			828.3386	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			828.3386	(376)
Pumps and fans	82.6245	0.5190	42.8821	(378)
Energy for lighting	238.7986	0.5190	123.9365	(379)
Total CO2, kg/year			995.1572	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			19.2900	(384)

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

DER		19.2900	ZC1
Total Floor Area	TFA	51.6000	
Assumed number of occupants	N	1.7373	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3856	ZC2
CO2 emissions from cooking, equation (L16)		3.1142	ZC3
Total CO2 emissions		39.7898	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		39.7898	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.6000 (1b)	x	2.5000 (2b)	=	129.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 51.6000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	129.0000	(5)

---

2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(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)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1550	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4050	(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) =	0.3443	(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													
	0.4390	0.4304	0.4217	0.3787	0.3701	0.3271	0.3271	0.3185	0.3443	0.3701	0.3873	0.4045	(22b)
Effective ac	0.5963	0.5926	0.5889	0.5717	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5750	0.5818	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			10.7900	1.3258	14.3049			(27)
External Wall	42.9000	10.7900	32.1100	0.1800	5.7798			(29a)
Wall to CA	20.1000	2.1200	17.9800	0.1800	3.2364			(29a)
External Roof 1	51.6000		51.6000	0.1300	6.7080			(30)
Total net area of external elements Aum(A, m2)			114.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1491			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.3157	(36)
Total fabric heat loss					(33) + (36) =		47.4648	(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	25.3863	25.2271	25.0710	24.3377	24.2006	23.5619	23.5619	23.4437	23.8079	24.2006	24.4781	24.7682	(38)
Heat transfer coeff	72.8512	72.6919	72.5358	71.8026	71.6654	71.0268	71.0268	70.9085	71.2728	71.6654	71.9429	72.2330	(39)
Average = Sum(39)m / 12 =												71.8019	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4118	1.4088	1.4057	1.3915	1.3889	1.3765	1.3765	1.3742	1.3813	1.3889	1.3942	1.3999	(40)
HLP (average)												1.3915	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7373	(42)
Average daily hot water use (litres/day)												75.4602	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.0062	79.9878	76.9694	73.9510	70.9326	67.9141	67.9141	70.9326	73.9510	76.9694	79.9878	83.0062	(44)
Energy conte	123.0958	107.6603	111.0958	96.8560	92.9357	80.1964	74.3138	85.2761	86.2946	100.5680	109.7779	119.2117	(45)
Energy content (annual)										Total = Sum(45)m =		1187.2821	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.4644	16.1491	16.6644	14.5284	13.9404	12.0295	11.1471	12.7914	12.9442	15.0852	16.4667	17.8818	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	150.7134	132.6053	138.7135	123.5828	120.5533	106.9232	101.9314	112.8938	113.0214	128.1857	136.5047	146.8293	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	150.7134	132.6053	138.7135	123.5828	120.5533	106.9232	101.9314	112.8938	113.0214	128.1857	136.5047	146.8293	(64)
Total per year (kWh/year) = Sum(64)m =												1512.4580	(64)
Heat gains from water heating, kWh/month	63.0235	55.7531	59.0335	53.5861	52.9952	48.0467	46.8035	50.4485	50.0744	55.5330	57.8826	61.7320	(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	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	86.8635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.5375	12.0239	9.7785	7.4029	5.5338	4.6719	5.0481	6.5617	8.8071	11.1827	13.0518	13.9138	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.3882	152.9591	149.0004	140.5728	129.9344	119.9359	113.2562	111.6853	115.6440	124.0716	134.7100	144.7085	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	31.6863	(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)	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	-69.4908	(71)
Water heating gains (Table 5)	84.7090	82.9659	79.3461	74.4251	71.2302	66.7316	62.9079	67.8071	69.5478	74.6411	80.3925	82.9731	(72)
Total internal gains	301.6937	300.0079	290.1841	274.4599	258.7575	243.3984	233.2713	238.1131	246.0579	261.9545	280.2133	293.6545	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8400	11.2829	0.6300	0.7000	0.7700	27.0340	(75)
Northwest	2.9500	11.2829	0.6300	0.7000	0.7700	10.1722	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	37.2062	75.7343	136.4492	224.0888	301.2193	321.1317	300.4121	239.4920	166.2655	92.5534	46.8151	30.3845	(83)
Total gains	338.9000	375.7423	426.6333	498.5487	559.9768	564.5300	533.6834	477.6051	412.3234	354.5079	327.0284	324.0390	(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	49.1870	49.2948	49.4009	49.9054	50.0009	50.4505	50.4505	50.5346	50.2763	50.0009	49.8080	49.6080	
alpha	4.2791	4.2863	4.2934	4.3270	4.3334	4.3634	4.3634	4.3690	4.3518	4.3334	4.3205	4.3072	
util living area	0.9970	0.9948	0.9875	0.9594	0.8758	0.7165	0.5607	0.6360	0.8771	0.9786	0.9946	0.9975	(86)
MIT	19.4734	19.6155	19.9036	20.3192	20.6929	20.9125	20.9768	20.9608	20.7727	20.3051	19.8242	19.4502	(87)
Th 2	19.7543	19.7566	19.7589	19.7698	19.7719	19.7814	19.7814	19.7832	19.7777	19.7719	19.7678	19.7634	(88)
util rest of house	0.9959	0.9929	0.9828	0.9428	0.8255	0.6129	0.4176	0.4896	0.8054	0.9670	0.9923	0.9966	(89)
MIT 2	17.7484	17.9571	18.3772	18.9771	19.4749	19.7250	19.7735	19.7677	19.5921	18.9685	18.2700	17.7205	(90)
Living area fraction									fLA = Living area / (4) =			0.5814	(91)
MIT	18.7513	18.9212	19.2647	19.7574	20.1831	20.4154	20.4731	20.4613	20.2785	19.7456	19.1736	18.7261	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7513	18.9212	19.2647	19.7574	20.1831	20.4154	20.4731	20.4613	20.2785	19.7456	19.1736	18.7261	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9912	0.9803	0.9426	0.8443	0.6699	0.5012	0.5749	0.8389	0.9667	0.9908	0.9956	(94)
Useful gains	337.0971	372.4327	418.2326	469.9336	472.7832	378.1643	267.4775	274.5545	345.8856	342.7134	324.0161	322.6162	(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	1052.7940	1019.2308	925.8947	779.5880	607.9414	413.0491	275.0914	287.9831	440.3596	655.4243	868.6111	1049.2647	(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	532.4785	434.6483	377.7006	222.9512	100.5577	0.0000	0.0000	0.0000	0.0000	232.6569	392.1084	540.6264	(98)
Space heating												2833.7280	(98)
Space heating per m2										(98) / (4) =		54.9172	(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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3030.7252	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	532.4785	434.6483	377.7006	222.9512	100.5577	0.0000	0.0000	0.0000	0.0000	232.6569	392.1084	540.6264	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	569.4957	464.8645	403.9578	238.4505	107.5484	0.0000	0.0000	0.0000	0.0000	248.8309	419.3673	578.2101	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	150.7134	132.6053	138.7135	123.5828	120.5533	106.9232	101.9314	112.8938	113.0214	128.1857	136.5047	146.8293	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.9000	87.7495	87.3538	86.3699	84.3347	79.8000	79.8000	79.8000	79.8000	86.3853	87.4713	87.9804	(217)
Fuel for water heating, kWh/month	171.4602	151.1180	158.7950	143.0854	142.9464	133.9890	127.7336	141.4709	141.6308	148.3884	156.0565	166.8887	(219)
Water heating fuel used												1783.5630	(219)

Annual totals kWh/year		
Space heating fuel - main system	3030.7252	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	239.0768	(232)
Total delivered energy for all uses	5128.3649	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3030.7252	0.2160	654.6366	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.5630	0.2160	385.2496	(264)
Space and water heating			1039.8862	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.0768	0.5190	124.0808	(268)
Total CO2, kg/m2/year			1202.8921	(272)
Emissions per m2 for space and water heating			20.1528	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4047	(272b)
Emissions per m2 for pumps and fans			0.7544	(272c)
Target Carbon Dioxide Emission Rate (TER) = (20.1528 * 1.55) + 2.4047 + 0.7544, rounded to 2 d.p.			34.4000	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	03 - 010 B1 - 2B4P	Issued on Date	15/12/2020
Assessment Reference	2B4P Be Clean	Prop Type Ref	Top floor
Property	Syon Lane, Brentford, London, TW7 5QE		

SAP Rating	82 B	DER	16.18	TER	28.38
Environmental	88 B	% DER<TER	42.99		
CO_2 Emissions (t/year)	0.98	DFEE	52.44	TFEE	60.81
General Requirements Compliance	Pass	% DFEE<TFEE	13.76		

Assessor Details	Miss Eleanor Ballinger, Hodkinson Consultancy Ltd, Tel: 0203 603 1625, Eleanor@hodkinsonconsultancy.com	Assessor ID	M976-0001
Client			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 78 m²

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 (c)
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 28.38 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.18 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.4 kWh/m²/yrOK

2 Fabric U-values
Element          Average              Highest
External wall    0.17 (max. 0.30)     0.18 (max. 0.70)          OK
Party wall       0.00 (max. 0.20)     -                         OK
Floor            (no floor)
Roof             0.10 (max. 0.20)     0.10 (max. 0.35)          OK
Openings         1.33 (max. 2.00)     1.40 (max. 3.30)          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                              10.0                                  OK

4 Heating efficiency
Main heating system:                 Community heating scheme              -

Secondary heating system:            None

5 Cylinder insulation
Hot water storage                    Nominal cylinder loss: 0.22 kWh/day
Permitted by DBSCG 0.35                    OK
Primary pipework insulated:          No primary pipework

6 Controls
Space heating controls:              Charging system linked to use of community heating, programmer and at least two room statsOK

Hot water controls:                  No cylinderstat

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                              75%                                   OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power:                  0.44
Maximum                              1.5                                   OK
MVHR efficiency:                     91%
Minimum:                             70%                                   OK

9 Summertime temperature
Overheating risk (Midlands):         Slight                                OK
Based on:
Overshading:                         Average
Windows facing North East:           8.10 m², No overhang
Windows facing South East:           8.10 m², No overhang
Air change rate:                     2.00 ach
Blinds/curtains:                     None

10 Key features
Party wall U-value                   0.00 W/m²K
Roof U-value                         0.10 W/m²K
Door U-value                         0.82 W/m²K
Air permeability                     3.0 m³/m²h
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	77.6000 (1b)	x	2.5000 (2b)	=	194.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	(7b)
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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.3500	(23c)

Effective ac	0.2758	0.2726	0.2694	0.2535	0.2503	0.2344	0.2344	0.2312	0.2408	0.2503	0.2567	0.2631	(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	
Window Double-Glazed (Uw = 1.40)			16.2000	1.3258	21.4773			(27)
Door			2.1200	0.8200	1.7384			(26)
External Wall	53.4800	16.2000	37.2800	0.1800	6.7104			(29a)
Wall to CA	29.6300	2.1200	27.5100	0.1671	4.5961			(29a)
External Roof 1	77.6000		77.6000	0.1000	7.7600			(30)
Total net area of external elements Aum(A, m2)			160.7100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.2821			(33)
Party Wall 1			25.9500	0.0000	0.0000			(32)
Party Floor 1			77.6000					(32d)
Party Ceilings 1			77.6000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.5436	(36)
Total fabric heat loss					(33) + (36) =		59.8257	(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	17.6575	17.4535	17.2494	16.2291	16.0250	15.0047	15.0047	14.8006	15.4128	16.0250	16.4331	16.8413	(38)
Heat transfer coeff	77.4833	77.2792	77.0751	76.0548	75.8507	74.8304	74.8304	74.6264	75.2386	75.8507	76.2589	76.6670	(39)
Average = Sum(39)m / 12 =												76.0038	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9985	0.9959	0.9932	0.9801	0.9775	0.9643	0.9643	0.9617	0.9696	0.9775	0.9827	0.9880	(40)
HLP (average)												0.9794	(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	2.4157 (42)
Average daily hot water use (litres/day)	91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(46)
Water storage loss:													
Store volume												3.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0212	(51)
Volume factor from Table 2a												3.4200	(52)
Temperature factor from Table 2b												1.0000	(53)
Enter (49) or (54) in (55)												0.2173	(55)
Total storage loss	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(56)
If cylinder contains dedicated solar storage	6.7353	6.0835	6.7353	6.5180	6.7353	6.5180	6.7353	6.7353	6.5180	6.7353	6.5180	6.7353	(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	179.3794	157.7449	164.8170	146.5687	142.7789	126.3516	120.1805	133.4837	133.7520	152.0411	162.2499	174.6659	(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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	179.3794	157.7449	164.8170	146.5687	142.7789	126.3516	120.1805	133.4837	133.7520	152.0411	162.2499	174.6659	(64)
								Total per year (kWh/year) = Sum(64)m =				1794.0135	(64)
Heat gains from water heating, kWh/month	73.6676	65.1169	68.8256	62.3056	61.4979	55.5835	53.9839	58.4073	58.0441	64.5776	67.5196	72.1003	(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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1702	17.0268	13.8471	10.4832	7.8363	6.6157	7.1485	9.2919	12.4716	15.8356	18.4824	19.7030	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)	99.0155	96.9002	92.5075	86.5356	82.6585	77.1992	72.5590	78.5044	80.6168	86.7978	93.7773	96.9090	(72)
Total internal gains	391.7735	389.7390	376.5615	355.2929	333.7060	312.8692	299.3040	305.1685	316.0657	337.5434	362.2327	380.7420	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1000	11.2829	0.4000	0.7000	0.7700	17.7337	(75)
Southeast	8.1000	36.7938	0.4000	0.7000	0.7700	57.8297	(77)
Solar gains	75.5634	134.6029	199.8155	273.8061	330.6227	338.7609	322.2199	278.2225	225.1851	152.9834	91.5803	63.9724	(83)
Total gains	467.3369	524.3419	576.3770	629.0991	664.3287	651.6301	621.5239	583.3910	541.2508	490.5268	453.8129	444.7144	(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, nil,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.5491	69.7327	69.9174	70.8553	71.0460	72.0147	72.0147	72.2116	71.6240	71.0460	70.6657	70.2896	
alpha	5.6366	5.6488	5.6612	5.7237	5.7364	5.8010	5.8010	5.8141	5.7749	5.7364	5.7110	5.6860	
util living area	0.9979	0.9956	0.9885	0.9611	0.8759	0.6977	0.5234	0.5770	0.8341	0.9742	0.9955	0.9984	(86)
MIT	19.9700	20.1008	20.3175	20.6058	20.8456	20.9696	20.9951	20.9917	20.9153	20.6114	20.2407	19.9475	(87)
Th 2	20.0846	20.0868	20.0890	20.1000	20.1022	20.1132	20.1132	20.1154	20.1088	20.1022	20.0978	20.0934	(88)
util rest of house	0.9973	0.9941	0.9844	0.9470	0.8333	0.6160	0.4213	0.4719	0.7662	0.9620	0.9937	0.9979	(89)
MIT 2	18.7047	18.8970	19.2132	19.6315	19.9489	20.0927	20.1113	20.1118	20.0403	19.6467	19.1100	18.6784	(90)
Living area fraction										fLA = Living area / (4) =		0.4253	(91)
MIT	19.2428	19.4089	19.6828	20.0459	20.3303	20.4656	20.4871	20.4860	20.4124	20.0570	19.5909	19.2181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2428	19.4089	19.6828	20.0459	20.3303	20.4656	20.4871	20.4860	20.4124	20.0570	19.5909	19.2181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9927	0.9821	0.9459	0.8452	0.6497	0.4649	0.5169	0.7914	0.9613	0.9924	0.9972	(94)
Useful gains	465.6568	520.5047	566.0699	595.0909	561.4950	423.3921	288.9729	301.5338	428.3716	471.5279	450.3466	443.4906	(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	1157.8135	1121.2369	1016.0636	847.6956	654.6116	438.9256	290.8749	304.9224	474.9331	717.3185	952.5406	1151.3913	(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	514.9646	403.6921	334.7953	181.8754	69.2788	0.0000	0.0000	0.0000	0.0000	182.8682	361.5797	526.6781	(98)
Space heating												2575.7321	(98)
Space heating per m2											(98) / (4) =	33.1924	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303b)
Fraction of total space heat from community Heat pump	1.0000	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.3000	(306)
Space heating:		
Annual space heating requirement	2575.7321	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.30	3348.4517	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1794.0135	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.30	2332.2176	(310b)
Electricity used for heat distribution	56.8067	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5500)		
mechanical ventilation fans (SFP = 0.5500)	130.1740	(330a)
Total electricity for the above, kWh/year	130.1740	(331)
Electricity for lighting (calculated in Appendix L)	338.5518	(332)
Total delivered energy for all uses	6149.3951	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			300.0000	(367b)
Space heating from Heat pump	1893.5564	0.5190	982.7558	(368)
Electrical energy for heat distribution	56.8067	0.5190	29.4827	(372)
Total CO2 associated with community systems			1012.2385	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1012.2385	(376)
Pumps and fans	130.1740	0.5190	67.5603	(378)
Energy for lighting	338.5518	0.5190	175.7084	(379)
Total CO2, kg/year			1255.5072	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			16.1800	(384)

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

DER		16.1800	ZC1
Total Floor Area	TFA	77.6000	
Assumed number of occupants	N	2.4157	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3686	ZC2
CO2 emissions from cooking, equation (L16)		2.2806	ZC3
Total CO2 emissions		34.8292	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.8292	ZC8

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)
HODKINSON

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.6000 (1b)	x	2.5000 (2b)	=	194.0000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 77.6000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.0000	(5)

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2. Ventilation rate

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	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1546	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4046	(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) =	0.3439	(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													
	0.4385	0.4299	0.4213	0.3783	0.3697	0.3267	0.3267	0.3181	0.3439	0.3697	0.3869	0.4041	(22b)
Effective ac	0.5962	0.5924	0.5888	0.5716	0.5684	0.5534	0.5534	0.5506	0.5591	0.5684	0.5749	0.5817	(25)

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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	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			16.2000	1.3258	21.4773			(27)
External Wall	53.4800	16.2000	37.2800	0.1800	6.7104			(29a)
Wall to CA	29.6300	2.1200	27.5100	0.1800	4.9518			(29a)
External Roof 1	77.6000		77.6000	0.1300	10.0880			(30)
Total net area of external elements Aum(A, m2)			160.7100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.3475			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.4278	(36)
Total fabric heat loss					(33) + (36) =		63.7753	(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	38.1657	37.9267	37.6924	36.5919	36.3860	35.4275	35.4275	35.2500	35.7967	36.3860	36.8025	37.2380	(38)
Heat transfer coeff													
	101.9410	101.7020	101.4677	100.3672	100.1613	99.2028	99.2028	99.0253	99.5720	100.1613	100.5778	101.0133	(39)
Average = Sum(39)m / 12 =												100.3662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3137	1.3106	1.3076	1.2934	1.2907	1.2784	1.2784	1.2761	1.2831	1.2907	1.2961	1.3017	(40)
HLP (average)												1.2934	(40)
Days in month													
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4157	(42)
Average daily hot water use (litres/day)	91.5740	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313	(44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682	(45)
Energy content (annual)										Total = Sum(45)m =		1440.8149	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002	(46)
Water storage loss:													
Store volume												3.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.2602	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.1405	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(56)
If cylinder contains dedicated solar storage	4.3553	3.9338	4.3553	4.2148	4.3553	4.2148	4.3553	4.3553	4.2148	4.3553	4.2148	4.3553	(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	176.9994	155.5952	162.4369	144.2655	140.3989	124.0484	117.8004	131.1037	131.4488	149.6611	159.9467	172.2859	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	176.9994	155.5952	162.4369	144.2655	140.3989	124.0484	117.8004	131.1037	131.4488	149.6611	159.9467	172.2859	(64)
Total per year (kWh/year) = Sum(64)m =												1765.9907	(64)
Heat gains from water heating, kWh/month	71.7635	63.3972	66.9215	60.4630	59.5939	53.7409	52.0799	56.5032	56.2015	62.6736	65.6770	70.1963	(65)

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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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1702	17.0268	13.8471	10.4832	7.8363	6.6157	7.1485	9.2919	12.4716	15.8356	18.4824	19.7030	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)	96.4564	94.3410	89.9483	83.9765	80.0993	74.6401	69.9999	75.9452	78.0576	84.2387	91.2181	94.3499	(72)
Total internal gains	392.2143	390.1799	377.0023	355.7338	334.1468	313.3100	299.7448	305.6093	316.5065	337.9842	362.6735	381.1828	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1000	11.2829	0.6300	0.7000	0.7700	27.9305	(75)
Southeast	8.1000	36.7938	0.6300	0.7000	0.7700	91.0819	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	119.0124	211.9995	314.7094	431.2447	520.7308	533.5484	507.4964	438.2005	354.6665	240.9489	144.2389	100.7566	(83)
Total gains	511.2267	602.1794	691.7117	786.9784	854.8776	846.8584	807.2412	743.8098	671.1730	578.9331	506.9124	481.9394	(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, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8628	52.9871	53.1094	53.6918	53.8021	54.3220	54.3220	54.4193	54.1205	53.8021	53.5793	53.3483	
alpha	4.5242	4.5325	4.5406	4.5795	4.5868	4.6215	4.6215	4.6280	4.6080	4.5868	4.5720	4.5566	
util living area	0.9970	0.9932	0.9825	0.9470	0.8543	0.6879	0.5258	0.5862	0.8312	0.9688	0.9938	0.9977	(86)
MIT	19.5983	19.7779	20.0686	20.4466	20.7627	20.9381	20.9857	20.9769	20.8473	20.4326	19.9458	19.5677	(87)
Th 2	19.8301	19.8325	19.8349	19.8460	19.8481	19.8578	19.8578	19.8596	19.8541	19.8481	19.8439	19.8395	(88)
util rest of house	0.9959	0.9908	0.9762	0.9271	0.8015	0.5890	0.3968	0.4536	0.7512	0.9532	0.9913	0.9969	(89)
MIT 2	17.9814	18.2446	18.6669	19.2086	19.6217	19.8183	19.8529	19.8506	19.7351	19.2009	18.4983	17.9432	(90)
Living area fraction									fLA = Living area / (4) =			0.4253	(91)
MIT	18.6690	18.8967	19.2630	19.7351	20.1069	20.2945	20.3346	20.3296	20.2081	19.7247	19.1139	18.6340	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6690	18.8967	19.2630	19.7351	20.1069	20.2945	20.3346	20.3296	20.2081	19.7247	19.1139	18.6340	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9882	0.9721	0.9248	0.8147	0.6290	0.4521	0.5104	0.7790	0.9510	0.9890	0.9957	(94)
Useful gains	508.3744	595.0810	672.4280	727.7891	696.5060	532.6387	364.9352	379.6287	522.8245	550.5850	501.3227	479.8550	(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	1464.7917	1423.4883	1295.0326	1087.4849	842.0470	564.9085	370.4861	389.1303	608.1933	913.9423	1208.3294	1458.0256	(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	711.5745	556.6897	463.2179	258.9810	108.2825	0.0000	0.0000	0.0000	0.0000	270.3378	509.0449	727.7589	(98)
Space heating												3605.8870	(98)
Space heating per m2										(98) / (4) =		46.4676	(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 %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3856.5637	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	711.5745	556.6897	463.2179	258.9810	108.2825	0.0000	0.0000	0.0000	0.0000	270.3378	509.0449	727.7589	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	761.0422	595.3900	495.4202	276.9850	115.8102	0.0000	0.0000	0.0000	0.0000	289.1314	544.4330	778.3517	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	176.9994	155.5952	162.4369	144.2655	140.3989	124.0484	117.8004	131.1037	131.4488	149.6611	159.9467	172.2859	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.1457	87.9247	87.4555	86.3574	84.1312	79.8000	79.8000	79.8000	79.8000	86.3731	87.6889	88.2353	(217)
Fuel for water heating, kWh/month	200.8031	176.9642	185.7367	167.0563	166.8809	155.4491	147.6196	164.2904	164.7228	173.2727	182.4025	195.2573	(219)
Water heating fuel used												2080.4555	(219)

Annual totals kWh/year		
Space heating fuel - main system	3856.5637	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	338.5518	(232)
Total delivered energy for all uses	6350.5710	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3856.5637	0.2160	833.0178	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2080.4555	0.2160	449.3784	(264)
Space and water heating			1282.3961	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	338.5518	0.5190	175.7084	(268)
Total CO2, kg/m2/year			1497.0295	(272)
Emissions per m2 for space and water heating			16.5257	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2643	(272b)
Emissions per m2 for pumps and fans			0.5016	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5257 * 1.55) + 2.2643 + 0.5016, rounded to 2 d.p.			28.3800	(273)

Appendix J

SBEM BRUKL Worksheets – *Be Clean*

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Tesco Osterley Commercial Areas

As designed

Date: Mon Nov 23 18:16:46 2020

Administrative information

Building Details

Address: Tesco Osterley Commercial Areas, ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	42.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	42.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	28.8
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	0.26	1.4	"04 Block D Ground Floor - GP Surgery_W_8"
Floor	0.25	0.1	0.25	"01 Block B Ground Floor - Library_F_4"
Roof	0.25	0.11	0.11	"04 Block D Ground Floor - GP Surgery_R_5"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"04 Block D Ground Floor - GP Surgery_G_7"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = 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	5

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	>0.95

1- Heat Pump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.4	4.2	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* 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.					

2- Indirectly Heated by ASHP

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.4	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* 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.					

1- Project DHW

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	Hot water provided by HVAC system	0
Standard value	N/A	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**
04 Block D Ground Floor - GP Surgery	-	-	-	1.5	-	-	-	-	-	0.85	0.5
04 Block D Ground Floor - Gym and Pool	-	-	-	1.5	-	-	-	-	-	0.85	0.5
04 Block D Ground Floor - Shower and Changing Rooms	-	-	0.5	-	-	-	-	-	-	-	N/A
04 Block D Ground Floor 3 - Concierge	-	-	-	1.5	-	-	-	-	-	0.85	0.5
00 Block B Lower Ground Floor - Retail	-	-	-	1.5	-	-	-	-	-	0.85	0.5
01 Block B Ground Floor - Library	-	-	-	1.5	-	-	-	-	-	0.85	0.5
00 Block B Lower Ground Floor 3 - Cafe	-	-	-	1.5	-	-	-	-	-	0.85	0.5
00 Block B Lower Ground Floor 3 - Pub	-	-	-	1.5	-	-	-	-	-	0.85	0.5

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
00 Block B Lower Ground Floor 3 - Hall	-	-	-	1.5	-	-	-	-	-	0.85	0.5
01 Block B Ground Floor 3 - Transport Hub	-	-	-	1.5	-	-	-	-	-	0.85	0.5

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
04 Block D Ground Floor - GP Surgery	120	-	-	588
04 Block D Ground Floor - Gym and Pool	-	120	-	852
04 Block D Ground Floor - Shower and Changing Rooms	-	120	-	45
04 Block D Ground Floor 3 - Concierge	120	-	-	2437
00 Block B Lower Ground Floor - Retail	-	100	100	6449
01 Block B Ground Floor - Library	120	-	-	987
00 Block B Lower Ground Floor 3 - Cafe	-	120	100	550
00 Block B Lower Ground Floor 3 - Pub	-	120	100	683
00 Block B Lower Ground Floor 3 - Hall	-	120	-	891
01 Block B Ground Floor 3 - Transport Hub	120	-	-	826
04 Block D Ground Floor 3 - Lobby	-	120	-	46

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?
04 Block D Ground Floor - GP Surgery	NO (-55.6%)	NO
04 Block D Ground Floor - Gym and Pool	NO (-76.6%)	NO
04 Block D Ground Floor - Shower and Changing Rooms	N/A	N/A
04 Block D Ground Floor 3 - Concierge	NO (-68.3%)	NO
00 Block B Lower Ground Floor - Retail	NO (-69.4%)	NO
01 Block B Ground Floor - Library	NO (-66.1%)	NO
00 Block B Lower Ground Floor 3 - Cafe	NO (-81.3%)	NO
00 Block B Lower Ground Floor 3 - Pub	NO (-72.1%)	NO
00 Block B Lower Ground Floor 3 - Hall	NO (-81.2%)	NO
01 Block B Ground Floor 3 - Transport Hub	NO (-40.1%)	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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	3162.9	3162.9
External area [m^2]	4388.5	4388.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	1372.32	2058.34
Average U-value [W/m^{2}K]	0.31	0.47
Alpha value* [%]	15.11	15.84

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
23	**A1/A2 Retail/Financial and Professional services**
21	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
21	**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
7	**D1 Non-residential Institutions: Community/Day Centre**
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
9	**D1 Non-residential Institutions: Education**
3	**D1 Non-residential Institutions: Primary Health Care Building**
	D1 Non-residential Institutions: Crown and County Courts
15	**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	1.38	3.53
Cooling	9.8	18.1
Auxiliary	11.49	6.88
Lighting	14.81	30.8
Hot water	19.35	24.34
Equipment*	52.61	52.61
TOTAL**	**56.83**	**83.65**

* 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]	178.63	266.84
Primary energy* [kWh/m^2]	170.1	250.39
Total emissions [kg/m^2]	28.8	42.3

* 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	14.4	164.4	1.3	9.9	11.6	3.17	4.62	3.4	6.5
	Notional	30	236.9	3.4	18.3	6.9	2.43	3.6	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	149.6	9.2	13.7	0	2.1	3.03	0	3.4	0
	Notional	127.2	138.8	14.5	0	1	2.43	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

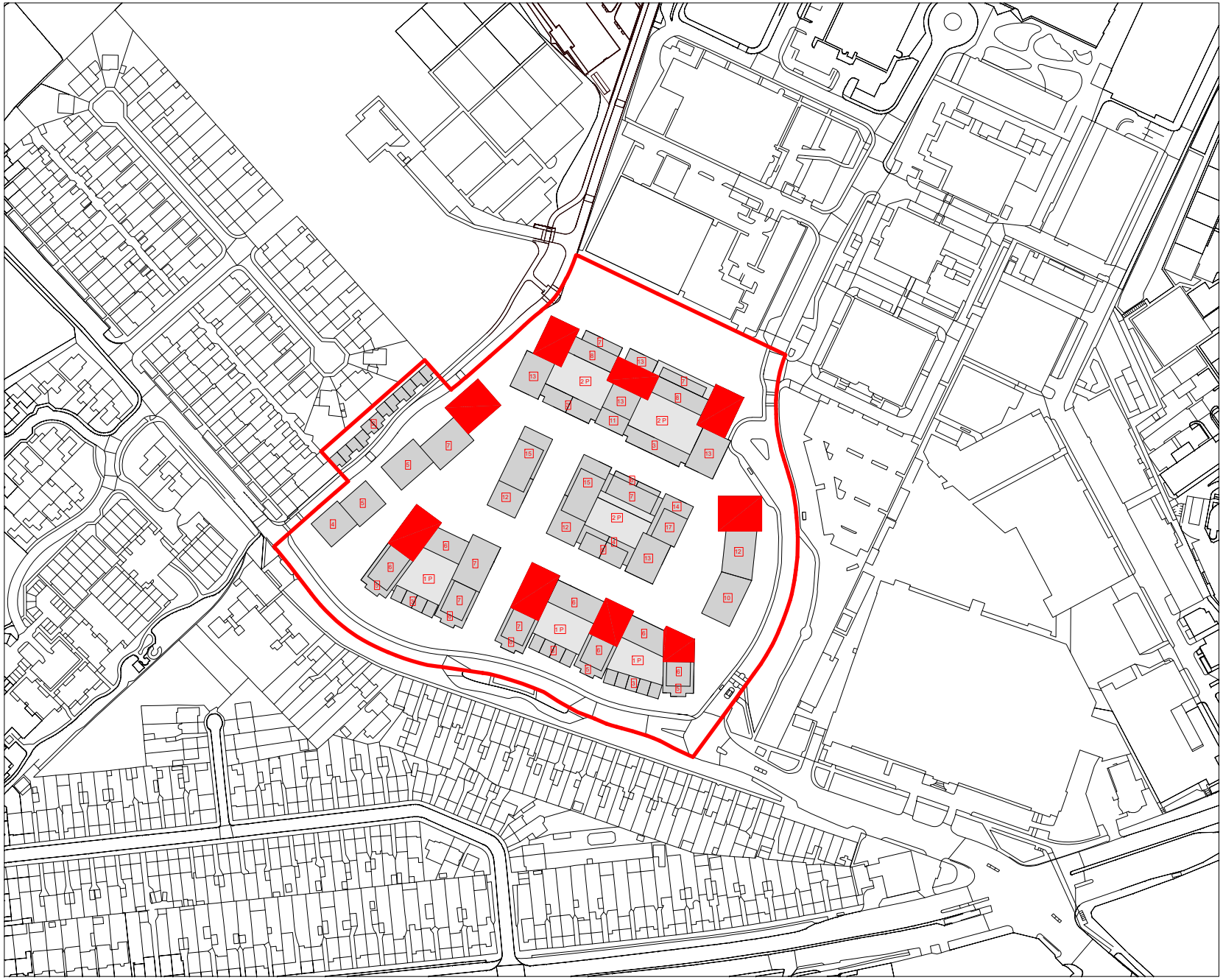
Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.19	"04 Block D Ground Floor - GP Surgery_P_15"
Floor	0.2	0.1	"00 Block B Lower Ground Floor - Retail_S_3"
Roof	0.15	0.11	"04 Block D Ground Floor - GP Surgery_R_5"
Windows, roof windows, and rooflights	1.5	1.4	"04 Block D Ground Floor - GP Surgery_G_7"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = 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	5

Appendix K
Indicative PV Locations



Notes

Do not scale from this drawing.
All contractors must visit the site and be responsible for taking and checking dimensions.
All construction information should be taken from figured dimensions only.
Any discrepancies between drawings, specifications and site conditions must be brought to the attention of the supervising officer.
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This drawing is prepared for the specific project stage in the Drawing Status section below and it is not intended to be used for any other purpose. Whilst all reasonable efforts are used to ensure drawings are accurate, JTP accept no liability for any reliance placed on, or use made of, this plan by anyone for purposes other than those stated in the Drawing Status below.

WIP Residential Areas_23.06.20

Use	GEA	GIA	NIA
Residential	141,559 m²	128,819 m²	100,479 m²
Urban House	3,303 m²	3,006 m²	2,345 m²
Grand total: 90	144,862 m²	131,825 m²	102,823 m²

Rev	Date	Description	Drawn	Chkd

Drawing Status
Outline Planning Application

Client
St Edward

jtp
JTP Studios, Unit 5
The Rum Warehouse
Pennington Street
London, E1W 2AP
+44 (0) 20 7017 1780
www.jtp.co.uk

Project
Tesco Osterley

Drawing Title
Massing - Design Freeze

Scale @A1 1 : 1000
Job Ref. 01754
Drawing No. SK-030
Revision.
Scale Bar
0 50 100 150 200 250 mm