AHIG LTD

152-156 KENTISH TOWN ROAD, LONDON, NW1 9QB

PLANNING STATEMENT ADDENDUM

JUNE 2016

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CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 This Planning Statement Addendum ("the/this Statement") has been prepared by Montagu Evans LLP as part of an application for Planning Permission ("the Application" or "Application Proposals") by AHIG Ltd ("the Applicant") for the development at 152-156 Kentish Town Road, London, NW1 9QB ("the/this Site").

1.2 The purpose of this report is to provide an updated assessment of planning matters following the proposed amendments to the planning application ("the Revised Scheme"). It will also respond to a number of matters raised by the London Borough of Camden (LBC), consultees, neighbours and other stakeholders received since the submission of the planning application.

1.3 The original application was registered by London Borough of Camden (LBC) on 24 March 2016 (ref. 2016/1372/P) for:

> *"Replacement of existing building with of a six storey mixed use building comprising retail (A1 Use Class) at ground and basement level and office space (B1 Use Class) and Dental Practice (D1 Use Class at first floor level with 9x residential units (7x2bed and 2x3bed) on upper floors."*

1.4 This report aims to assist in the consideration and determination of the application by providing an overview on the revised scheme.

1.5 The matters discussed are set out in the following sections:

- **Section 2** – Design – amendments to application drawings;
- **Section 3** – Planning – assessment of the revised scheme against the development plan and other material considerations; and
- **Section 4** – Conclusion.

2.0 DESIGN

2.1 The following section provides an overview of the Applicant's responses to comments received since the submission of the application and identifies a number of amendments to the scheme which are sought under this revision to the application.

2.2 The Applicant has carefully considered these comments and this has resulted in a number of revisions to the scheme that are illustrated on the revised plans and summarised below.

2.3 For further information, please refer to the revised Design and Access Statement, prepared by Marek Wojciechowski Architects (MWA) and their revised drawings.

Design Amendments

2.4 The following amendments to the Planning Application are sought:

- Reduction in height of the proposed building (from six storeys above ground, to four storeys);
- Reduction in the number of residential units proposed (from nine units to eight);
- Minor amendments to the internal layout of proposed residential units;
- Inclusion of photovoltaic panels at roof level;
- Amendment to the layout of cycle and waste/recycling storage facilities; and
- Revised shopfront design.

Reduction in Height

2.5 The submitted scheme received a number of objections from local residents relating to the height and scale of the building. The Revised Scheme removes the previously proposed fourth floor, which comprised the upper levels of two duplex apartments. These apartments have been consolidated into a single lateral apartment on the third floor.

Residential Accommodation

2.6 The reduction in height has resulted in the reconsolidation of the internal layouts of the proposed residential units and a reduction in the number of units. The Revised Scheme now proposes eight residential units, located on the second and third floors. This includes 5 x 2 bed (62.5%) and 3 x 3 bed units (37.5%). There are now 19 bedrooms proposed in total.

Proposed Floorspace

2.7 Table 2.1 shows the updated floorspace schedule for the application which is provided in more detail in the Design and Access Statement. The Application Form and CIL Form has also been amended and re-submitted to incorporate the changes.

2.8 The commercial floorspace at first floor level, comprising office (Class B1) and dentist (Class D1) is retained. Overall, with the removal of the top floor, there is a reduction in proposed floorspace from 2,740 sqm to 2,644 sqm (GIA).

Table 3.1 – Existing and Proposed Land Use

Land Use		GIA		GEA	
		Existing (sqm)	Proposed (sqm)	Existing (sqm)	Proposed (sqm)
A1	Retail	486	1,170	517	1,287
B1	Office	566	575	599	601
C3	Residential	0	796	0	879
D1	Dentist	98	103	108	117
Sui Generis	Betting office	164	0	183	0
	TOTAL	**1,314**	**2,644**	**1,407**	**2,884**

Cycle and Waste Storage

2.9 The Revised Scheme retains the previously proposed 51 cycle spaces which are located at ground floor level within dedicated cycle stores. This provision now exceeds the requirement for both A1 retail and C3 residential cycle storage.

2.10 On 26 May 2016, LBC highways officers commented on the Proposed Scheme, including the arrangement and type of cycle storage facilities proposed.

2.11 In response to those comments, the ground floor has been reconfigured to allow greater separation between cycle storage and waste storage, and thus improve the standard of cycle parking facilities within the scheme. Separate access is provided to the cycle storage and waste storage for B1/D1 uses with two doors opening to the side passage.

2.12 The cycle and waste storage for the A1 use has also been separated into individual rooms, and the same amendment has been made for the C3 storage. Cycle users will have level access to the street, passing the bin store, but these will be situated within separate cupboards with direct venting to the façade.

2.13 The proposed cycle facilities are 2-tier Josta racks and have been arranged in accordance with CPG7 to allow appropriate clearance in front of stands for easy loading onto the stands.

Revised Shopfronts

2.14 In response to comments received from Peter Kelly, LBC design officer on 13 May 2016, the Proposed Scheme has been amended to remain in keeping with the character of the area, whilst providing a high-quality contemporary shopfront along Kentish Town Road.

Updated Drawing Schedule

2.15 An updated Drawing Schedule has been provided showing the latest revision numbers for the proposed drawings. It should be noted that none of the 'existing' drawings have been amended.

Updated Document Schedule

2.16 An updated Document Schedule has been provided showing which planning documents have been revised following the original submission. These are discussed in further detail in **Section 3**.

3.0 DOCUMENT AMENDMENTS AND RESPONSES

3.1 The following section provides a summary of the Applicant's responses on other issues and summarises the changes made to other application documents.

3.2 The preparation of the Revised Scheme has been informed by adopted development plan policies and other relevant guidance.

3.3 It is noted that there has been no change in the development plan since the planning Application was submitted in March 2016, other than the formal adoption of Minor Alterations to the London Plan. We do not consider there to be any other material considerations which have changed since this time.

Basement Impact Assessment

3.4 The Council's independent assessors, Campbell Reith provided their BIA Audit on 16 May 2016 and raised two queries with the Proposed Scheme.

3.5 A revised Basement Impact Assessment, prepared by Parmarbrook has been submitted to address these comments. The report includes an updated Desk Study and Ground Investigation Report at Appendix E and F, prepared by GEA.

3.6 This includes confirmation of ground water level and impact on hydrogeology as requested by Campbell Reith. Section 3.0 of this report updates the responses to the screening assessment, also requested by Campbell Reith.

Energy and Sustainability

3.7 On 18 April 2016, LBC Sustainability Officers provided detailed comments on the application. A revised Energy and Sustainability Statement has been prepared by Cundall, outlining the approach to sustainability, energy efficiency and renewable energy strategies and responding to the comments made.

3.8 Table 3.1 provides a summary of the comments and the responses to each, provided by Cundall.

Table 3.1 Schedule of Responses to LBC Sustainability Comments

LBC Comments	Applicant Response
Regarding the solar PV - the developer will need to confirm that risk of overshadowing has been minimized. We would like to see drawings indicating the spacing and tilt of the system. The developer should also consider expanding the PV provision where feasible.	We have proposed approximately 50m2 of PV panels located on the roof of the building, tilted at 30 degrees to the horizontal. Due to the space take required for access and to avoid overshadowing, we recommend around 75m2 of space allocated on the roof as the efficiency of panel collector to total area required is around 65% for panels at this orientation. The drawing in the energy and sustainability report illustrates where we believe these panels could be sited, where they do not interfere with other rooftop based systems. With

The applicant should refer to p46 of CPG3 for more information on what we expect to see when solar PV is proposed.	regards to the requirements of CPG3, we have stated the orientation, array size, efficiency and installed peak power production of the array. A meter that displays energy production of the panels is usually provided as part of the turnkey package. We have updated the Energy and Sustainability strategy to reflect the increased detail for the PV array (Page 12). The revised application drawings, prepared by MWA illustrate how this array will be incorporated into the roof design.
Applicant to submit carbon efficiency of the proposed VRF Heat pump system.	We have proposed heat pumps as part of the shell and core fit out, and therefore the requirement will be written into the tenant fit out guide. For the VRF heat pumps, we have specified a minimum heating and cooling SCoP/SEER of 4.0 for the fit out team. Manufacturers quote efficiencies in excess of these values for a number of VRF models, up to 7 or 8. Therefore, there should not be any issues in specifying VRF that achieves the proposed efficiency of 4.0. Tenants should therefore not experience any problems in meeting this requirement. A representative manufacturer's data sheet indicating typical efficiency ratings is contained within Appendix 1 of this document.
Applicant to confirm if the secondary gas heating supply will be supplied through a site-wide centralized system.	The dwellings have been modelled with individual combination boilers supplying an underfloor heating network. Each dwelling will have an individual gas supply feeding each boiler. By using individual gas boilers, distribution losses around a primary network are disregarded. This note has been incorporated into the Energy and Sustainability report on page 8.
Applicant to investigate the feasibility of connecting to the future Kentish Town DEN in future, and if feasible submit details of future-proofing, e.g. plant room space allocated.	We have interrogated the London Heat Map at length and cannot find any information pertaining to the Kentish Town DEN. The London Heat Map indicates that the nearest potential heat network is the Euston Road system, which is a prohibitive distance from the proposed site. If you have any further information about this district system, please forward it on and we can include in the next revision of the document. We have attempted to contact the Camden Green team but thus far have not received any response with regards to this DEN. This commentary has been incorporated into the Energy and Sustainability report on page 11.
To submit a pre-assessment BREEAM report for the non-residential parts of the development.	Analysis of the size of the individual non-domestic elements shows that they do not meet the minimum size to be assessed under BREEAM. The BREEAM methodology has instead been used as guidance throughout the energy and sustainability statement in order to deliver a high quality development.
The applicant should clarify whether air conditioning will be proposed, as this will generally not be supported	We will recommend that the fit out teams for non-domestic elements use ASHPs rather than a conventional chiller and boiler arrangement. Domestic elements are cooled via natural ventilation. This has been clarified multiple times in the Energy and Sustainability Statement.

unless provided through ASHP.	
The applicant should consider the feasibility of implementing greywater harvesting throughout the development.	All water from residential development will be discharged via individual black water stacks, meaning that it cannot be feasibly recovered and reused with an individual unit. The non-domestic elements have a low potable water usage rate and therefore greywater recycling is not a viable method due to the minimal water consumption of these elements. It is unlikely that waste water from the dental surgery could be recycled as it may contain traces of medical liquids. Therefore, only retail and office elements could potentially make use of recycled greywater. However, their respective potable water usage rates are minimal, meaning that installing a greywater recycling system for these elements is not financially feasible. This has been captured on page 17 of the Energy and Sustainability Statement.
Could the applicant provide more information on how they have produced their energy assessment calculations, and how they will ensure that fit-out is consistent with the assumptions made in the calculations for this report (in particular the lighting), as well as explain why energy consumption has increased from the TER in certain areas. The applicant should submit the full Brukl report.	The information used to achieve the quoted improvements in CO2 emissions will form the basis of the tenant fit-out guide. This will specify minimum efficiencies of systems that can be installed that the tenant will legally have to install as part of the contract. As part of the analysis, each separate use of the development was independently assessed against the relevant NCM usage type, therefore there is not a single BRUKL that reflects the mixture of usages. Instead, an area weighted calculation has been performed using the results from each assessment. Whilst the energy consumption may be greater than the TER in certain cases, the fit out guide will stipulate that efficient systems are specified that ensure the CO2 emissions will be less than the Target Emission Rate. Each independent BRUKL for the non-domestic elements is provided to the case officer, and the SAP output calculations for the domestic elements is provided at Appendix 1 of this document.
As the sustainability measures will be secured in the S106 Sustainability Plan, further specific details and commitment to targets will be required in the Energy and Sustainability Statement, e.g. final proposals for waste and recycling provision and water efficiency.	Specific targets for water usage efficiency and waste/recycling proposals in the form of an operational waste plan will be produced as part of the fit-out guide and building user guide. In the initial stages of design, we have recommended targets for water efficiency and waste/recycling as based on the now-defunct Code for Sustainable Homes methodology, and incorporating BREEAM complaint water efficiency rates. This will detail efficiency of water fittings to inform fit out teams and set out a recycling strategy. Details of these efficiencies can be found in the respective sections in the Energy and Sustainability strategy, page 17 and 19 respectively.
The applicant should confirm how they are following the waste hierarchy of material use, as outlined in CPG3 and demonstrate how they	A new Site Waste Management Plan has been submitted, including all requirements as set out in CPG3. This has been referred to on page 19 and 20 of the Energy and Sustainability Statement.

follow CPG3 in regards to reusing materials from the demolition. The Council encourages developers to use the Demolition Protocol for Major developments over 1,000m2. Their SWMP should include a pre-demolition audit of materials. CPG3 has information on how to reuse the material on and off-site.	
The applicant should confirm how they are meeting the target for 15-20% of the total value of materials used to be derived from recycled and reused sources.	This has been outlined in the new Site Waste Management Plan.
Explain why rainwater harvesting is not proposed.	Incorporating rainwater harvesting in a mixed use development such as Kentish Town Road is not feasible for the same reason that greywater recycling is not a viable strategy. Each individual dwelling is a self-contained unit with little to no space to accommodate a rainwater collection vessel. Collecting rainwater from the roof and then distributing it to the non-domestic elements is also an overly complicated solution, as the non-domestic elements will have a low potable water consumption anyway. Therefore, the residential units are too small to have individual rainwater harvesting systems, and the non-domestic elements cannot justify the small saving in potable water that may be achievable. Rainwater harvesting could be incorporated with the office space where the water could be used, however the space required for the storage is unjustifiable. For these reasons we have not specified rainwater harvesting for this development. This has been captured on page 18 of the Energy and Sustainability Statement.
Could the applicant confirm that there are no trees or vegetation on site which is planned for removal.	Site analysis confirms that the development currently consists entirely of hard standing with no ecological value.
Could the applicant submit an ecological scoping survey, or confirm why they think one is not necessary – refer to CPG3. A scoping report will look for further opportunities to enhance biodiversity on site.	As the development has no pre-existing soft landscaping or biodiverse areas, a scoping survey is not necessary.
Could the applicant confirm whether they meet	The site's urban location and lack of any biodiverse areas means that a protected species survey is not required. These comments have been captured in

the triggers for a protected species survey.	the Energy and Sustainability Statement on page 21.
Could the applicant submit an appraisal of whether other habitat features are appropriate.	Thorough analysis of the green potential of the site has been undertaken and the area of green roof has been maximised. In addition to this, planters and terrace space have been incorporated into the design. The final outcome is a design that greatly improves on the preceding biodiversity. Images of the proposed strategy are included in the Energy and Sustainability Statement on page 21.

3.9 Overall, the Scheme continues to incorporate a range of sustainable design and construction techniques which is in accordance with the relevant planning policy, at the local and regional levels.

3.10 The area of PV panels has been optimised to use as much of the south facing roof area that is not overshadowed as possible, with all other roof space hosting either external plant or a green/brown roof, improving the local biodiversity. The proposed solution therefore meets both Policy 5.2 of the London Plan whilst also delivering a marked improvement in the amount of green space.

3.11 In addition to the above, a revised Building Services Report has been submitted for the Revised Scheme.

Site Waste Management Plan

3.12 A new Site Waste Management Plan (SWMP), prepared by Cundall is submitted in response to comments raised by sustainability officers, as detailed above.

3.13 The report sets out the importance of effective waste management, in accordance with the various policy and guidance documents produced at all tiers. The report also identifies the baseline conditions and sets out waste management issues at each of the three main stages; design, construction and operation.

3.14 It is concluded that there will be waste produced through different stages of the scheme and it will be possible to mitigate these effects through effective management.

Daylight and Sunlight

3.15 A revised Daylight and Sunlight Report (prepared by GVA) has been submitted, which considers the effect of the revised Scheme on the surrounding residential properties and open spaces, in terms of daylight, sunlight and overshadowing.

3.16 The Revised Scheme has not materially impacted on the surrounding properties. In any event, the removal of the fourth floor has improved the situation due to the lower height of the proposed building.

3.17 The result of the analysis shows that all habitable rooms and windows to neighbouring the neighbouring property at 150 Kentish Town Road will satisfy all the BRE Guidelines

for daylight and sunlight, with the exception of one window at second floor which despite a reduction in condition, will retain a very good VSC level.

3.18 Within the Proposed Scheme, all habitable rooms will continue to exceed the target values for their use in respect of daylight and sunlight.

3.19 Overall, it is therefore considered that the Proposed Scheme continues to be acceptable and would not adversely impact on the light levels or neighbouring amenity of adjacent occupiers.

Transport Assessment

3.20 A revised Transport Assessment has been prepared by Motion and submitted as part of this application, to reassess the highway and transport matters relating to the scheme.

3.21 The loss of a residential unit has marginally improved the impact on traffic and the cycle storage requirements are now exceeded. Overall, it is concluded that the development proposals will not result in detrimental harm to the operation of the local highway or public transport networks and is therefore considered to be acceptable. The development is considered to be fully in accordance with the policy at the national, regional and local level.

Other Matters

Air Quality Assessment (Air Quality Consultants)

3.22 This Assessment has not been revised.

3.23 During the determination, the Council's Sustainability Team provided comments on the Air Quality Assessment produced by Air Quality Consultants and these were responded to on 20 April 2016 as follows:

"LBC Comment: *Given that local monitoring data shows NO2 levels are quite high in the area, could the applicant confirm why their dispersion modelling levels are all below the limits (we are assuming this is because the units are set back from the road), and also confirm why dispersion modelling hasn't been undertaken on the ground and first floor levels.*

> ***Response:*** *NO2 concentrations reduce rapidly with distance away from roads; this is noticeable both with horizontal and vertical distances. The modelling indicates that NO2 concentrations will be below the annual mean objective at second-floor level due to a combination of distance from the road and height above ground. The reason no modelling was undertaken at ground and first-floor levels is because these floors will be occupied by commercial uses, which do not represent relevant exposure to the national air quality objectives. The*

approach to the dispersion modelling was discussed in detail and agreed with Adam Webber at Camden Council.

LBC Comment: *Also, the worst case results show NO2 levels are below the limit, but only just. Although they are not required to under policy unless limits are breached, it would be useful to know if they are including any mitigation measures, and if so what these are.*

Applicant Response: *The best practice air quality mitigation measures included in the scheme are listed in paragraph 7.6 of the submitted air quality assessment report. It is also notable that the majority of the proposed apartments that front on to Kentish Town Road also include an aspect to the rear of the building, allowing ventilation from the rear façade where air is cleaner. Only two flats have a single aspect to Kentish Town Road (Flat 01 on the 2nd floor and Flat 05 on the 3rd floor). Given the dispersion modelling predicts that the annual mean nitrogen dioxide objective will be met at these facades, it has not been deemed necessary to recommend any additional mitigation."*

Drainage Strategy (Cundall)

3.24 This Strategy has not been revised in this submission.

3.25 It is noted that this document did not form part of the original application submission and was submitted to the LBC on 18 April 2016 following a request from officers to provide this information, along with the SUDs Pro-forma.

Historic Environment Desk-Based Assessment (Archaeology South-East)

3.26 This Assessment has not been revised.

3.27 The conclusions of the report remain as originally assessed and have not changed as a result of the minor amendments to the scheme. The Site is considered to have low potential for remains of all date but high potential for remains dating to post-medieval period. The proposed works have the potential to impact upon any subsurface features that exist. The report concludes that it would be unlikely that there would be any setting issues arising from the development of the Site.

Environmental Noise Survey (Hann Tucker)

3.28 This Assessment has not been revised.

3.29 The report assesses that the proposed plant, if implemented with proposed mitigation measures (i.e. in-duct attenuators) would be within LB Camden's plant noise emission criteria. The Scheme itself is not considered to be a noise-generating use, which would impact on the surrounding residential uses.

Construction Management Plan (CMP)

3.30 This Assessment has not been revised.

3.31 This document was provided in draft at the application submission stage and will be progressed into a final version should planning permission be granted. As is usual in Camden, this is likely to be the requirement of clause in the Section 106 Legal Agreement.

4.0 CONCLUSIONS

4.1 Following submission of the Planning Application the Applicant has continued to engage with the London Borough of Camden and other stakeholders in order to resolve issues as they have arisen through the consultation process. This has given rise to a number of changes to the Proposed Scheme, in terms of layout and design as described in this Addendum Report.

4.2 This report has provided an updated assessment of planning matters following the proposed amendments to the planning application.

4.3 The Proposed Amendments are all considered positive responses to the issues raised by LBC's officers, independent consultants and local stakeholders / residents. As a result of the Proposed Amendments, it is considered that the Revised Scheme has been improved, particularly in terms of its height, shopfront design and internal layouts.

4.4 As a consequence of these Proposed Amendments the planning benefits that would arise from the scheme are even greater. For the avoidance of doubt these can be summarised as follows:

- Delivers sustainable development of brownfield land within London in line with the overarching approach to development outlined in the NPPF;
- Delivers a development that would contribute positively to the delivery of the vision for Camden and its strategic objectives;
- Applies a high quality design which promotes sustainability measures throughout its design, construction and lifetime of the building;
- Delivers a high quality landmark building of high quality architecture that is well-related to the surrounding context and neighbouring buildings;
- Retains an active frontage along Kentish Town Road and increases the amount of retail floorspace, while removing a betting office unit;
- Exceeds the amount of business floorspace on-site, as well as the re-provision of the community space (dentist);
- Development of eight high quality residential units is consistent with the strategic objectives of all tiers of planning policy, seeking to promote residential development within accessible locations; and
- Contributes to the sustainable travel objectives of national, regional and local planning policy by providing a car free development which promotes other means of travel such as cycling and walking.

4.5 The Proposed Amendments are therefore compliant with statutory development plan policy and other material considerations. In all other regards the conclusions drawn in the original Planning Statement remain fully justified.

4.6 For these reasons we respectfully request that officers recommend approval and that the Council resolves to grant the planning application at Planning Committee.

APPENDIX 1

ADDITIONAL SUSTAINABILITY INFORMATION PURSUANT TO TABLE 3.1

(Including Example VRF Heat Pump System, PV Panel Specifications and SAP Calculations)

Air Conditioning

Product Information

PURY-EP550YSLM-A1
Heat Recovery Outdoor Unit

Making a World of Difference

CITY MULTI

Throughout the year, many buildings require cooling in some areas and heating in others - even in adjacent rooms. The outstanding City Multi High COP R2 system meets this requirement by distributing surplus heat from cooling operations (and vice versa) to rooms where it is needed. This efficiency can result in energy savings of up to 30% over conventional systems.

Key Features

- Unique 2-pipe technology means minimal disruption, quicker installation and less connections than 3 pipe equivalents
- Designed from day 1 for seasonal efficiency
- Flat tube aluminium micro-channel heat exchanger protected with a sacrificial zinc coating - a world's first in VRF providing higher heat transfer, improved efficiency and reduced weight, size and refrigerant volume
- Energy-saving inverter driven compressor with very low start currents
- Reduced standby power by up to 50% using induction heated compressor
- By changing the system evaporating temperature, there are various options for indoor units to offer increased air off temperatures, higher SHF and improved comfort with the benefit of energy saving
- A choice of standard reverse defrost or a continued supply of heating during the defrost cycle

MITSUBISHI ELECTRIC

Air Conditioning | Heating
Ventilation | Controls

Air Conditioning

Product Information

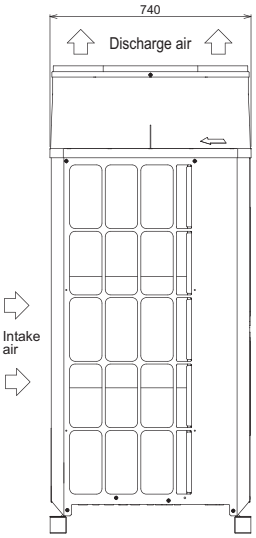
PURY-EP550YSLM-A1
Heat Recovery Outdoor Unit

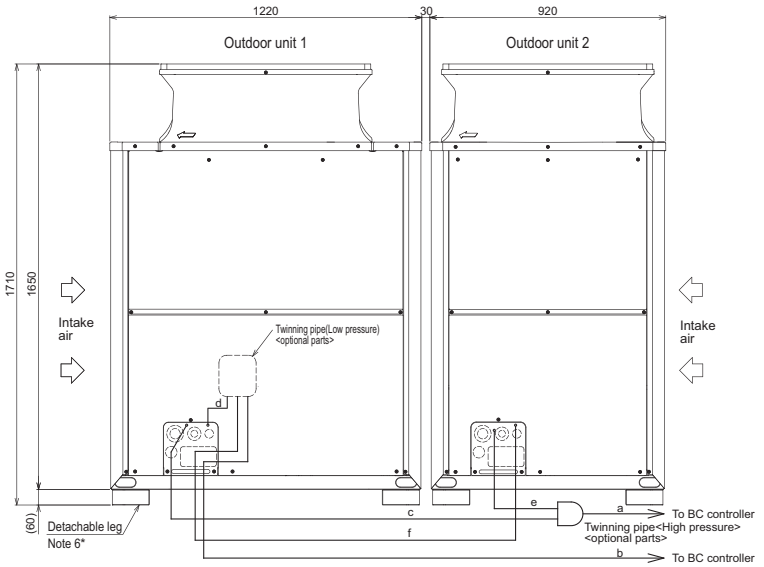
Making a World of Difference

PURY - OUTDOOR UNIT		PURY-EP550YSLM-A1
CAPACITY (kW)	Heating (nominal)	69.0
	Cooling (nominal)	63.0
	High Performance Heating (UK)	62.4
	COP Priority Heating (UK)	60.0
	Cooling (UK)	55.9
POWER INPUT (kW)	Heating (nominal)	18.44
	Cooling (nominal)	17.35
	High Performance Heating (UK)	21.05
	COP Priority Heating (UK)	16.86
	Cooling (UK)	8.49
COP / EER (nominal)		3.74 / 3.63
SCOP / SEER (system)		5.60 / 7.88
MAX No. OF CONNECTABLE INDOOR UNITS		50
MAX CONNECTABLE CAPACITY		50~150% OU Capacity
AIRFLOW (m^3/min)	High	230 / 185
PIPE SIZE mm (in)	Gas	28.58 (1-1/8")
	Liquid	28.58 (1-1/8")
SOUND PRESSURE LEVEL (dBA)		64.5
SOUND POWER LEVEL (dBA)		88
WEIGHT (kg)		244 + 202
DIMENSIONS (mm)	Width	1220 + 920
	Depth	740
(1650mm without legs)	Height	1710
ELECTRICAL SUPPLY*		380-415v, 50Hz
PHASE*		Three
STARTING CURRENT (A)*		8 / 8
NOMINAL SYSTEM RUNNING CURRENT (A)*	Heating / Cooling [MAX]	28.5 / 26.8 [23.6+19.9]
GUARANTEED OPERATING RANGE (°C)	Heating / Cooling	-20~15.5 / -5~46
FUSE RATING (MCB sizes BS EN 60947-2) - (A)*		1 x 25 / 1 x 20
MAINS CABLE No. Cores*		4

Note: * A separate power supply is required for each module. Where more than one figure is quoted there are multiple modules.

DIMENSIONS





MITSUBISHI ELECTRIC
Changes for the Better

Telephone: 01707 282880
email: air.conditioning@meuk.mee.com web: www.airconditioning.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environmental Systems Division
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England General Enquiries Telephone: 01707 282880 Fax: 01707 278881
IRELAND Mitsubishi Electric Europe Westgate Business Park, Ballymount, Dublin 24, Ireland
Telephone: Dublin (01) 419 8800 Fax: Dublin (01) 419 8890 International code: (003531)

Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning and heat pump systems contain fluorinated greenhouse gases R410A, R407C and R134a.

Green Gateway
www.greengateway.mitsubishielectric.co.uk
Mitsubishi Electric UK's commitment to the environment

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Mitsubishi Electric Living Environmental Systems UK
mitsubishielectric2

Effective as of April 2015

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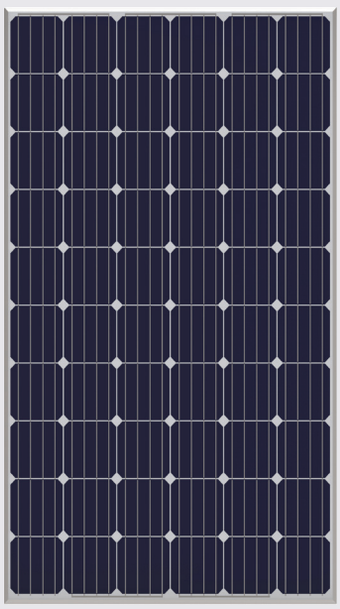
PANDA 60 CELL
SERIES 2

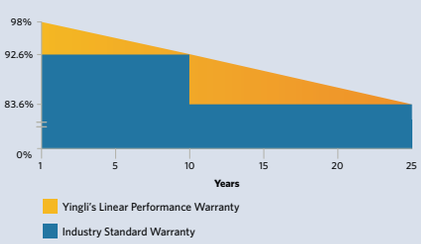


20.1%
CELL EFFICIENCY

10 YEAR
PRODUCT WARRANTY

0 - 5W
POWER TOLERANCE

25 Years Linear Warranty



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MORE ENERGY
FROM DAWN UNTIL DUSK

PV modules with our cutting-edge PANDA technology wake up earlier than regular PV modules and go to sleep later, thereby working harder to generate more energy, especially during mornings, evenings and winter months.

Low Light Behavior
PANDA technology is highly sensitive to photons (light energy), hence it continues to produce energy even at low light levels. The result is a higher yield from your system.

High Power Density
PANDA technology has a higher efficiency than other technologies, so PANDA panels make the best out of each m^2.

Durability
Durable PV modules, independently tested for harsh environmental conditions such as exposure to salt mist, ammonia and known PID risk factors.

PID Resistant
Tested in accordance to the standard IEC 62804, our PV modules have demonstrated resistance against PID (Potential Induced Degradation), which translates to security for your investment.

Yingli Green Energy
Yingli Green Energy Holding Company Limited (NYSE: YGE), known as "Yingli Solar," is one of the world's leading solar panel manufacturers with the mission to provide affordable green energy for all. Deploying more than 60 million solar panels worldwide, Yingli Solar makes solar power possible for communities everywhere by using our global manufacturing and logistics expertise to address unique local challenges.

PANDA 60 CELL SERIES 2

ELECTRICAL PERFORMANCE

Electrical parameters at Standard Test Conditions (STC)

Module type			YLxxxC-30b (xxx=P_{max})					
Power output	P_{max}	W	300	295	290	285	280	275
Power output tolerances	ΔP_{max}	W	0 / + 5					
Module efficiency	η_m	%	18.5	18.2	17.9	17.6	17.2	16.9
Voltage at P_{max}	V_{mpp}	V	32.7	32.4	32.0	31.6	31.3	30.9
Current at P_{max}	I_{mpp}	A	9.16	9.11	9.06	9.01	8.96	8.91
Open-circuit voltage	V_{oc}	V	40.1	39.9	39.6	39.4	39.1	38.8
Short-circuit current	I_{sc}	A	9.66	9.62	9.58	9.54	9.50	9.47

STC: 1000W/m² irradiance, 25°C cell temperature, AM1.5g spectrum according to EN 60904-3.
Average relative efficiency reduction of 1.9% at 200W/m² according to EN 60904-1.

Electrical parameters at Nominal Operating Cell Temperature (NOCT)

Power output	P_{max}	W	220.8	217.2	213.5	209.8	206.1	202.4
Voltage at P_{max}	V_{mpp}	V	30.3	29.9	29.6	29.2	28.9	28.5
Current at P_{max}	I_{mpp}	A	7.30	7.26	7.22	7.18	7.14	7.10
Open-circuit voltage	V_{oc}	V	37.2	37.0	36.7	36.5	36.3	36.0
Short-circuit current	I_{sc}	A	7.79	7.76	7.73	7.70	7.66	7.64

NOCT: open-circuit module operation temperature at 800W/m² irradiance, 20°C ambient temperature, 1m/s wind speed.

THERMAL CHARACTERISTICS

Nominal operating cell temperature	NOCT	°C	46 +/- 2
Temperature coefficient of P_{max}	γ	%/°C	-0.38
Temperature coefficient of V_{oc}	β_{Voc}	%/°C	-0.30
Temperature coefficient of I_{sc}	α_{Isc}	%/°C	0.04

OPERATING CONDITIONS

Max. system voltage	1000V_{DC}
Max. series fuse rating	15A
Limiting reverse current	15A
Operating temperature range	-40°C to 85°C
Max. static load, front (e.g., snow)	5400Pa
Max. static load, back (e.g., wind)	2400Pa
Max. hailstone impact (diameter / velocity)	25mm / 23m/s

CONSTRUCTION MATERIALS

Front cover (material / thickness)	low-iron tempered glass / 3.2mm
Backsheet (color)	white
Cell (quantity / material / dimensions / number of busbar)	60 / monocrystalline silicon / 156mm x 156mm / 3 or 4
Frame (material)	anodized aluminum alloy
Junction box (protection degree)	≥ IP65
Cable (length / cross-sectional area)	1000mm / 4mm²
Plug connector (type / protection degree)	MC4 / IP67 or YT08-1 / IP67 or Amphenol H4 / IP68

• Due to continuous innovation, research and product improvement, the specifications in this product information sheet are subject to change without prior notice. The specifications may deviate slightly and are not guaranteed.

• The data do not refer to a single module and they are not part of the offer, they only serve for comparison to different module types.

QUALIFICATIONS & CERTIFICATES

IEC 61215, IEC 61730, CE, MCS, ISO 9001:2008, ISO 14001:2004, BS OHSAS 18001:2007, PV Cycle, SA 8000

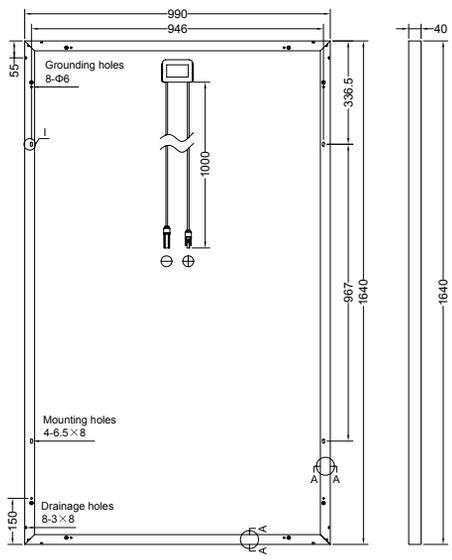
GENERAL CHARACTERISTICS

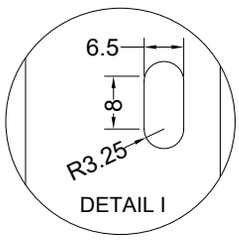
Dimensions (L / W / H)	1640mm / 990mm / 40mm
Weight	18.5kg

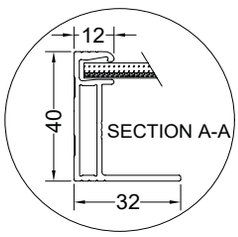
PACKAGING SPECIFICATIONS

Number of modules per pallet	26
Number of pallets per 40' container	28
Packaging box dimensions (L / W / H)	1700mm / 1160mm / 1165mm
Box weight	514kg

Unit: mm







Warning: Read the Installation and User Manual in its entirety before handling, installing, and operating Yingli Solar modules.

Yingli Partners:

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YINGLISOLAR.COM

YINGLI SOLAR
Power Your Life

Sample Report Ltd
1 Sample Street
Sampletown

Full SAP Calculation Printout

Property Reference: Flats
Survey Reference: 2 bed
Property: Kentish Town Road

Issued on Date: 05.Nov.2015
Prop Type Ref: -

SAP Rating:	83 B	**CO2 Emissions (t/year):**	1.09	**DER:**	15.48 Pass	**TER:**	16.10	**Percentage DER<TER:**	3.84 %
Environmental:	88 B	**General Requirements Compliance:**	Pass	**DFEE:**	31.88 Pass	**TFEE:**	41.74	**Percentage DFEE<TFEE:**	23.64 %

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: admin Admin, Tel: 4, Fax: s@l.f Surveyor ID: Admin
Address:
Client:

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

CALCULATION DETAILS for survey reference no '2 bed'
SAP2012 - 9.92 input data (DesignData) -

SAP2012 Input Data (Flat)	21/04/2016
FullRefNo:	2 bed
Regs Region:	England
SAP Region:	Thames Valley
Postcode:	
DwellingOrientation:	West
Property Type:	Flat, Mid-Terrace
Storeys:	1
Date Built:	2015
Sheltered Sides:	2
Sunlight Shade:	Average or unknown
Measurements	Perimeter, Floor Area, Storey Height
1st Storey:	17.7, 79.5, 3
Living Area:	30 m2, fraction: 37.7%
Thermal Mass:	Simple calculation
Thermal Mass Simple:	Medium
Thermal MassValue:	250
External Walls	Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1	32.52, 53.1, 190, CavityWallDensePlasterDenseBlock, Cavity, 0, 0.15, Calculate
Party Walls	Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1	54, 180, PartyWallDensePlaster, Solid, 0, 0
External Roofs	Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings	Area, Kappa, Construction, Element
Party Ceilings 1	78.5, 64, In-situ concrete slab supported by profiled metal deck, carpeted
Heat Loss Floors	Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors	Area, Kappa, Construction, Element
Party Floor 1	78.5, 64
Description	Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Opening Type 1	Manufacturer, Window, Triple Low-E Hard 0.2, , , 0.6, , 0.9,
door	SAP table, Solid Door, , , , , , 3.00
Openings	Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
Opening 1	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 20.58,
Conservatory:	None
Draught Proofing:	100
Draught Lobby:	Yes
Thermal Bridges	
Bridging:	User Input
Y	0.04
Description:	0.04
List of Bridges	Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
0.	External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, Yes, 9.8, 0.5, 0.5, 4.90,
1.	External wall, E2 Other lintels (including other steel lintels), , No, 0, 0, 0, 0.00,
2.	External wall, E3 Sill, Table K1 - Approved, Yes, 9.8, 0.04, 0.04, 0.39,
3.	External wall, E4 Jamb, Table K1 - Approved, Yes, 8.4, 0.05, 0.05, 0.42,
4.	External wall, E5 Ground floor (normal), , No, 0, 0, 0, 0.00,
5.	External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
6.	External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
7.	External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
8.	External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
9.	External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
10.	External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, Yes, 17.7, 0.07, 0.07, 1.24,
11.	External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 10.4, 0, 0, 0.00,
12.	External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
13.	External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 0, 0, 0.00,
14.	External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
15.	External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
16.	External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
17.	External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
18.	External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
19.	External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
20.	External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
21.	External wall, E16 Corner (normal), , No, 3, 0, 0, 0.00,
22.	External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
23.	External wall, E18 Party wall between dwellings, Table K1 - Approved, Yes, 12, 0.06, 0.06, 0.72,
24.	External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
25.	Party wall, P1 Party wall - Ground floor, , No, 0, 0, 0, 0.00,
26.	Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
27.	Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
28.	Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,
29.	Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
30.	Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
31.	Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
32.	Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
33.	External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
34.	External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
35.	External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
36.	External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,

37.	External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
38.	External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
39.	External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	3
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows fully open
Cross Ventilation	No
Night Ventilation	Yes
Air Change Rate	4.00
Approved Installation	Yes
DataType	Database
Type	Balanced mechanical ventilation with heat recovery
Database Ref Number	500167
Configuration	2
HR Duct Insulated	Yes
ManufacturerSFP	0.55
DuctType	Semi rigid
HR Efficiency	92
Wet Rooms	2
Chimneys MHS:	0
Chimneys SHS:	0
Chimneys Other:	0
Chimneys Total:	0
Open Flues MHS:	0
Open Flues SHS:	0
Open Flues Other:	0
Open Flues Total:	0
Intermittent Fans:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	None
Light Fittings:	5
LEL Fittings:	5
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	
Description	Combi Boiler
Percentage	100
MHS	Mains gas BGW Post 98 Combi condens. with auto ign.
SAP Code	104
Boiler Efficiency Type	Sedbuk 2009
Efficiency	88
Model Name	na
Manufacturer	na
Controls by PCDF	0
MHS Controls	CBI Time and temperature zone control
Boiler Interlock	Yes
Compensator	0
Delayed Start Stat	Yes
Ctrl SAP Code	2110
Burner Control	Modulating
Flue Type	None or Unknown
Fan Assisted Flue	Yes
Pumped	Pump in heated space
Heat Pump Age	2013 or later
Heat Emitter	Underfloor
Flow Temperature	Normal (> 45°C)
Under Floor Heating	Yes - Pipes in Concrete
Combi boiler type	Standard Combi
Combi keep hot type	Electric, time clock
Main Heating 2	None
Heating Systems Interaction	Both systems heat whole dwelling
Smoke Control Area	Unknown
Community Heating	None
Secondary Heating	None
Water Heating	
Type	MainHeating1
WHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	None
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 80 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
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.10 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.48 kg/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)41.7 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE)31.9 kWh/m²OK

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using user-specified y-value of 0.040

---

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
na na
Combi boiler
Efficiency: 88.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage: No cylinder

---

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---

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: 0.55
Maximum 1.5 OK
MVHR efficiency: 92%
Minimum: 70% OK

---

9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing East: 20.58 m^2, No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value 0.00 W/m^2K
Air permeability 3.0 m^3/m^2h

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	79.5000 (1b)	x	3.0000 (2b)	=	238.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	238.5000	(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 q50		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) = 78.2000 (23c)

Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(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	
Opening Type 1 (Uw = 1.40)			20.5800	1.3258	27.2841			(27)
External Wall 1	53.1000	20.5800	32.5200	0.1500	4.8780			(29a)
Total net area of external elements Aum(A, m2)			53.1000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1621			(33)
Party Wall 1			54.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 2.1240 (36)
Total fabric heat loss (33) + (36) = 34.2861 (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	21.3733	21.1225	20.8716	19.6172	19.3663	18.1120	18.1120	17.8611	18.6137	19.3663	19.8681	20.3698	(38)
Heat transfer coeff	55.6594	55.4085	55.1577	53.9033	53.6524	52.3981	52.3981	52.1472	52.8998	53.6524	54.1542	54.6559	(39)

Average = Sum(39)m / 12 = 53.8406 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7001	0.6970	0.6938	0.6780	0.6749	0.6591	0.6591	0.6559	0.6654	0.6749	0.6812	0.6875	(40)
HLP (average)												0.6772	(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 2.4533 (42)
Average daily hot water use (litres/day) 92.4660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.7126	98.0140	94.3153	90.6167	86.9180	83.2194	83.2194	86.9180	90.6167	94.3153	98.0140	101.7126	(44)
Energy conte	150.8369	131.9229	136.1326	118.6837	113.8798	98.2696	91.0613	104.4941	105.7421	123.2323	134.5176	146.0774	(45)
Energy content (annual)										Total = Sum(45)m =		1454.8504	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6255	19.7884	20.4199	17.8026	17.0820	14.7404	13.6592	15.6741	15.8613	18.4848	20.1776	21.9116	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364	(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
201.7958 177.9503 187.0915 167.9988 164.8387 147.5847 142.0202 155.4530 155.0572 174.1912 183.8327 197.0364 (64)
Total per year (kWh/year) = Sum(64)m = 2054.8504 (64)
Heat gains from water heating, kWh/month
62.8930 55.3712 58.0038 51.7911 50.6048 45.0034 43.0176 47.4840 47.4880 53.7144 57.0559 61.3105 (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	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
19.4698 17.2929 14.0636 10.6470 7.9588 6.7191 7.2603 9.4372 12.6665 16.0831 18.7713 20.0110 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
218.3924 220.6586 214.9478 202.7901 187.4432 173.0193 163.3833 161.1171 166.8279 178.9855 194.3324 208.7563 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.2665 35.2665 35.2665 35.2665 35.2665 35.2665 35.2665 35.2665 35.2665 35.2665 35.2665 35.2665 (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)
-98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 (71)
Water heating gains (Table 5)
84.5336 82.3976 77.9621 71.9321 68.0172 62.5048 57.8194 63.8226 65.9556 72.1968 79.2443 82.4066 (72)
Total internal gains
385.1954 383.1488 369.7730 348.1688 326.2188 305.0428 291.2625 297.1764 308.2496 330.0650 355.1476 373.9734 (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	
East	20.5800	19.6403	0.6000	0.9000	0.7700	151.2585	(76)

Solar gains	151.2585	295.8936	487.2947	710.6902	870.9776	891.6005	848.8400	729.1411	566.7439	351.1027	188.6015	124.3876	(83)
Total gains	536.4538	679.0424	857.0677	1058.8590	1197.1963	1196.6433	1140.1025	1026.3175	874.9935	681.1678	543.7491	498.3610	(84)

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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	99.1896	99.6387	100.0918	102.4210	102.8999	105.3633	105.3633	105.8702	104.3639	102.8999	101.9466	101.0107	
alpha	7.6126	7.6426	7.6728	7.8281	7.8600	8.0242	8.0242	8.0580	7.9576	7.8600	7.7964	7.7340	
util living area	0.9935	0.9672	0.8519	0.6106	0.4165	0.2802	0.2022	0.2337	0.4169	0.7819	0.9767	0.9959	(86)
MIT	20.7650	20.8172	20.8710	20.8937	20.8958	20.8980	20.8980	20.8985	20.8971	20.8877	20.8235	20.7582	(87)
Th 2	20.3407	20.3435	20.3463	20.3603	20.3631	20.3771	20.3771	20.3799	20.3715	20.3631	20.3575	20.3519	(88)
util rest of house	0.9916	0.9592	0.8277	0.5798	0.3881	0.2530	0.1736	0.2022	0.3791	0.7440	0.9696	0.9947	(89)
MIT 2	20.0134	20.0904	20.1646	20.2054	20.2106	20.2278	20.2278	20.2312	20.2209	20.2026	20.1136	20.0142	(90)
Living area fraction									fLA = Living area / (4) =			0.3774	(91)
MIT	20.2970	20.3647	20.4311	20.4651	20.4692	20.4807	20.4807	20.4830	20.4761	20.4611	20.3815	20.2949	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.1470	20.2147	20.2811	20.3151	20.3192	20.3307	20.3307	20.3330	20.3261	20.3111	20.2315	20.1449	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9574	0.8252	0.5776	0.3861	0.2509	0.1715	0.1998	0.3763	0.7408	0.9679	0.9943	(94)
Useful gains	531.6159	650.1274	707.2184	611.6029	462.2778	300.2738	195.4811	205.0940	329.2709	504.5946	526.3095	495.5082	(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	882.0347	848.5653	760.1346	615.3132	462.4385	300.2772	195.4812	205.0944	329.3572	521.0256	711.1249	871.4847	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	260.7116	133.3503	39.3697	2.6714	0.1196	0.0000	0.0000	0.0000	0.0000	12.2247	133.0671	279.7265	(98)
Space heating												861.2408	(98)
Space heating per m2											(98) / (4) =	10.8332	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 88.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 968.7748 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	260.7116	133.3503	39.3697	2.6714	0.1196	0.0000	0.0000	0.0000	0.0000	12.2247	133.0671	279.7265	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	293.2638	150.0003	44.2853	3.0050	0.1345	0.0000	0.0000	0.0000	0.0000	13.7511	149.6817	314.6530	(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

201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364 (64)

Efficiency of water heater												78.8000 (216)
(217)m	84.1918	82.8311	80.3877	78.9404	78.8065	78.8000	78.8000	78.8000	78.8000	79.3915	82.7475	84.4278 (217)

Fuel for water heating, kWh/month

179.1587	159.2673	169.3450	150.3460	144.5057	124.7077	115.5600	132.6068	134.1905	155.2210	162.5640	173.0206 (219)

Water heating fuel used	1800.4931 (219)
Annual totals kWh/year	
Space heating fuel - main system	968.7748 (211)
Space heating fuel - secondary	0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)

mechanical ventilation fans (SFP = 0.6875)	200.0419 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	875.0419 (231)
Electricity for lighting (calculated in Appendix L)	343.8434 (232)
Total delivered energy for all uses	3988.1532 (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	968.7748	0.2160	209.2554	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.4931	0.2160	388.9065	(264)
Space and water heating			598.1619	(265)
Pumps and fans	875.0419	0.5190	454.1467	(267)
Energy for lighting	343.8434	0.5190	178.4547	(268)
Total CO2, kg/year			1230.7633	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4800	(273)

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

DER		15.4800	ZC1
Total Floor Area	TFA	79.5000	
Assumed number of occupants	N	2.4533	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2786	ZC2
CO2 emissions from cooking, equation (L16)		2.2375	ZC3
Total CO2 emissions		33.9961	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		33.9961	ZC8

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	79.5000 (1b)	x	3.0000 (2b)	=	238.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	238.5000	(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) =	0.1258	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3758	(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) =	0.3194	(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	0.4073	0.3993	0.3913	0.3514	0.3434	0.3034	0.3034	0.2955	0.3194	0.3434	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5766	0.5617	0.5590	0.5460	0.5460	0.5436	0.5510	0.5590	0.5646	0.5704	(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 Opening Type (Uw = 1.40)			19.8800	1.3258	26.3561			(27)
External Wall 1	53.1000	19.8800	33.2200	0.1800	5.9796			(29a)
Total net area of external elements Aum(A, m2)			53.1000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3357			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6290	(36)
Total fabric heat loss					(33) + (36) =		35.9647	(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	45.8795	45.6260	45.3776	44.2107	43.9924	42.9761	42.9761	42.7879	43.3676	43.9924	44.4341	44.8958	(38)
Heat transfer coeff	81.8441	81.5907	81.3423	80.1754	79.9571	78.9407	78.9407	78.7525	79.3322	79.9571	80.3987	80.8604	(39)
Average = Sum(39)m / 12 =												80.1743	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0295	1.0263	1.0232	1.0085	1.0057	0.9930	0.9930	0.9906	0.9979	1.0057	1.0113	1.0171	(40)
HLP (average)												1.0085	(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												2.4533	(42)
Average daily hot water use (litres/day)												92.4660	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.7126	98.0140	94.3153	90.6167	86.9180	83.2194	83.2194	86.9180	90.6167	94.3153	98.0140	101.7126	(44)
Energy conte	150.8369	131.9229	136.1326	118.6837	113.8798	98.2696	91.0613	104.4941	105.7421	123.2323	134.5176	146.0774	(45)
Energy content (annual)										Total = Sum(45)m =		1454.8504	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6255	19.7884	20.4199	17.8026	17.0820	14.7404	13.6592	15.6741	15.8613	18.4848	20.1776	21.9116	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.1133	48.0621	44.6877	44.2925	41.0397	42.4077	44.2925	44.6877	48.0621	48.3357	50.9589	(61)
Total heat required for water heating calculated for each month	201.7958	177.0362	184.1947	163.3714	158.1723	139.3093	133.4690	148.7866	150.4298	171.2943	182.8533	197.0364	(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	201.7958	177.0362	184.1947	163.3714	158.1723	139.3093	133.4690	148.7866	150.4298	171.2943	182.8533	197.0364	(64)
									Total per year (kWh/year) = Sum(64)m =			2007.7490	(64)
Heat gains from water heating, kWh/month	62.8930	55.1427	57.2796	50.6342	48.9382	42.9346	40.8798	45.8174	46.3312	52.9902	56.8110	61.3105	(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	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4698	17.2929	14.0636	10.6470	7.9588	6.7191	7.2603	9.4372	12.6665	16.0831	18.7713	20.0110	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	218.3924	220.6586	214.9478	202.7901	187.4432	173.0193	163.3833	161.1171	166.8279	178.9855	194.3324	208.7563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	(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)													
	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	(71)
Water heating gains (Table 5)													
	84.5336	82.0576	76.9887	70.3253	65.7771	59.6314	54.9460	61.5826	64.3489	71.2234	78.9042	82.4066	(72)
Total internal gains													
	385.1954	382.8087	368.7996	346.5621	323.9787	302.1694	288.3891	294.9364	306.6429	329.0916	354.8075	373.9734	(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	
East	19.8800	19.6403	0.6300	0.7000	0.7700	119.3261	(76)
Solar gains	119.3261	233.4272	384.4214	560.6556	687.1045	703.3737	669.6405	575.2113	447.0979	276.9810	148.7856	98.1280	(83)
Total gains	504.5215	616.2359	753.2210	907.2177	1011.0832	1005.5432	958.0296	870.1476	753.7408	606.0727	503.5932	472.1014	(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	67.4555	67.6650	67.8717	68.8595	69.0475	69.9364	69.9364	70.1036	69.5913	69.0475	68.6682	68.2761	
alpha	5.4970	5.5110	5.5248	5.5906	5.6032	5.6624	5.6624	5.6736	5.6394	5.6032	5.5779	5.5517	
util living area													
	0.9974	0.9917	0.9679	0.8752	0.6954	0.4973	0.3618	0.4146	0.6891	0.9474	0.9935	0.9982	(86)
MIT	19.9569	20.1510	20.4554	20.7864	20.9509	20.9937	20.9991	20.9982	20.9660	20.6878	20.2520	19.9259	(87)
Th 2	20.0588	20.0615	20.0641	20.0763	20.0785	20.0892	20.0892	20.0912	20.0851	20.0785	20.0739	20.0691	(88)
util rest of house													
	0.9965	0.9891	0.9580	0.8430	0.6387	0.4288	0.2873	0.3336	0.6119	0.9258	0.9910	0.9975	(89)
MIT 2	18.6666	18.9507	19.3880	19.8431	20.0357	20.0854	20.0889	20.0905	20.0609	19.7289	19.1083	18.6289	(90)
Living area fraction									fLA = Living area / (4) =			0.3774	(91)
MIT	19.1535	19.4037	19.7907	20.1991	20.3811	20.4282	20.4324	20.4330	20.4024	20.0907	19.5398	19.1183	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1535	19.4037	19.7907	20.1991	20.3811	20.4282	20.4324	20.4330	20.4024	20.0907	19.5398	19.1183	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9867	0.9545	0.8477	0.6580	0.4546	0.3155	0.3642	0.6397	0.9261	0.9891	0.9967	(94)
Useful gains	502.1667	608.0153	718.9551	769.0076	665.2593	457.0844	302.2283	316.9475	482.1910	561.3016	498.0895	470.5259	(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													
	1215.6697	1183.3631	1081.0995	905.9057	694.1113	460.0822	302.5314	317.6111	499.9849	758.8506	1000.1476	1206.3014	(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													
	530.8462	386.6337	269.4354	98.5666	21.4659	0.0000	0.0000	0.0000	0.0000	146.9764	361.4818	547.4170	(98)
Space heating												2362.8231	(98)
Space heating per m2											(98) / (4) =	29.7210	(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 %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2529.7892	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	530.8462	386.6337	269.4354	98.5666	21.4659	0.0000	0.0000	0.0000	0.0000	146.9764	361.4818	547.4170	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	568.3579	413.9547	288.4747	105.5317	22.9828	0.0000	0.0000	0.0000	0.0000	157.3623	387.0254	586.0995	(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													
	201.7958	177.0362	184.1947	163.3714	158.1723	139.3093	133.4690	148.7866	150.4298	171.2943	182.8533	197.0364	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3731	86.9645	86.0074	83.8241	81.3866	80.3000	80.3000	80.3000	80.3000	84.6684	86.7353	87.4875	(217)
Fuel for water heating, kWh/month													

	230.9588	203.5728	214.1613	194.8978	194.3470	173.4861	166.2129	185.2884	187.3348	202.3119	210.8176	225.2165 (219)
Water heating fuel used												2388.6058 (219)
Annual totals kWh/year												
Space heating fuel - main system												2529.7892 (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)												343.8434 (232)
Total delivered energy for all uses												5337.2384 (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	2529.7892	0.2160	546.4345 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2388.6058	0.2160	515.9389 (264)
Space and water heating			1062.3733 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	343.8434	0.5190	178.4547 (268)
Total CO2, kg/m2/year			1279.7531 (272)
Emissions per m2 for space and water heating			13.3632 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2447 (272b)
Emissions per m2 for pumps and fans			0.4896 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.3632 * 1.00) + 2.2447 + 0.4896, rounded to 2 d.p.			16.1000 (273)

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.5000 (1b)	x	3.0000 (2b)	=	238.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	238.5000	(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) =	0.1258 (8)
Pressure test		Yes
Measured/design q50		3.0000
Infiltration rate		0.2758 (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) =	0.2344 (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	0.2989	0.2930	0.2872	0.2579	0.2520	0.2227	0.2227	0.2168	0.2344	0.2520	0.2637	0.2754	(22b)
Effective ac	0.5447	0.5429	0.5412	0.5332	0.5318	0.5248	0.5248	0.5235	0.5275	0.5318	0.5348	0.5379	(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	
Opening Type 1 (Uw = 1.40)			20.5800	1.3258	27.2841			(27)
External Wall 1	53.1000	20.5800	32.5200	0.1500	4.8780			(29a)
Total net area of external elements Aum(A, m2)			53.1000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1621			(33)
Party Wall 1			54.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area)		2.1240 (36)
Total fabric heat loss	(33) + (36) =	34.2861 (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	42.8679	42.7314	42.5976	41.9691	41.8515	41.3042	41.3042	41.2028	41.5150	41.8515	42.0894	42.3381	(38)
Heat transfer coeff	77.1540	77.0175	76.8837	76.2552	76.1376	75.5902	75.5902	75.4889	75.8011	76.1376	76.3755	76.6242	(39)
Average = Sum(39)m / 12 =												76.2546	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9705	0.9688	0.9671	0.9592	0.9577	0.9508	0.9508	0.9495	0.9535	0.9577	0.9607	0.9638	(40)
HLP (average)												0.9592	(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	2.4533 (42)
Average daily hot water use (litres/day)	92.4660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.7126	98.0140	94.3153	90.6167	86.9180	83.2194	83.2194	86.9180	90.6167	94.3153	98.0140	101.7126	(44)
Energy conte	150.8369	131.9229	136.1326	118.6837	113.8798	98.2696	91.0613	104.4941	105.7421	123.2323	134.5176	146.0774	(45)
Energy content (annual)										Total = Sum(45)m =		1454.8504	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.0528	28.0336	28.9282	25.2203	24.1995	20.8823	19.3505	22.2050	22.4702	26.1869	28.5850	31.0415	(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	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	(66)

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

	19.4698	17.2929	14.0636	10.6470	7.9588	6.7191	7.2603	9.4372	12.6665	16.0831	18.7713	20.0110	(67)

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

	218.3924	220.6586	214.9478	202.7901	187.4432	173.0193	163.3833	161.1171	166.8279	178.9855	194.3324	208.7563	(68)

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

	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	(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)

	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	(71)

Water heating gains (Table 5)

	43.0818	41.7167	38.8820	35.0282	32.5262	29.0032	26.0088	29.8454	31.2086	35.1974	39.7014	41.7224	(72)

Total internal gains

	340.7436	339.4678	327.6929	308.2649	287.7278	268.5412	256.4519	260.1992	270.5026	290.0656	312.6047	330.2893	(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	
East	20.5800	19.6403	0.6000	0.9000	0.7700	151.2585	(76)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	151.2585	295.8936	487.2947	710.6902	870.9776	891.6005	848.8400	729.1411	566.7439	351.1027	188.6015	124.3876	(83)
Total gains	492.0020	635.3614	814.9876	1018.9551	1158.7053	1160.1418	1105.2919	989.3403	837.2465	641.1683	501.2062	454.6769	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.5560	71.6829	71.8076	72.3994	72.5112	73.0363	73.0363	73.1344	72.8332	72.5112	72.2854	72.0508	
alpha	5.7704	5.7789	5.7872	5.8266	5.8341	5.8691	5.8691	5.8756	5.8555	5.8341	5.8190	5.8034	
util living area	0.9976	0.9897	0.9502	0.8080	0.5972	0.4156	0.3007	0.3505	0.6092	0.9273	0.9933	0.9985	(86)
MIT	20.0259	20.2533	20.5840	20.8784	20.9803	20.9980	20.9998	20.9994	20.9841	20.7585	20.3102	19.9810	(87)
Th 2	20.1080	20.1094	20.1108	20.1175	20.1187	20.1245	20.1245	20.1256	20.1223	20.1187	20.1162	20.1136	(88)
util rest of house	0.9968	0.9864	0.9363	0.7697	0.5452	0.3594	0.2410	0.2841	0.5380	0.9005	0.9907	0.9980	(89)
MIT 2	19.2174	19.4441	19.7645	20.0305	20.1074	20.1237	20.1245	20.1254	20.1149	19.9383	19.5074	19.1774	(90)
Living area fraction									fLA = Living area / (4) =			0.3774	(91)
MIT	19.5225	19.7495	20.0737	20.3505	20.4368	20.4536	20.4548	20.4552	20.4429	20.2478	19.8104	19.4806	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5225	19.7495	20.0737	20.3505	20.4368	20.4536	20.4548	20.4552	20.4429	20.2478	19.8104	19.4806	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9848	0.9356	0.7804	0.5643	0.3806	0.2635	0.3092	0.5645	0.9050	0.9896	0.9975	(94)
Useful gains	490.1101	625.7280	762.5033	795.1717	653.8229	441.5187	291.2964	305.9107	472.6618	580.2371	495.9728	453.5264	(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	1174.4771	1143.6675	1043.5992	873.1584	665.2001	442.4758	291.3821	306.1255	480.7967	734.5620	970.7595	1170.8673	(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	509.1691	348.0553	209.1353	56.1504	8.4646	0.0000	0.0000	0.0000	0.0000	114.8177	341.8464	533.7016	(98)
Space heating												2121.3404	(98)
Space heating per m2											(98) / (4) =	26.6835	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	710.5483	559.3678	573.7155	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9921	0.9970	0.9943	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	704.9489	557.7128	570.4695	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1447.4086	1381.4050	1247.3936	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	534.5710	612.8270	503.6315	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1651.0295	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	133.6427	153.2068	125.9079	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												412.7574	(107)
Space cooling per m2												5.1919	(108)
Energy for space heating												26.6835	(99)
Energy for space cooling												5.1919	(108)
Total												31.8754	(109)
Dwelling Fabric Energy Efficiency (DFEE)												31.9	(109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.5000 (1b)	x	3.0000 (2b)	=	238.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	238.5000	(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) =	0.1258	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3758	(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) =	0.3194	(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	0.4073	0.3993	0.3913	0.3514	0.3434	0.3034	0.3034	0.2955	0.3194	0.3434	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5766	0.5617	0.5590	0.5460	0.5460	0.5436	0.5510	0.5590	0.5646	0.5704	(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 Opening Type (Uw = 1.40)			19.8800	1.3258	26.3561			(27)
External Wall 1	53.1000	19.8800	33.2200	0.1800	5.9796			(29a)
Total net area of external elements Aum(A, m2)			53.1000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3357			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.6290	(36)
Total fabric heat loss					(33) + (36) =		35.9647	(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	45.8795	45.6260	45.3776	44.2107	43.9924	42.9761	42.9761	42.7879	43.3676	43.9924	44.4341	44.8958	(38)
Heat transfer coeff	81.8441	81.5907	81.3423	80.1754	79.9571	78.9407	78.9407	78.7525	79.3322	79.9571	80.3987	80.8604	(39)
Average = Sum(39)m / 12 =												80.1743	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0295	1.0263	1.0232	1.0085	1.0057	0.9930	0.9930	0.9906	0.9979	1.0057	1.0113	1.0171	(40)
HLP (average)												1.0085	(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		2.4533 (42)
Average daily hot water use (litres/day)		92.4660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.7126	98.0140	94.3153	90.6167	86.9180	83.2194	83.2194	86.9180	90.6167	94.3153	98.0140	101.7126	(44)
Energy conte	150.8369	131.9229	136.1326	118.6837	113.8798	98.2696	91.0613	104.4941	105.7421	123.2323	134.5176	146.0774	(45)
Energy content (annual)										Total = Sum(45)m =		1454.8504	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.0528	28.0336	28.9282	25.2203	24.1995	20.8823	19.3505	22.2050	22.4702	26.1869	28.5850	31.0415	(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	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	122.6653	(66)

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

19.4698	17.2929	14.0636	10.6470	7.9588	6.7191	7.2603	9.4372	12.6665	16.0831	18.7713	20.0110 (67)

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

218.3924	220.6586	214.9478	202.7901	187.4432	173.0193	163.3833	161.1171	166.8279	178.9855	194.3324	208.7563 (68)

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

35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665	35.2665 (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)

-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322 (71)

Water heating gains (Table 5)

43.0818	41.7167	38.8820	35.0282	32.5262	29.0032	26.0088	29.8454	31.2086	35.1974	39.7014	41.7224 (72)

Total internal gains

340.7436	339.4678	327.6929	308.2649	287.7278	268.5412	256.4519	260.1992	270.5026	290.0656	312.6047	330.2893 (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
East	19.8800	19.6403	0.6300	0.7000	0.7700	119.3261 (76)

Solar gains	119.3261	233.4272	384.4214	560.6556	687.1045	703.3737	669.6405	575.2113	447.0979	276.9810	148.7856	98.1280 (83)
Total gains	460.0697	572.8950	712.1142	868.9205	974.8323	971.9150	926.0924	835.4105	717.6006	567.0466	461.3904	428.4173 (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	67.4555	67.6650	67.8717	68.8595	69.0475	69.9364	69.9364	70.1036	69.5913	69.0475	68.6682	68.2761
alpha	5.4970	5.5110	5.5248	5.5906	5.6032	5.6624	5.6624	5.6736	5.6394	5.6032	5.5779	5.5517
util living area	0.9983	0.9942	0.9747	0.8908	0.7151	0.5136	0.3741	0.4315	0.7157	0.9595	0.9958	0.9989 (86)
MIT	19.9039	20.1007	20.4130	20.7623	20.9436	20.9926	20.9990	20.9978	20.9589	20.6513	20.2024	19.8735 (87)
Th 2	20.0588	20.0615	20.0641	20.0763	20.0785	20.0892	20.0892	20.0912	20.0851	20.0785	20.0739	20.0691 (88)
util rest of house	0.9978	0.9922	0.9665	0.8610	0.6585	0.4433	0.2972	0.3474	0.6384	0.9419	0.9941	0.9985 (89)
MIT 2	19.0554	19.2534	19.5621	19.8969	20.0446	20.0862	20.0890	20.0906	20.0648	19.8070	19.3656	19.0335 (90)
Living area fraction									fLA = Living area / (4) =			0.3774 (91)
MIT	19.3756	19.5732	19.8832	20.2235	20.3839	20.4282	20.4324	20.4329	20.4022	20.1256	19.6814	19.3505 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3756	19.5732	19.8832	20.2235	20.3839	20.4282	20.4324	20.4329	20.4022	20.1256	19.6814	19.3505 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9972	0.9909	0.9646	0.8662	0.6780	0.4697	0.3263	0.3792	0.6664	0.9430	0.9931	0.9981 (94)
Useful gains	458.7940	567.7084	686.9258	752.6805	660.9369	456.5519	302.1679	316.7882	478.2370	534.6990	458.2244	427.6003 (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	1233.8505	1197.1948	1088.6226	907.8622	694.3367	460.0855	302.5292	317.6045	499.9668	761.6403	1011.5278	1225.0742 (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	576.6421	423.0149	298.8624	111.7308	24.8495	0.0000	0.0000	0.0000	0.0000	168.8443	398.3784	593.3206 (98)
Space heating												2595.6429 (98)
Space heating per m2											(98) / (4) =	32.6496 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	742.0430	584.1615	598.5193	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9763	0.9902	0.9832	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	724.4475	578.4220	588.4399	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1227.4032	1171.9510	1067.4757	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	362.1281	441.5856	356.4026	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1160.1163 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	90.5320	110.3964	89.1006	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												290.0291 (107)
Space cooling per m2												3.6482 (108)
Energy for space heating												32.6496 (99)
Energy for space cooling												3.6482 (108)
Total												36.2978 (109)
Target Fabric Energy Efficiency (TFEE)												41.7 (109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.5000 (1b)	x	3.0000 (2b)	=	238.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	238.5000	(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 q50		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	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211	(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) = 78.2000 (23c)

Effective ac	0.2429	0.2365	0.2365	0.2269	0.2269	0.2142	0.2174	0.2110	0.2142	0.2206	0.2206	0.2301	(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	
Opening Type 1 (Uw = 1.40)			20.5800	1.3258	27.2841			(27)
External Wall 1	53.1000	20.5800	32.5200	0.1500	4.8780			(29a)
Total net area of external elements Aum(A, m2)			53.1000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1621			(33)
Party Wall 1			54.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 2.1240 (36)
Total fabric heat loss (33) + (36) = 34.2861 (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	19.1155	18.6137	18.6137	17.8611	17.8611	16.8576	17.1085	16.6068	16.8576	17.3594	17.3594	18.1120	(38)
Heat transfer coeff	53.4016	52.8998	52.8998	52.1472	52.1472	51.1437	51.3946	50.8928	51.1437	51.6455	51.6455	52.3981	(39)

Average = Sum(39)m / 12 = 51.9800 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6717	0.6654	0.6654	0.6559	0.6559	0.6433	0.6465	0.6402	0.6433	0.6496	0.6496	0.6591	(40)
HLP (average)												0.6538	(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 2.4533 (42)
Average daily hot water use (litres/day) 92.4660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.7126	98.0140	94.3153	90.6167	86.9180	83.2194	83.2194	86.9180	90.6167	94.3153	98.0140	101.7126	(44)
Energy conte	150.8369	131.9229	136.1326	118.6837	113.8798	98.2696	91.0613	104.4941	105.7421	123.2323	134.5176	146.0774	(45)
Energy content (annual)										Total = Sum(45)m =		1454.8504	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6255	19.7884	20.4199	17.8026	17.0820	14.7404	13.6592	15.6741	15.8613	18.4848	20.1776	21.9116	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364	(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

	201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364 (64)

Total per year (kWh/year) = Sum(64)m = 2054.8504 (64)

RHI water heating demand 2055 (64)

Heat gains from water heating, kWh/month

	62.8930	55.3712	58.0038	51.7911	50.6048	45.0034	43.0176	47.4840	47.4880	53.7144	57.0559	61.3105 (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	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	(66)

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

	48.6746	43.2323	35.1589	26.6176	19.8969	16.7978	18.1506	23.5929	31.6663	40.2077	46.9283	50.0274 (67)

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

	325.9588	329.3412	320.8176	302.6718	279.7660	258.2378	243.8556	240.4732	248.9968	267.1426	290.0484	311.5766 (68)

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

	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731 (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)

	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322 (71)

Water heating gains (Table 5)

	84.5336	82.3976	77.9621	71.9321	68.0172	62.5048	57.8194	63.8226	65.9556	72.1968	79.2443	82.4066 (72)

Total internal gains

	563.4062	559.2104	538.1779	505.4607	471.9194	441.7796	424.0649	432.1280	450.8580	483.7864	520.4602	548.2498 (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	
East	20.5800	22.3313	0.6000	0.9000	0.7700	171.9835	(76)

Solar gains	171.9835	302.6298	491.4173	736.4937	877.5633	960.6536	904.9745	796.1630	618.8282	383.2099	219.6878	140.0585	(83)
Total gains	735.3897	861.8402	1029.5952	1241.9544	1349.4827	1402.4332	1329.0394	1228.2910	1069.6862	866.9963	740.1480	688.3084	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	103.3834	104.3639	104.3639	105.8702	105.8702	107.9474	107.4205	108.4796	107.9474	106.8987	106.8987	105.3633	
alpha	7.8922	7.9576	7.9576	8.0580	8.0580	8.1965	8.1614	8.2320	8.1965	8.1266	8.1266	8.0242	
util living area	0.9403	0.8618	0.6861	0.4655	0.3091	0.1823	0.1199	0.1326	0.2773	0.5577	0.8424	0.9543	(86)
MIT	20.8454	20.8739	20.8930	20.8982	20.8985	20.9002	20.8997	20.9006	20.9002	20.8987	20.8837	20.8409	(87)
Th 2	20.3659	20.3715	20.3715	20.3799	20.3799	20.3912	20.3884	20.3940	20.3912	20.3855	20.3855	20.3771	(88)
util rest of house	0.9276	0.8403	0.6574	0.4397	0.2852	0.1601	0.0962	0.1075	0.2482	0.5220	0.8155	0.9439	(89)
MIT 2	20.1510	20.1937	20.2165	20.2310	20.2312	20.2449	20.2415	20.2484	20.2449	20.2375	20.2209	20.1561	(90)
Living area fraction									fLA = Living area / (4) =			0.3774	(91)
MIT	20.4130	20.4504	20.4718	20.4828	20.4830	20.4922	20.4899	20.4945	20.4922	20.4870	20.4710	20.4145	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.2630	20.3004	20.3218	20.3328	20.3330	20.3422	20.3399	20.3445	20.3422	20.3370	20.3210	20.2645	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9254	0.8377	0.6551	0.4377	0.2834	0.1584	0.0944	0.1054	0.2459	0.5192	0.8125	0.9418	(94)
Useful gains	680.5053	721.9403	674.5044	543.6454	382.3840	222.0758	125.3971	129.4967	262.9888	450.1522	601.3974	648.2607	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	809.7299	777.6487	683.5590	544.0407	382.3946	222.0759	125.3971	129.4967	262.9908	451.2273	636.3252	794.5917	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	(97a)
Space heating kWh	96.1431	37.4361	6.7366	0.2847	0.0079	0.0000	0.0000	0.0000	0.0000	0.7999	25.1480	108.8703	(98)

Space heating 275.4265 (98)

RHI space heating demand 275 (98)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.5000 (1b)	x	3.0000 (2b)	=	238.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	238.5000	(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 q50		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) = 78.2000 (23c)

Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(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	
Opening Type 1 (Uw = 1.40)			20.5800	1.3258	27.2841			(27)
External Wall 1	53.1000	20.5800	32.5200	0.1500	4.8780			(29a)
Total net area of external elements Aum(A, m2)			53.1000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1621			(33)
Party Wall 1			54.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 2.1240 (36)
Total fabric heat loss (33) + (36) = 34.2861 (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	21.3733	21.1225	20.8716	19.6172	19.3663	18.1120	18.1120	17.8611	18.6137	19.3663	19.8681	20.3698	(38)
Heat transfer coeff	55.6594	55.4085	55.1577	53.9033	53.6524	52.3981	52.3981	52.1472	52.8998	53.6524	54.1542	54.6559	(39)

Average = Sum(39)m / 12 = 53.8406 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7001	0.6970	0.6938	0.6780	0.6749	0.6591	0.6591	0.6559	0.6654	0.6749	0.6812	0.6875	(40)
HLP (average)												0.6772	(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 2.4533 (42)
Average daily hot water use (litres/day) 92.4660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.7126	98.0140	94.3153	90.6167	86.9180	83.2194	83.2194	86.9180	90.6167	94.3153	98.0140	101.7126	(44)
Energy conte	150.8369	131.9229	136.1326	118.6837	113.8798	98.2696	91.0613	104.4941	105.7421	123.2323	134.5176	146.0774	(45)
Energy content (annual)										Total = Sum(45)m =		1454.8504	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6255	19.7884	20.4199	17.8026	17.0820	14.7404	13.6592	15.6741	15.8613	18.4848	20.1776	21.9116	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364	(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
201.7958 177.9503 187.0915 167.9988 164.8387 147.5847 142.0202 155.4530 155.0572 174.1912 183.8327 197.0364 (64)
Total per year (kWh/year) = Sum(64)m = 2054.8504 (64)
Heat gains from water heating, kWh/month
62.8930 55.3712 58.0038 51.7911 50.6048 45.0034 43.0176 47.4840 47.4880 53.7144 57.0559 61.3105 (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	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.6746	43.2323	35.1589	26.6176	19.8969	16.7978	18.1506	23.5929	31.6663	40.2077	46.9283	50.0274	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	325.9588	329.3412	320.8176	302.6718	279.7660	258.2378	243.8556	240.4732	248.9968	267.1426	290.0484	311.5766	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	52.1731	(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)													
	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	-98.1322	(71)
Water heating gains (Table 5)													
	84.5336	82.3976	77.9621	71.9321	68.0172	62.5048	57.8194	63.8226	65.9556	72.1968	79.2443	82.4066	(72)
Total internal gains													
	563.4062	559.2104	538.1779	505.4607	471.9194	441.7796	424.0649	432.1280	450.8580	483.7864	520.4602	548.2498	(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	
East	20.5800	19.6403	0.6000	0.9000	0.7700	151.2585	(76)
Solar gains	151.2585	295.8936	487.2947	710.6902	870.9776	891.6005	848.8400	729.1411	566.7439	351.1027	188.6015	124.3876	(83)
Total gains	714.6647	855.1041	1025.4725	1216.1509	1342.8969	1333.3802	1272.9049	1161.2690	1017.6019	834.8891	709.0618	672.6374	(84)

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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	99.1896	99.6387	100.0918	102.4210	102.8999	105.3633	105.3633	105.8702	104.3639	102.8999	101.9466	101.0107	
alpha	7.6126	7.6426	7.6728	7.8281	7.8600	8.0242	8.0242	8.0580	7.9576	7.8600	7.7964	7.7340	
util living area													
	0.9651	0.9021	0.7511	0.5344	0.3715	0.2515	0.1811	0.2066	0.3586	0.6587	0.9110	0.9742	(86)
MIT	20.8154	20.8541	20.8839	20.8948	20.8959	20.8980	20.8980	20.8985	20.8972	20.8933	20.8606	20.8094	(87)
Th 2	20.3407	20.3435	20.3463	20.3603	20.3631	20.3771	20.3771	20.3799	20.3715	20.3631	20.3575	20.3519	(88)
util rest of house													
	0.9570	0.8846	0.7233	0.5067	0.3461	0.2270	0.1555	0.1787	0.3260	0.6213	0.8918	0.9679	(89)
MIT 2	20.0850	20.1400	20.1798	20.2065	20.2106	20.2278	20.2278	20.2312	20.2209	20.2082	20.1633	20.0875	(90)
Living area fraction									fLA = Living area / (4) =			0.3774	(91)
MIT	20.3606	20.4095	20.4455	20.4662	20.4692	20.4807	20.4807	20.4830	20.4761	20.4668	20.4264	20.3600	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.2106	20.2595	20.2955	20.3162	20.3192	20.3307	20.3307	20.3330	20.3261	20.3168	20.2764	20.2100	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9552	0.8822	0.7211	0.5048	0.3443	0.2252	0.1536	0.1766	0.3236	0.6185	0.8891	0.9664	(94)
Useful gains	682.6543	754.3552	739.4179	613.8999	462.3715	300.2758	195.4811	205.0943	329.3309	516.4183	630.4264	650.0233	(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													
	885.5756	851.0459	760.9268	615.3722	462.4411	300.2773	195.4812	205.0944	329.3590	521.3279	713.5591	875.0390	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	150.9734	64.9762	16.0026	1.0601	0.0518	0.0000	0.0000	0.0000	0.0000	3.6527	59.8555	167.4117	(98)
Space heating												463.9840	(98)
Space heating per m2											(98) / (4) =	5.8363	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 88.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 521.9168 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	150.9734	64.9762	16.0026	1.0601	0.0518	0.0000	0.0000	0.0000	0.0000	3.6527	59.8555	167.4117	(98)
Space heating efficiency (main heating system 1)													
	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)													
	169.8239	73.0891	18.0007	1.1924	0.0583	0.0000	0.0000	0.0000	0.0000	4.1088	67.3291	188.3146	(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

201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364 (64)

Efficiency of water heater												78.8000 (216)
(217)m	82.8272	81.2696	79.5118	78.8562	78.8028	78.8000	78.8000	78.8000	78.8000	78.9843	81.0621	83.1388 (217)

Fuel for water heating, kWh/month

182.1103	162.3275	171.2106	150.5065	144.5124	124.7077	115.5600	132.6068	134.1905	156.0212	165.9440	175.7030 (219)

Water heating fuel used	1815.4004 (219)
Annual totals kWh/year	
Space heating fuel - main system	521.9168 (211)
Space heating fuel - secondary	0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)

mechanical ventilation fans (SFP = 0.6875)	200.0419 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	875.0419 (231)
Electricity for lighting (calculated in Appendix L)	343.8434 (232)
Total delivered energy for all uses	3556.2025 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	521.9168	3.4800	18.1627 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1815.4004	3.4800	63.1759 (247)
Mechanical ventilation fans	200.0419	13.1900	26.3855 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Electric keep-hot	600.0000	13.1900	79.1400 (249)
Energy for lighting	343.8434	13.1900	45.3530 (250)
Additional standing charges			120.0000 (251)
Total energy cost			362.1096 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2216 (257)
SAP value		82.9590
SAP rating (Section 12)		83 (258)
SAP band		B

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	521.9168	0.2160	112.7340 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1815.4004	0.2160	392.1265 (264)
Space and water heating			504.8605 (265)
Pumps and fans	875.0419	0.5190	454.1467 (267)
Energy for lighting	343.8434	0.5190	178.4547 (268)
Total kg/year			1137.4620 (272)
CO2 emissions per m2			14.3100 (273)
EI value			87.7574
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.75) / 0.8890 = 4.766, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.75) / 0.8890 = 0.2958, stars = 4
Water heating energy efficiency	3.48 / 0.7997 = 4.352, stars = 4
Water heating environmental impact	0.216 / 0.7997 = 0.2701, stars = 4

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.5000 (1b)	x	3.0000 (2b)	=	238.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	238.5000 (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 q50		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	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211	(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) = 78.2000 (23c)

Effective ac	0.2429	0.2365	0.2365	0.2269	0.2269	0.2142	0.2174	0.2110	0.2142	0.2206	0.2206	0.2301	(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	
Opening Type 1 (Uw = 1.40)			20.5800	1.3258	27.2841			(27)
External Wall 1	53.1000	20.5800	32.5200	0.1500	4.8780			(29a)
Total net area of external elements Aum(A, m2)			53.1000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1621			(33)
Party Wall 1			54.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area)		2.1240 (36)
Total fabric heat loss	(33) + (36) =	34.2861 (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	19.1155	18.6137	18.6137	17.8611	17.8611	16.8576	17.1085	16.6068	16.8576	17.3594	17.3594	18.1120	(38)
Heat transfer coeff	53.4016	52.8998	52.8998	52.1472	52.1472	51.1437	51.3946	50.8928	51.1437	51.6455	51.6455	52.3981	(39)
Average = Sum(39)m / 12 =												51.9800	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6717	0.6654	0.6654	0.6559	0.6559	0.6433	0.6465	0.6402	0.6433	0.6496	0.6496	0.6591	(40)
HLP (average)												0.6538	(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	2.4533 (42)
Average daily hot water use (litres/day)	92.4660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.7126	98.0140	94.3153	90.6167	86.9180	83.2194	83.2194	86.9180	90.6167	94.3153	98.0140	101.7126	(44)
Energy conte	150.8369	131.9229	136.1326	118.6837	113.8798	98.2696	91.0613	104.4941	105.7421	123.2323	134.5176	146.0774	(45)
Energy content (annual)										Total = Sum(45)m =		1454.8504	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6255	19.7884	20.4199	17.8026	17.0820	14.7404	13.6592	15.6741	15.8613	18.4848	20.1776	21.9116	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364	(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
201.7958 177.9503 187.0915 167.9988 164.8387 147.5847 142.0202 155.4530 155.0572 174.1912 183.8327 197.0364 (64)
Total per year (kWh/year) = Sum(64)m = 2054.8504 (64)
Heat gains from water heating, kWh/month
62.8930 55.3712 58.0038 51.7911 50.6048 45.0034 43.0176 47.4840 47.4880 53.7144 57.0559 61.3105 (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	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	147.1983	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
48.6746 43.2323 35.1589 26.6176 19.8969 16.7978 18.1506 23.5929 31.6663 40.2077 46.9283 50.0274 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
325.9588 329.3412 320.8176 302.6718 279.7660 258.2378 243.8556 240.4732 248.9968 267.1426 290.0484 311.5766 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.1731 52.1731 52.1731 52.1731 52.1731 52.1731 52.1731 52.1731 52.1731 52.1731 52.1731 52.1731 (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)
-98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 -98.1322 (71)
Water heating gains (Table 5)
84.5336 82.3976 77.9621 71.9321 68.0172 62.5048 57.8194 63.8226 65.9556 72.1968 79.2443 82.4066 (72)
Total internal gains
563.4062 559.2104 538.1779 505.4607 471.9194 441.7796 424.0649 432.1280 450.8580 483.7864 520.4602 548.2498 (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	
East	20.5800	22.3313	0.6000	0.9000	0.7700	171.9835	(76)

Solar gains	171.9835	302.6298	491.4173	736.4937	877.5633	960.6536	904.9745	796.1630	618.8282	383.2099	219.6878	140.0585	(83)
Total gains	735.3897	861.8402	1029.5952	1241.9544	1349.4827	1402.4332	1329.0394	1228.2910	1069.6862	866.9963	740.1480	688.3084	(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	103.3834	104.3639	104.3639	105.8702	105.8702	107.9474	107.4205	108.4796	107.9474	106.8987	106.8987	105.3633	
alpha	7.8922	7.9576	7.9576	8.0580	8.0580	8.1965	8.1614	8.2320	8.1965	8.1266	8.1266	8.0242	
util living area	0.9403	0.8618	0.6861	0.4655	0.3091	0.1823	0.1199	0.1326	0.2773	0.5577	0.8424	0.9543	(86)
MIT	20.8454	20.8739	20.8930	20.8982	20.8985	20.9002	20.8997	20.9006	20.9002	20.8987	20.8837	20.8409	(87)
Th 2	20.3659	20.3715	20.3715	20.3799	20.3799	20.3912	20.3884	20.3940	20.3912	20.3855	20.3855	20.3771	(88)
util rest of house	0.9276	0.8403	0.6574	0.4397	0.2852	0.1601	0.0962	0.1075	0.2482	0.5220	0.8155	0.9439	(89)
MIT 2	20.1510	20.1937	20.2165	20.2310	20.2312	20.2449	20.2415	20.2484	20.2449	20.2375	20.2209	20.1561	(90)
Living area fraction									fLA = Living area / (4) =			0.3774	(91)
MIT	20.4130	20.4504	20.4718	20.4828	20.4830	20.4922	20.4899	20.4945	20.4922	20.4870	20.4710	20.4145	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.2630	20.3004	20.3218	20.3328	20.3330	20.3422	20.3399	20.3445	20.3422	20.3370	20.3210	20.2645	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9254	0.8377	0.6551	0.4377	0.2834	0.1584	0.0944	0.1054	0.2459	0.5192	0.8125	0.9418	(94)
Useful gains	680.5053	721.9403	674.5044	543.6454	382.3840	222.0758	125.3971	129.4967	262.9888	450.1522	601.3974	648.2607	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	809.7299	777.6487	683.5590	544.0407	382.3946	222.0759	125.3971	129.4967	262.9908	451.2273	636.3252	794.5917	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	(97a)
Space heating kWh	96.1431	37.4361	6.7366	0.2847	0.0079	0.0000	0.0000	0.0000	0.0000	0.7999	25.1480	108.8703	(98)

Space heating 275.4265 (98)
Space heating per m2 (98) / (4) = 3.4645 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 88.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 309.8161 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	96.1431	37.4361	6.7366	0.2847	0.0079	0.0000	0.0000	0.0000	0.0000	0.7999	25.1480	108.8703	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	108.1475	42.1103	7.5777	0.3202	0.0089	0.0000	0.0000	0.0000	0.0000	0.8998	28.2880	122.4637	(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

201.7958	177.9503	187.0915	167.9988	164.8387	147.5847	142.0202	155.4530	155.0572	174.1912	183.8327	197.0364 (64)
Efficiency of water heater											78.8000 (216)
(217)m 81.7989	80.3874	79.1124	78.8151	78.8004	78.8000	78.8000	78.8000	78.8000	78.8409	79.8922	82.1204 (217)
Fuel for water heating, kWh/month											
184.3997	164.1090	172.0750	150.5849	144.5168	124.7077	115.5600	132.6068	134.1905	156.3049	168.3738	177.8820 (219)
Water heating fuel used											1825.3109 (219)

Annual totals kWh/year
Space heating fuel - main system 309.8161 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)
mechanical ventilation fans (SFP = 0.6875) 200.0419 (230a)
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
maintaining electric keep-hot facility for gas combi boiler 600.0000 (230f)
Total electricity for the above, kWh/year 875.0419 (231)
Electricity for lighting (calculated in Appendix L) 343.8434 (232)
Total delivered energy for all uses 3354.0124 (238)

10a. Fuel costs - using BEDF prices (387)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	309.8161	4.3200	13.3841 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1825.3109	4.3200	78.8534 (247)
Mechanical ventilation fans	200.0419	15.3200	30.6464 (249)
Pumps and fans for heating	75.0000	15.3200	11.4900 (249)
Electric keep-hot	600.0000	15.3200	91.9200 (249)
Energy for lighting	343.8434	15.3200	52.6768 (250)
Additional standing charges			95.0000 (251)
Total energy cost			373.9707 (255)

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	309.8161	0.2160	66.9203 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1825.3109	0.2160	394.2672 (264)
Space and water heating			461.1874 (265)
Pumps and fans	875.0419	0.5190	454.1467 (267)
Energy for lighting	343.8434	0.5190	178.4547 (268)
Total kg/year			1093.7889 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	309.8161	1.2200	377.9757 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1825.3109	1.2200	2226.8793 (264)
Space and water heating			2604.8550 (265)
Pumps and fans	875.0419	3.0700	2686.3786 (267)
Energy for lighting	343.8434	3.0700	1055.5994 (268)
Primary energy kWh/year			6346.8329 (272)
Primary energy kWh/m2/year			79.8344 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 88

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered

J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 387 TEST (20 Jan 2016)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£187	£187	£0
Mains gas	£187	£187	£0
Space heating	£151	£151	£0
Water heating	£171	£171	£0
Lighting	£53	£53	£0
Total cost of fuels	£374	£374	£0
Total cost of uses	£375	£375	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	80 kWh/m²	80 kWh/m²	0 kWh/m²

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	314.82 (P1)
Transmission heat loss coefficient	34.29 (37)
Summer heat loss coefficient	349.11 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	20.5800	117.5071	0.6000	0.9000	0.9000	1057.7624
total:						1057.7624

	Jun	Jul	Aug	
Solar gains	1123	1058	931	(P3)
Internal gains	439	421	429	
Total summer gains	1562	1479	1360	(P5)
Summer gain/loss ratio	4.47	4.24	3.89	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	20.72	22.39	21.94	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			

Sample Report Ltd
1 Sample Street
Sampletown

Full SAP Calculation Printout

Property Reference: Flats
Survey Reference: 3 bed
Property: Kentish Town Road

Issued on Date: 05.Nov.2015
Prop Type Ref: -

SAP Rating:	84 B	**CO2 Emissions (t/year):**	1.03	**DER:**	14.47 Pass	**TER:**	15.49	**Percentage DER<TER:**	6.58 %
Environmental:	89 B	**General Requirements Compliance:**	Pass	**DFEE:**	26.92 Pass	**TFEE:**	36.00	**Percentage DFEE<TFEE:**	25.24 %

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: admin Admin, Tel: 4, Fax: s@l.f Surveyor ID: Admin
Address:
Client:

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.05r04
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

CALCULATION DETAILS for survey reference no '3 bed'
SAP2012 - 9.92 input data (DesignData) -

SAP2012 Input Data (Flat)	21/04/2016
FullRefNo:	3 bed
Regs Region:	England
SAP Region:	Thames Valley
Postcode:	
DwellingOrientation:	East
Property Type:	Flat, Mid-Terrace
Storeys:	1
Date Built:	2015
Sheltered Sides:	2
Sunlight Shade:	Average or unknown
Measurements	Perimeter, Floor Area, Storey Height
1st Storey:	15.2, 78.5, 3
Living Area:	22.8 m2, fraction: 29.0%
Thermal Mass:	Simple calculation
Thermal Mass Simple:	Medium
Thermal MassValue:	250
External Walls	Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1	34.26, 45.6, 190, CavityWallDensePlasterDenseBlock, Cavity, 0, 0.15, Calculate
Party Walls	Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1	47, 180, PartyWallDensePlaster, Solid, 0, 0
External Roofs	Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings	Area, Kappa, Construction, Element
Party Ceilings 1	78.5, 64, In-situ concrete slab supported by profiled metal deck, carpeted
Heat Loss Floors	Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors	Area, Kappa, Construction, Element
Party Floor 1	78.5, 64
Description	Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Opening Type 1	Manufacturer, Window, Triple Low-E Hard 0.2, , , 0.6, , 0.9,
Openings	Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
Opening 1	Window, External Wall 1, West, , None, 0, , 0, 0, 0, 11.34,
Conservatory:	None
Draught Proofing:	100
Draught Lobby:	Yes
Thermal Bridges	
Bridging:	User Input
Y	0.04
Description:	0.04
List of Bridges	Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
0.	External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, Yes, 5.4, 0.5, 0.5, 2.70,
1.	External wall, E2 Other lintels (including other steel lintels), , No, 0, 0, 0, 0.00,
2.	External wall, E3 Sill, Table K1 - Approved, Yes, 5.4, 0.04, 0.04, 0.22,
3.	External wall, E4 Jamb, Table K1 - Approved, Yes, 4.2, 0.05, 0.05, 0.21,
4.	External wall, E5 Ground floor (normal), , No, 0, 0, 0, 0.00,
5.	External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
6.	External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
7.	External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
8.	External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
9.	External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
10.	External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, Yes, 15.2, 0.07, 0.07, 1.06,
11.	External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
12.	External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
13.	External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 0, 0, 0.00,
14.	External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
15.	External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
16.	External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
17.	External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
18.	External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
19.	External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
20.	External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
21.	External wall, E16 Corner (normal), , No, 6, 0, 0, 0.00,
22.	External wall, E17 Corner (inverted - internal area greater than external area), , No, 3, 0, 0, 0.00,
23.	External wall, E18 Party wall between dwellings, Table K1 - Approved, Yes, 12, 0.06, 0.06, 0.72,
24.	External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
25.	Party wall, P1 Party wall - Ground floor, , No, 0, 0, 0, 0.00,
26.	Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
27.	Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
28.	Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), , No, 0, 0, 0, 0.00,
29.	Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
30.	Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
31.	Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
32.	Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
33.	External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
34.	External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
35.	External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
36.	External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
37.	External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,

38.	External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
39.	External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	3
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows fully open
Cross Ventilation	No
Night Ventilation	Yes
Air Change Rate	4.00
Approved Installation	Yes
DataType	Database
Type	Balanced mechanical ventilation with heat recovery
Database Ref Number	500167
Configuration	2
HR Duct Insulated	Yes
ManufacturerSFP	0.55
DuctType	Semi rigid
HR Efficiency	92
Wet Rooms	2
Chimneys MHS:	0
Chimneys SHS:	0
Chimneys Other:	0
Chimneys Total:	0
Open Flues MHS:	0
Open Flues SHS:	0
Open Flues Other:	0
Open Flues Total:	0
Intermittent Fans:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	None
Light Fittings:	5
LEL Fittings:	5
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	
Description	Combi Boilers
Percentage	100
MHS	Mains gas BGW Post 98 Combi condens. with auto ign.
SAP Code	104
Boiler Efficiency Type	Sedbuk 2009
Efficiency	88
Model Name	na
Manufacturer	na
Controls by PCDF	0
MHS Controls	CBI Time and temperature zone control
Boiler Interlock	Yes
Compensator	0
Delayed Start Stat	Yes
Ctrl SAP Code	2110
Burner Control	Modulating
Flue Type	None or Unknown
Fan Assisted Flue	No
Pumped	Pump in heated space
Heat Pump Age	2013 or later
Heat Emitter	Underfloor
Flow Temperature	Normal (> 45°C)
Under Floor Heating	Yes - Pipes in Concrete
Combi boiler type	Standard Combi
Combi keep hot type	Electric, time clock
Main Heating 2	None
Heating Systems Interaction	Both systems heat whole dwelling
Smoke Control Area	Unknown
Community Heating	None
Secondary Heating	None
Water Heating	
Type	MainHeating1
WHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	None
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 79 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
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.49 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.47 kg/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)36.0 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE)26.9 kWh/m²OK

---

2 Fabric U-values

Element	Average	Highest

External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using user-specified y-value of 0.040

---

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

---

4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas	
Data from manufacturer		
na na		
Combi boiler		
Efficiency: 88.0% SEDBUK2009		
Minimum: 88.0%	OK	
Secondary heating system:	None	

---

5 Cylinder insulation

Hot water storage	No cylinder	

---

6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	No cylinder	
Boiler interlock	Yes	OK

---

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:	0.55	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum:	70%	OK

---

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing West:	11.34 m^2, No overhang	
Air change rate:	4.00 ach	
Blinds/curtains:	None	

---

10 Key features

Party wall U-value	0.00 W/m^2K
Air permeability	3.0 m^3/m^2h

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	78.5000 (1b)	x	3.0000 (2b)	=	235.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.5000	(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 q50		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) = 78.2000 (23c)

Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(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	
Opening Type 1 (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
External Wall 1	45.6000	11.3400	34.2600	0.1500	5.1390			(29a)
Total net area of external elements Aum(A, m2)			45.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.1731			(33)
Party Wall 1			47.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (User defined value 0.040 * total exposed area)		1.8240	(36)
Total fabric heat loss	(33) + (36) =	21.9971	(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	21.1045	20.8568	20.6090	19.3705	19.1227	17.8842	17.8842	17.6364	18.3796	19.1227	19.6182	20.1136	(38)
Heat transfer coeff	43.1016	42.8539	42.6061	41.3676	41.1198	39.8813	39.8813	39.6335	40.3767	41.1198	41.6153	42.1107	(39)

Average = Sum(39)m / 12 = 41.3056 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5491	0.5459	0.5428	0.5270	0.5238	0.5080	0.5080	0.5049	0.5144	0.5238	0.5301	0.5364	(40)
HLP (average)												0.5262	(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		2.4338 (42)
Average daily hot water use (litres/day)		92.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.2026	97.5225	93.8424	90.1623	86.4822	82.8021	82.8021	86.4822	90.1623	93.8424	97.5225	101.2026	(44)
Energy conte	150.0805	131.2614	135.4500	118.0886	113.3088	97.7769	90.6047	103.9702	105.2119	122.6143	133.8431	145.3450	(45)
Energy content (annual)										Total = Sum(45)m =		1447.5553	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5121	19.6892	20.3175	17.7133	16.9963	14.6665	13.5907	15.5955	15.7818	18.3921	20.0765	21.8017	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039	(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
201.0394 177.2888 186.4089 167.4037 164.2677 147.0920 141.5636 154.9291 154.5270 173.5732 183.1582 196.3039 (64)
Total per year (kWh/year) = Sum(64)m = 2047.5553 (64)
Heat gains from water heating, kWh/month
62.6415 55.1513 57.7768 51.5932 50.4149 44.8396 42.8658 47.3098 47.3117 53.5090 56.8316 61.0669 (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	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.0545	17.8122	14.4859	10.9667	8.1978	6.9209	7.4783	9.7205	13.0469	16.5660	19.3350	20.6119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	216.2770	218.5213	212.8658	200.8259	185.6276	171.3434	161.8007	159.5565	165.2120	177.2519	192.4501	206.7343	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	(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)													
	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	(71)
Water heating gains (Table 5)													
	84.1956	82.0703	77.6571	71.6573	67.7620	62.2772	57.6153	63.5885	65.7107	71.9207	78.9328	82.0792	(72)
Total internal gains													
	383.0338	380.9106	367.5155	345.9566	324.0941	303.0483	289.4011	295.3722	306.4763	328.2453	353.2246	371.9321	(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	
West	11.3400	19.6403	0.6000	0.9000	0.7700	83.3465	(80)

Solar gains	83.3465	163.0434	268.5093	391.6048	479.9264	491.2901	467.7282	401.7716	312.2874	193.4648	103.9233	68.5401	(83)
Total gains	466.3803	543.9540	636.0248	737.5614	804.0205	794.3384	757.1292	697.1438	618.7638	521.7101	457.1479	440.4722	(84)

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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	126.4777	127.2088	127.9484	131.7793	132.5732	136.6905	136.6905	137.5448	135.0133	132.5732	130.9949	129.4538	
alpha	9.4318	9.4806	9.5299	9.7853	9.8382	10.1127	10.1127	10.1697	10.0009	9.8382	9.7330	9.6303	
util living area													
	0.9941	0.9758	0.8913	0.6737	0.4755	0.3213	0.2318	0.2615	0.4502	0.7961	0.9769	0.9960	(86)
MIT	20.8271	20.8601	20.8969	20.9150	20.9167	20.9190	20.9190	20.9194	20.9180	20.9125	20.8714	20.8244	(87)
Th 2	20.4761	20.4789	20.4818	20.4962	20.4990	20.5135	20.5135	20.5164	20.5077	20.4990	20.4933	20.4875	(88)
util rest of house													
	0.9924	0.9699	0.8728	0.6470	0.4499	0.2969	0.2061	0.2340	0.4181	0.7642	0.9703	0.9949	(89)
MIT 2	20.2336	20.2834	20.3359	20.3723	20.3770	20.3948	20.3948	20.3983	20.3877	20.3729	20.3138	20.2408	(90)
Living area fraction									fLA = Living area / (4) =			0.2904	(91)
MIT	20.4060	20.4509	20.4988	20.5299	20.5338	20.5470	20.5470	20.5497	20.5417	20.5297	20.4757	20.4103	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.2560	20.3009	20.3488	20.3799	20.3838	20.3970	20.3970	20.3997	20.3917	20.3797	20.3257	20.2603	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9676	0.8677	0.6408	0.4440	0.2910	0.2000	0.2274	0.4105	0.7563	0.9678	0.9943	(94)
Useful gains	462.4620	526.3398	551.8473	472.5996	357.0069	231.1915	151.4296	158.5207	254.0178	394.5699	442.4231	437.9745	(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													
	687.7265	659.9891	590.0453	474.8959	357.0745	231.1921	151.4296	158.5208	254.0382	402.1378	550.3928	676.3110	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	167.5968	89.8123	28.4193	1.6534	0.0503	0.0000	0.0000	0.0000	0.0000	5.6305	77.7382	177.3223	(98)
Space heating												548.2231	(98)
Space heating per m2											(98) / (4) =	6.9837	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 88.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 616.6739 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	167.5968	89.8123	28.4193	1.6534	0.0503	0.0000	0.0000	0.0000	0.0000	5.6305	77.7382	177.3223	(98)
Space heating efficiency (main heating system 1)													
	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)													
	188.5228	101.0262	31.9677	1.8598	0.0566	0.0000	0.0000	0.0000	0.0000	6.3335	87.4446	199.4627	(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

201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039 (64)
Efficiency of water heater											78.8000 (216)
(217)m	83.0919	81.9298	80.0024	78.8877	78.8027	78.8000	78.8000	78.8000	78.8000	79.0823	81.5610	83.2910 (217)
Fuel for water heating, kWh/month											
180.6200	160.2119	169.3074	149.6921	143.7879	124.0823	114.9805	131.9418	133.5176	155.0465	164.1018	174.5026 (219)
Water heating fuel used											1801.7927 (219)
Annual totals kWh/year											
Space heating fuel - main system											616.6739 (211)
Space heating fuel - secondary											0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)

mechanical ventilation fans (SFP = 0.6875)	197.5256 (230a)
central heating pump	30.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	827.5256 (231)
Electricity for lighting (calculated in Appendix L)	354.1687 (232)
Total delivered energy for all uses	3600.1609 (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	616.6739	0.2160	133.2016	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.7927	0.2160	389.1872	(264)
Space and water heating			522.3888	(265)
Pumps and fans	827.5256	0.5190	429.4858	(267)
Energy for lighting	354.1687	0.5190	183.8135	(268)
Total CO2, kg/year			1135.6881	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4700	(273)

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

DER		14.4700	ZC1
Total Floor Area	TFA	78.5000	
Assumed number of occupants	N	2.4338	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3263	ZC2
CO2 emissions from cooking, equation (L16)		2.2600	ZC3
Total CO2 emissions		33.0563	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		33.0563	ZC8

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	78.5000 (1b)	x	3.0000 (2b)	=	235.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.5000 (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) =	0.1274	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3774	(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) =	0.3208	(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	0.4090	0.4010	0.3930	0.3529	0.3448	0.3047	0.3047	0.2967	0.3208	0.3448	0.3609	0.3769	(22b)
Effective ac	0.5836	0.5804	0.5772	0.5623	0.5595	0.5464	0.5464	0.5440	0.5514	0.5595	0.5651	0.5710	(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 Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
External Wall 1	45.6000	11.3400	34.2600	0.1800	6.1668			(29a)
Total net area of external elements Aum(A, m2)			45.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.2009			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		2.8040 (36)
Total fabric heat loss	(33) + (36) =	24.0049 (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	45.3575	45.1051	44.8577	43.6956	43.4782	42.4661	42.4661	42.2787	42.8559	43.4782	43.9180	44.3778	(38)
Heat transfer coeff	69.3623	69.1099	68.8625	67.7005	67.4831	66.4710	66.4710	66.2836	66.8608	67.4831	67.9229	68.3827	(39)
Average = Sum(39)m / 12 =												67.6995	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8836	0.8804	0.8772	0.8624	0.8597	0.8468	0.8468	0.8444	0.8517	0.8597	0.8653	0.8711	(40)
HLP (average)												0.8624	(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	2.4338 (42)
Average daily hot water use (litres/day)	92.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.2026	97.5225	93.8424	90.1623	86.4822	82.8021	82.8021	86.4822	90.1623	93.8424	97.5225	101.2026	(44)
Energy conte	150.0805	131.2614	135.4500	118.0886	113.3088	97.7769	90.6047	103.9702	105.2119	122.6143	133.8431	145.3450	(45)
Energy content (annual)										Total = Sum(45)m =		1447.5553	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5121	19.6892	20.3175	17.7133	16.9963	14.6665	13.5907	15.5955	15.7818	18.3921	20.0765	21.8017	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.8871	47.8211	44.4636	44.0704	40.8339	42.1951	44.0704	44.4636	47.8211	48.0933	50.9589	(61)
Total heat required for water heating calculated for each month	201.0394	176.1485	183.2711	162.5522	157.3792	138.6108	132.7997	148.0406	149.6755	170.4354	181.9364	196.3039	(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	201.0394	176.1485	183.2711	162.5522	157.3792	138.6108	132.7997	148.0406	149.6755	170.4354	181.9364	196.3039	(64)
									Total per year (kWh/year) = Sum(64)m =			1998.1926	(64)
Heat gains from water heating, kWh/month	62.6415	54.8662	56.9924	50.3804	48.6928	42.7193	40.6748	45.5877	46.0989	52.7245	56.5262	61.0669	(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	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	(66)

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

	20.5456	18.2484	14.8406	11.2353	8.3985	7.0904	7.6614	9.9586	13.3664	16.9717	19.8085	21.1166	(67)

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

	216.2770	218.5213	212.8658	200.8259	185.6276	171.3434	161.8007	159.5565	165.2120	177.2519	192.4501	206.7343	(68)

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

	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	(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)

	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	(71)

Water heating gains (Table 5)

	84.1956	81.6461	76.6027	69.9727	65.4473	59.3324	54.6704	61.2738	64.0262	70.8663	78.5086	82.0792	(72)

Total internal gains

	383.5249	380.9225	366.8158	344.5406	321.9802	300.2729	286.6393	293.2955	305.1113	327.5966	353.2739	372.4368	(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	
West	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(80)

Solar gains	68.0663	133.1521	219.2826	319.8106	391.9399	401.2202	381.9780	328.1135	255.0347	157.9962	84.8707	55.9744	(83)
Total gains	451.5912	514.0747	586.0984	664.3512	713.9201	701.4932	668.6174	621.4090	560.1460	485.5928	438.1446	428.4113	(84)

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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.5929	78.8799	79.1633	80.5221	80.7816	82.0116	82.0116	82.2435	81.5334	80.7816	80.2585	79.7188	
alpha	6.2395	6.2587	6.2776	6.3681	6.3854	6.4674	6.4674	6.4829	6.4356	6.3854	6.3506	6.3146	
util living area													
	0.9983	0.9957	0.9851	0.9367	0.8031	0.5968	0.4363	0.4882	0.7690	0.9686	0.9959	0.9988	(86)
MIT	20.1104	20.2441	20.4698	20.7514	20.9314	20.9914	20.9990	20.9980	20.9613	20.7076	20.3593	20.0913	(87)
Th 2	20.1815	20.1842	20.1869	20.1996	20.2019	20.2130	20.2130	20.2150	20.2087	20.2019	20.1971	20.1921	(88)
util rest of house													
	0.9977	0.9943	0.9802	0.9171	0.7549	0.5276	0.3589	0.4062	0.7006	0.9549	0.9943	0.9984	(89)
MIT 2	18.9825	19.1796	19.5083	19.9116	20.1375	20.2075	20.2126	20.2142	20.1790	19.8610	19.3582	18.9629	(90)
Living area fraction										fLA = Living area / (4) =		0.2904	(91)
MIT	19.3101	19.4888	19.7876	20.1555	20.3681	20.4352	20.4410	20.4419	20.4063	20.1069	19.6489	19.2906	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3101	19.4888	19.7876	20.1555	20.3681	20.4352	20.4410	20.4419	20.4063	20.1069	19.6489	19.2906	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9927	0.9772	0.9159	0.7655	0.5475	0.3814	0.4301	0.7187	0.9529	0.9928	0.9977	(94)
Useful gains	450.1938	510.3272	572.7170	608.4511	546.5177	384.0682	255.0037	267.2568	402.5765	462.7335	435.0102	427.4368	(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													
	1041.1366	1008.2311	915.0171	762.0057	584.9495	387.8701	255.3159	267.9100	421.6416	641.5554	852.3612	1031.9384	(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													
	439.6614	334.5915	254.6712	110.5593	28.5933	0.0000	0.0000	0.0000	0.0000	133.0435	300.4927	449.7492	(98)
Space heating												2051.3621	(98)
Space heating per m2											(98) / (4) =	26.1320	(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 %) 93.4000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2196.3191 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	439.6614	334.5915	254.6712	110.5593	28.5933	0.0000	0.0000	0.0000	0.0000	133.0435	300.4927	449.7492	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	470.7296	358.2350	272.6673	118.3718	30.6138	0.0000	0.0000	0.0000	0.0000	142.4449	321.7266	481.5302	(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													
	201.0394	176.1485	183.2711	162.5522	157.3792	138.6108	132.7997	148.0406	149.6755	170.4354	181.9364	196.3039	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.9677	86.6415	85.8796	84.1039	81.7035	80.3000	80.3000	80.3000	80.3000	84.4357	86.3061	87.0723	(217)
Fuel for water heating, kWh/month													

	231.1657	203.3072	213.4045	193.2755	192.6224	172.6162	165.3795	184.3594	186.3954	201.8524	210.8036	225.4493 (219)
Water heating fuel used												2380.6311 (219)
Annual totals kWh/year												
Space heating fuel - main system												2196.3191 (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)												362.8411 (232)
Total delivered energy for all uses												5014.7913 (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	2196.3191	0.2160	474.4049 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2380.6311	0.2160	514.2163 (264)
Space and water heating			988.6213 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	362.8411	0.5190	188.3145 (268)
Total CO2, kg/m2/year			1215.8608 (272)
Emissions per m2 for space and water heating			12.5939 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3989 (272b)
Emissions per m2 for pumps and fans			0.4959 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5939 * 1.00) + 2.3989 + 0.4959, rounded to 2 d.p.			15.4900 (273)

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.5000 (1b)	x	3.0000 (2b)	=	235.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.5000	(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) =	0.1274	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2774	(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) =	0.2358	(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	0.3006	0.2947	0.2888	0.2594	0.2535	0.2240	0.2240	0.2181	0.2358	0.2535	0.2653	0.2770	(22b)
Effective ac	0.5452	0.5434	0.5417	0.5336	0.5321	0.5251	0.5251	0.5238	0.5278	0.5321	0.5352	0.5384	(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	
Opening Type 1 (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
External Wall 1	45.6000	11.3400	34.2600	0.1500	5.1390			(29a)
Total net area of external elements Aum(A, m2)			45.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.1731			(33)
Party Wall 1			47.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area)		1.8240 (36)
Total fabric heat loss	(33) + (36) =	21.9971 (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	42.3691	42.2328	42.0991	41.4713	41.3539	40.8071	40.8071	40.7058	41.0177	41.3539	41.5915	41.8399	(38)
Heat transfer coeff	64.3662	64.2299	64.0962	63.4684	63.3509	62.8042	62.8042	62.7029	63.0148	63.3509	63.5886	63.8370	(39)
Average = Sum(39)m / 12 =												63.4678	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8200	0.8182	0.8165	0.8085	0.8070	0.8001	0.8001	0.7988	0.8027	0.8070	0.8100	0.8132	(40)
HLP (average)												0.8085	(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		2.4338 (42)
Average daily hot water use (litres/day)		92.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.2026	97.5225	93.8424	90.1623	86.4822	82.8021	82.8021	86.4822	90.1623	93.8424	97.5225	101.2026	(44)
Energy conte	150.0805	131.2614	135.4500	118.0886	113.3088	97.7769	90.6047	103.9702	105.2119	122.6143	133.8431	145.3450	(45)
Energy content (annual)										Total = Sum(45)m =		1447.5553	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.8921	27.8930	28.7831	25.0938	24.0781	20.7776	19.2535	22.0937	22.3575	26.0555	28.4417	30.8858	(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	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	(66)

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

	20.0545	17.8122	14.4859	10.9667	8.1978	6.9209	7.4783	9.7205	13.0469	16.5660	19.3350	20.6119	(67)

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

	216.2770	218.5213	212.8658	200.8259	185.6276	171.3434	161.8007	159.5565	165.2120	177.2519	192.4501	206.7343	(68)

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

	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	35.1689	(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)

	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	(71)

Water heating gains (Table 5)

	42.8657	41.5075	38.6870	34.8525	32.3631	28.8578	25.8783	29.6958	31.0521	35.0209	39.5023	41.5132	(72)

Total internal gains

	338.7040	337.3478	325.5454	306.1519	285.6952	266.6289	254.6641	258.4795	268.8177	288.3456	310.7942	328.3661	(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	
West	11.3400	19.6403	0.6000	0.9000	0.7700	83.3465	(80)

Solar gains	83.3465	163.0434	268.5093	391.6048	479.9264	491.2901	467.7282	401.7716	312.2874	193.4648	103.9233	68.5401	(83)
Total gains	422.0505	500.3912	594.0547	697.7567	765.6216	757.9189	722.3923	660.2511	581.1052	481.8103	414.7175	396.9062	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	84.6933	84.8731	85.0501	85.8914	86.0506	86.7998	86.7998	86.9400	86.5097	86.0506	85.7291	85.3955	
alpha	6.6462	6.6582	6.6700	6.7261	6.7367	6.7867	6.7867	6.7960	6.7673	6.7367	6.7153	6.6930	
util living area	0.9988	0.9959	0.9812	0.9083	0.7346	0.5269	0.3822	0.4360	0.7187	0.9642	0.9967	0.9992	(86)
MIT	20.1683	20.3178	20.5586	20.8288	20.9658	20.9967	20.9997	20.9993	20.9781	20.7521	20.3999	20.1385	(87)
Th 2	20.2361	20.2376	20.2390	20.2460	20.2473	20.2533	20.2533	20.2544	20.2510	20.2473	20.2446	20.2419	(88)
util rest of house	0.9984	0.9946	0.9752	0.8839	0.6857	0.4670	0.3175	0.3658	0.6520	0.9493	0.9954	0.9989	(89)
MIT 2	19.4668	19.6169	19.8553	20.1141	20.2262	20.2519	20.2532	20.2542	20.2398	20.0510	19.7051	19.4420	(90)
Living area fraction									fLA = Living area / (4) =			0.2904	(91)
MIT	19.6705	19.8204	20.0596	20.3217	20.4410	20.4682	20.4700	20.4706	20.4543	20.2546	19.9069	19.6443	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6705	19.8204	20.0596	20.3217	20.4410	20.4682	20.4700	20.4706	20.4543	20.2546	19.9069	19.6443	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9936	0.9736	0.8866	0.6987	0.4844	0.3363	0.3862	0.6708	0.9495	0.9947	0.9986	(94)
Useful gains	421.2082	497.2099	578.3487	618.6111	534.9385	367.1236	242.9537	254.9926	389.8107	457.4684	412.5148	396.3684	(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	989.3429	958.3386	869.1168	724.9151	553.7520	368.5483	243.0530	255.2380	400.4119	611.6301	814.3738	985.9180	(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	422.6922	309.8785	216.3314	76.5389	13.9972	0.0000	0.0000	0.0000	0.0000	114.6963	289.3385	438.6249	(98)
Space heating												1882.0979	(98)
Space heating per m2											(98) / (4) =	23.9758	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	590.3590	464.7507	476.5420	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9868	0.9956	0.9920	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	582.5461	462.6883	472.7204	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	976.8438	933.4751	862.4564	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	283.8943	350.2654	289.9636	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												924.1233	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	70.9736	87.5663	72.4909	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												231.0308	(107)
Space cooling per m2												2.9431	(108)
Energy for space heating												23.9758	(99)
Energy for space cooling												2.9431	(108)
Total												26.9188	(109)
Dwelling Fabric Energy Efficiency (DFEE)												26.9	(109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.5000 (1b)	x	3.0000 (2b)	=	235.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.5000	(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) =	0.1274 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.3774 (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) =	0.3208 (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	0.4090	0.4010	0.3930	0.3529	0.3448	0.3047	0.3047	0.2967	0.3208	0.3448	0.3609	0.3769	(22b)
Effective ac	0.5836	0.5804	0.5772	0.5623	0.5595	0.5464	0.5464	0.5440	0.5514	0.5595	0.5651	0.5710	(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 Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
External Wall 1	45.6000	11.3400	34.2600	0.1800	6.1668			(29a)
Total net area of external elements Aum(A, m2)			45.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.2009			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.8040	(36)
Total fabric heat loss					(33) + (36) =		24.0049	(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	45.3575	45.1051	44.8577	43.6956	43.4782	42.4661	42.4661	42.2787	42.8559	43.4782	43.9180	44.3778	(38)
Heat transfer coeff	69.3623	69.1099	68.8625	67.7005	67.4831	66.4710	66.4710	66.2836	66.8608	67.4831	67.9229	68.3827	(39)
Average = Sum(39)m / 12 =												67.6995	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8836	0.8804	0.8772	0.8624	0.8597	0.8468	0.8468	0.8444	0.8517	0.8597	0.8653	0.8711	(40)
HLP (average)												0.8624	(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												2.4338	(42)
Average daily hot water use (litres/day)												92.0024	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.2026	97.5225	93.8424	90.1623	86.4822	82.8021	82.8021	86.4822	90.1623	93.8424	97.5225	101.2026	(44)
Energy conte	150.0805	131.2614	135.4500	118.0886	113.3088	97.7769	90.6047	103.9702	105.2119	122.6143	133.8431	145.3450	(45)
Energy content (annual)										Total = Sum(45)m =		1447.5553	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.8921	27.8930	28.7831	25.0938	24.0781	20.7776	19.2535	22.0937	22.3575	26.0555	28.4417	30.8858	(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	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	121.6892	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
20.5456 18.2484 14.8406 11.2353 8.3985 7.0904 7.6614 9.9586 13.3664 16.9717 19.8085 21.1166 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
216.2770 218.5213 212.8658 200.8259 185.6276 171.3434 161.8007 159.5565 165.2120 177.2519 192.4501 206.7343 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.1689 35.1689 35.1689 35.1689 35.1689 35.1689 35.1689 35.1689 35.1689 35.1689 35.1689 35.1689 (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)
-97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 (71)
Water heating gains (Table 5)
42.8657 41.5075 38.6870 34.8525 32.3631 28.8578 25.8783 29.6958 31.0521 35.0209 39.5023 41.5132 (72)
Total internal gains
339.1951 337.7839 325.9001 306.4204 285.8960 266.7983 254.8472 258.7176 269.1372 288.7512 311.2676 328.8708 (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
West	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solar gains	68.0663	133.1521	219.2826	319.8106	391.9399	401.2202	381.9780	328.1135	255.0347	157.9962	84.8707	55.9744 (83)
Total gains	407.2614	470.9361	545.1827	626.2310	677.8359	668.0186	636.8252	586.8310	524.1720	446.7474	396.1383	384.8452 (84)

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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	78.5929	78.8799	79.1633	80.5221	80.7816	82.0116	82.0116	82.2435	81.5334	80.7816	80.2585	79.7188
alpha	6.2395	6.2587	6.2776	6.3681	6.3854	6.4674	6.4674	6.4829	6.4356	6.3854	6.3506	6.3146
util living area	0.9990	0.9973	0.9897	0.9506	0.8291	0.6239	0.4576	0.5160	0.8045	0.9789	0.9977	0.9993 (86)
MIT	20.0551	20.1910	20.4222	20.7173	20.9172	20.9891	20.9987	20.9973	20.9498	20.6659	20.3074	20.0367 (87)
Th 2	20.1815	20.1842	20.1869	20.1996	20.2019	20.2130	20.2130	20.2150	20.2087	20.2019	20.1971	20.1921 (88)
util rest of house	0.9987	0.9965	0.9862	0.9342	0.7831	0.5527	0.3767	0.4299	0.7383	0.9691	0.9967	0.9991 (89)
MIT 2	19.3078	19.4456	19.6772	19.9724	20.1477	20.2081	20.2126	20.2143	20.1816	19.9303	19.5728	19.2984 (90)
Living area fraction									fLA = Living area / (4) =			0.2904 (91)
MIT	19.5248	19.6621	19.8936	20.1888	20.3712	20.4349	20.4409	20.4417	20.4047	20.1440	19.7862	19.5128 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5248	19.6621	19.8936	20.1888	20.3712	20.4349	20.4409	20.4417	20.4047	20.1440	19.7862	19.5128 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9984	0.9957	0.9846	0.9340	0.7936	0.5732	0.4003	0.4550	0.7559	0.9682	0.9961	0.9989 (94)
Useful gains	406.6055	468.9203	536.7819	584.8917	537.9201	382.9357	254.8967	266.9929	396.2244	432.5553	394.5945	384.4071 (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	1056.0307	1020.2098	922.3167	764.2542	585.1596	387.8533	255.3114	267.8979	421.5378	644.0564	861.6823	1047.1340 (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	483.1723	370.4666	286.8379	129.1410	35.1461	0.0000	0.0000	0.0000	0.0000	157.3568	336.3032	493.0688 (98)
Space heating												2291.4927 (98)
Space heating per m2											(98) / (4) =	29.1910 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	624.8272	491.8852	503.7550	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9642	0.9862	0.9779	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	602.4561	485.1061	492.6459	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	871.9910	833.7054	776.9576	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	194.0652	259.3579	211.5279	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												664.9509 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	48.5163	64.8395	52.8820	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												166.2377 (107)
Space cooling per m2												2.1177 (108)
Energy for space heating												29.1910 (99)
Energy for space cooling												2.1177 (108)
Total												31.3087 (109)
Target Fabric Energy Efficiency (TFEE)												36.0 (109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.5000 (1b)	x	3.0000 (2b)	=	235.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.5000	(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 q50		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	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211	(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) = 78.2000 (23c)

Effective ac	0.2429	0.2365	0.2365	0.2269	0.2269	0.2142	0.2174	0.2110	0.2142	0.2206	0.2206	0.2301	(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	
Opening Type 1 (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
External Wall 1	45.6000	11.3400	34.2600	0.1500	5.1390			(29a)
Total net area of external elements Aum(A, m2)			45.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.1731			(33)
Party Wall 1			47.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area)		1.8240 (36)
Total fabric heat loss	(33) + (36) =	21.9971 (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	18.8750	18.3796	18.3796	17.6364	17.6364	16.6456	16.8933	16.3979	16.6456	17.1410	17.1410	17.8842	(38)
Heat transfer coeff	40.8721	40.3767	40.3767	39.6335	39.6335	38.6427	38.8904	38.3950	38.6427	39.1381	39.1381	39.8813	(39)
Average = Sum(39)m / 12 =												39.4684	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5207	0.5144	0.5144	0.5049	0.5049	0.4923	0.4954	0.4891	0.4923	0.4986	0.4986	0.5080	(40)
HLP (average)												0.5028	(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	2.4338 (42)
Average daily hot water use (litres/day)	92.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.2026	97.5225	93.8424	90.1623	86.4822	82.8021	82.8021	86.4822	90.1623	93.8424	97.5225	101.2026	(44)
Energy conte	150.0805	131.2614	135.4500	118.0886	113.3088	97.7769	90.6047	103.9702	105.2119	122.6143	133.8431	145.3450	(45)
Energy content (annual)										Total = Sum(45)m =		1447.5553	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5121	19.6892	20.3175	17.7133	16.9963	14.6665	13.5907	15.5955	15.7818	18.3921	20.0765	21.8017	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039	(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

	201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039 (64)

Total per year (kWh/year) = Sum(64)m = 2047.5553 (64)

RHI water heating demand 2048 (64)

Heat gains from water heating, kWh/month

	62.6415	55.1513	57.7768	51.5932	50.4149	44.8396	42.8658	47.3098	47.3117	53.5090	56.8316	61.0669 (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	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	(66)

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

	50.1362	44.5306	36.2147	27.4168	20.4944	17.3022	18.6957	24.3014	32.6172	41.4151	48.3375	51.5297 (67)

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

	322.8015	326.1512	317.7101	299.7401	277.0562	255.7365	241.4936	238.1440	246.5850	264.5550	287.2390	308.5586 (68)

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

	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365 (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)

	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513 (71)

Water heating gains (Table 5)

	84.1956	82.0703	77.6571	71.6573	67.7620	62.2772	57.6153	63.5885	65.7107	71.9207	78.9328	82.0792 (72)

Total internal gains

	560.8455	556.4642	535.2940	502.5263	469.0247	439.0281	421.5168	429.7459	448.6251	481.6030	518.2214	545.8797 (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	
West	11.3400	22.3313	0.6000	0.9000	0.7700	94.7664	(80)

Solar gains	94.7664	166.7552	270.7810	405.8231	483.5553	529.3397	498.6594	438.7021	340.9869	211.1565	121.0525	77.1751	(83)
Total gains	655.6118	723.2194	806.0750	908.3494	952.5800	968.3678	920.1762	868.4480	789.6121	692.7594	639.2739	623.0548	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	133.3767	135.0133	135.0133	137.5448	137.5448	141.0717	140.1732	141.9819	141.0717	139.2860	139.2860	136.6905	
alpha	9.8918	10.0009	10.0009	10.1697	10.1697	10.4048	10.3449	10.4655	10.4048	10.2857	10.2857	10.1127	
util living area	0.9041	0.8269	0.6765	0.4842	0.3328	0.1995	0.1310	0.1415	0.2838	0.5307	0.7791	0.9178	(86)
MIT	20.8979	20.9100	20.9168	20.9194	20.9194	20.9212	20.9208	20.9217	20.9212	20.9202	20.9167	20.8979	(87)
Th 2	20.5019	20.5077	20.5077	20.5164	20.5164	20.5279	20.5250	20.5308	20.5279	20.5221	20.5221	20.5135	(88)
util rest of house	0.8887	0.8066	0.6532	0.4631	0.3127	0.1807	0.1109	0.1207	0.2607	0.5038	0.7544	0.9038	(89)
MIT 2	20.3574	20.3785	20.3863	20.3983	20.3983	20.4125	20.4090	20.4161	20.4125	20.4053	20.4015	20.3692	(90)
Living area fraction									fLA = Living area / (4) =			0.2904	(91)
MIT	20.5144	20.5329	20.5404	20.5496	20.5497	20.5603	20.5576	20.5629	20.5603	20.5549	20.5511	20.5227	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.3644	20.3829	20.3904	20.3996	20.3997	20.4103	20.4076	20.4129	20.4103	20.4049	20.4011	20.3727	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8841	0.8013	0.6476	0.4580	0.3079	0.1760	0.1060	0.1155	0.2550	0.4973	0.7480	0.8994	(94)
Useful gains	579.6033	579.4942	521.9943	416.0565	293.2735	170.4250	97.5224	100.3237	201.3391	344.4750	478.1618	560.3459	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	623.8870	596.8830	524.5086	416.1369	293.2748	170.4250	97.5224	100.3237	201.3392	344.6067	485.3575	609.0951	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	(97a)
Space heating kWh	32.9471	11.6853	1.8707	0.0579	0.0009	0.0000	0.0000	0.0000	0.0000	0.0980	5.1809	36.2694	(98)

Space heating 88.1102 (98)

RHI space heating demand 88 (98)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.5000 (1b)	x	3.0000 (2b)	=	235.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.5000	(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 q50		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) = 78.2000 (23c)

Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(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	
Opening Type 1 (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
External Wall 1	45.6000	11.3400	34.2600	0.1500	5.1390			(29a)
Total net area of external elements Aum(A, m2)			45.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.1731			(33)
Party Wall 1			47.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area) 1.8240 (36)
Total fabric heat loss (33) + (36) = 21.9971 (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	21.1045	20.8568	20.6090	19.3705	19.1227	17.8842	17.8842	17.6364	18.3796	19.1227	19.6182	20.1136	(38)
Heat transfer coeff	43.1016	42.8539	42.6061	41.3676	41.1198	39.8813	39.8813	39.6335	40.3767	41.1198	41.6153	42.1107	(39)

Average = Sum(39)m / 12 = 41.3056 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5491	0.5459	0.5428	0.5270	0.5238	0.5080	0.5080	0.5049	0.5144	0.5238	0.5301	0.5364	(40)
HLP (average)												0.5262	(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 2.4338 (42)
Average daily hot water use (litres/day) 92.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.2026	97.5225	93.8424	90.1623	86.4822	82.8021	82.8021	86.4822	90.1623	93.8424	97.5225	101.2026	(44)
Energy conte	150.0805	131.2614	135.4500	118.0886	113.3088	97.7769	90.6047	103.9702	105.2119	122.6143	133.8431	145.3450	(45)
Energy content (annual)										Total = Sum(45)m =		1447.5553	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5121	19.6892	20.3175	17.7133	16.9963	14.6665	13.5907	15.5955	15.7818	18.3921	20.0765	21.8017	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039	(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
201.0394 177.2888 186.4089 167.4037 164.2677 147.0920 141.5636 154.9291 154.5270 173.5732 183.1582 196.3039 (64)
Total per year (kWh/year) = Sum(64)m = 2047.5553 (64)
Heat gains from water heating, kWh/month
62.6415 55.1513 57.7768 51.5932 50.4149 44.8396 42.8658 47.3098 47.3117 53.5090 56.8316 61.0669 (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	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
50.1362 44.5306 36.2147 27.4168 20.4944 17.3022 18.6957 24.3014 32.6172 41.4151 48.3375 51.5297 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
322.8015 326.1512 317.7101 299.7401 277.0562 255.7365 241.4936 238.1440 246.5850 264.5550 287.2390 308.5586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.0365 52.0365 52.0365 52.0365 52.0365 52.0365 52.0365 52.0365 52.0365 52.0365 52.0365 52.0365 (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)
-97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 -97.3513 (71)
Water heating gains (Table 5)
84.1956 82.0703 77.6571 71.6573 67.7620 62.2772 57.6153 63.5885 65.7107 71.9207 78.9328 82.0792 (72)
Total internal gains
560.8455 556.4642 535.2940 502.5263 469.0247 439.0281 421.5168 429.7459 448.6251 481.6030 518.2214 545.8797 (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	
West	11.3400	19.6403	0.6000	0.9000	0.7700	83.3465	(80)

Solar gains	83.3465	163.0434	268.5093	391.6048	479.9264	491.2901	467.7282	401.7716	312.2874	193.4648	103.9233	68.5401	(83)
Total gains	644.1920	719.5076	803.8033	894.1312	948.9511	930.3182	889.2450	831.5175	760.9126	675.0677	622.1447	614.4198	(84)

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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	126.4777	127.2088	127.9484	131.7793	132.5732	136.6905	136.6905	137.5448	135.0133	132.5732	130.9949	129.4538	
alpha	9.4318	9.4806	9.5299	9.7853	9.8382	10.1127	10.1127	10.1697	10.0009	9.8382	9.7330	9.6303	
util living area	0.9462	0.8845	0.7531	0.5590	0.4030	0.2744	0.1973	0.2193	0.3661	0.6309	0.8705	0.9564	(86)
MIT	20.8761	20.8956	20.9099	20.9160	20.9167	20.9190	20.9190	20.9194	20.9181	20.9161	20.9034	20.8746	(87)
Th 2	20.4761	20.4789	20.4818	20.4962	20.4990	20.5135	20.5135	20.5164	20.5077	20.4990	20.4933	20.4875	(88)
util rest of house	0.9358	0.8673	0.7296	0.5359	0.3813	0.2535	0.1755	0.1962	0.3400	0.6013	0.8497	0.9476	(89)
MIT 2	20.3024	20.3309	20.3513	20.3733	20.3770	20.3948	20.3948	20.3983	20.3877	20.3765	20.3558	20.3118	(90)
Living area fraction									fLA = Living area / (4) =			0.2904	(91)
MIT	20.4690	20.4949	20.5135	20.5309	20.5338	20.5470	20.5470	20.5497	20.5417	20.5332	20.5148	20.4753	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.3190	20.3449	20.3635	20.3809	20.3838	20.3970	20.3970	20.3997	20.3917	20.3832	20.3648	20.3253	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9323	0.8626	0.7241	0.5307	0.3763	0.2485	0.1703	0.1906	0.3339	0.5944	0.8441	0.9445	(94)
Useful gains	600.6111	620.6776	582.0225	474.4804	357.0609	231.1920	151.4296	158.5207	254.0358	401.2828	525.1461	580.3242	(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	690.4461	661.8748	590.6720	474.9369	357.0758	231.1921	151.4296	158.5208	254.0387	402.2847	552.0199	679.0464	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	(97a)
Space heating kWh	66.8373	27.6845	6.4352	0.3287	0.0110	0.0000	0.0000	0.0000	0.0000	0.7454	19.3492	73.4493	(98)

Space heating 194.8406 (98)
Space heating per m2 (98) / (4) = 2.4820 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 88.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 219.1682 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	66.8373	27.6845	6.4352	0.3287	0.0110	0.0000	0.0000	0.0000	0.0000	0.7454	19.3492	73.4493	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	75.1825	31.1411	7.2387	0.3697	0.0124	0.0000	0.0000	0.0000	0.0000	0.8385	21.7651	82.6201	(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

201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039 (64)

Efficiency of water heater											78.8000 (216)
(217)m	81.0989	80.0280	79.0999	78.8175	78.8006	78.8000	78.8000	78.8000	78.8000	78.8383	79.6648	81.3154 (217)

Fuel for water heating, kWh/month

185.0587	164.0193	171.2392	149.8252	143.7918	124.0823	114.9805	131.9418	133.5176	155.5263	168.0079	178.7422 (219)

Water heating fuel used 1820.7330 (219)
Annual totals kWh/year
Space heating fuel - main system 219.1682 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)
mechanical ventilation fans (SFP = 0.6875) 197.5256 (230a)
central heating pump 30.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler 600.0000 (230f)
Total electricity for the above, kWh/year 827.5256 (231)
Electricity for lighting (calculated in Appendix L) 354.1687 (232)
Total delivered energy for all uses 3221.5955 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	219.1682	3.4800	7.6271	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1820.7330	3.4800	63.3615	(247)
Mechanical ventilation fans	197.5256	13.1900	26.0536	(249)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Electric keep-hot	600.0000	13.1900	79.1400	(249)
Energy for lighting	354.1687	13.1900	46.7148	(250)
Additional standing charges			120.0000	(251)
Total energy cost			346.8540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1796 (257)
SAP value		83.5448
SAP rating (Section 12)		84 (258)
SAP band		B

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	219.1682	0.2160	47.3403	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1820.7330	0.2160	393.2783	(264)
Space and water heating			440.6187	(265)
Pumps and fans	827.5256	0.5190	429.4858	(267)
Energy for lighting	354.1687	0.5190	183.8135	(268)
Total kg/year			1053.9180	(272)
CO2 emissions per m2			13.4300	(273)
EI value			88.5648	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.75) / 0.8890 = 4.766, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.75) / 0.8890 = 0.2958, stars = 4
Water heating energy efficiency	3.48 / 0.7941 = 4.383, stars = 4
Water heating environmental impact	0.216 / 0.7941 = 0.2720, stars = 4

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	78.5000 (1b)	x	3.0000 (2b)	=	235.5000 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 78.5000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	235.5000	(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 q50		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	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1339	0.1275	0.1275	0.1179	0.1179	0.1052	0.1084	0.1020	0.1052	0.1116	0.1116	0.1211	(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) = 78.2000 (23c)

Effective ac	0.2429	0.2365	0.2365	0.2269	0.2269	0.2142	0.2174	0.2110	0.2142	0.2206	0.2206	0.2301	(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	
Opening Type 1 (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
External Wall 1	45.6000	11.3400	34.2600	0.1500	5.1390			(29a)
Total net area of external elements Aum(A, m2)			45.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.1731			(33)
Party Wall 1			47.0000	0.0000	0.0000			(32)
Party Floor 1			78.5000					(32d)
Party Ceilings 1			78.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.040 * total exposed area)		1.8240 (36)
Total fabric heat loss	(33) + (36) =	21.9971 (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	18.8750	18.3796	18.3796	17.6364	17.6364	16.6456	16.8933	16.3979	16.6456	17.1410	17.1410	17.8842	(38)
Heat transfer coeff	40.8721	40.3767	40.3767	39.6335	39.6335	38.6427	38.8904	38.3950	38.6427	39.1381	39.1381	39.8813	(39)
Average = Sum(39)m / 12 =												39.4684	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5207	0.5144	0.5144	0.5049	0.5049	0.4923	0.4954	0.4891	0.4923	0.4986	0.4986	0.5080	(40)
HLP (average)												0.5028	(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	2.4338 (42)
Average daily hot water use (litres/day)	92.0024 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.2026	97.5225	93.8424	90.1623	86.4822	82.8021	82.8021	86.4822	90.1623	93.8424	97.5225	101.2026	(44)
Energy conte	150.0805	131.2614	135.4500	118.0886	113.3088	97.7769	90.6047	103.9702	105.2119	122.6143	133.8431	145.3450	(45)
Energy content (annual)										Total = Sum(45)m =		1447.5553	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5121	19.6892	20.3175	17.7133	16.9963	14.6665	13.5907	15.5955	15.7818	18.3921	20.0765	21.8017	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039	(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
201.0394 177.2888 186.4089 167.4037 164.2677 147.0920 141.5636 154.9291 154.5270 173.5732 183.1582 196.3039 (64)
Total per year (kWh/year) = Sum(64)m = 2047.5553 (64)
Heat gains from water heating, kWh/month
62.6415 55.1513 57.7768 51.5932 50.4149 44.8396 42.8658 47.3098 47.3117 53.5090 56.8316 61.0669 (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	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	146.0270	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.1362	44.5306	36.2147	27.4168	20.4944	17.3022	18.6957	24.3014	32.6172	41.4151	48.3375	51.5297	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.8015	326.1512	317.7101	299.7401	277.0562	255.7365	241.4936	238.1440	246.5850	264.5550	287.2390	308.5586	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	52.0365	(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)													
	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	-97.3513	(71)
Water heating gains (Table 5)													
	84.1956	82.0703	77.6571	71.6573	67.7620	62.2772	57.6153	63.5885	65.7107	71.9207	78.9328	82.0792	(72)
Total internal gains													
	560.8455	556.4642	535.2940	502.5263	469.0247	439.0281	421.5168	429.7459	448.6251	481.6030	518.2214	545.8797	(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	
West	11.3400	22.3313	0.6000	0.9000	0.7700	94.7664	(80)

Solar gains	94.7664	166.7552	270.7810	405.8231	483.5553	529.3397	498.6594	438.7021	340.9869	211.1565	121.0525	77.1751	(83)
Total gains	655.6118	723.2194	806.0750	908.3494	952.5800	968.3678	920.1762	868.4480	789.6121	692.7594	639.2739	623.0548	(84)

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7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	133.3767	135.0133	135.0133	137.5448	137.5448	141.0717	140.1732	141.9819	141.0717	139.2860	139.2860	136.6905	
alpha	9.8918	10.0009	10.0009	10.1697	10.1697	10.4048	10.3449	10.4655	10.4048	10.2857	10.2857	10.1127	
util living area													
	0.9041	0.8269	0.6765	0.4842	0.3328	0.1995	0.1310	0.1415	0.2838	0.5307	0.7791	0.9178	(86)
MIT	20.8979	20.9100	20.9168	20.9194	20.9194	20.9212	20.9208	20.9217	20.9212	20.9202	20.9167	20.8979	(87)
Th 2	20.5019	20.5077	20.5077	20.5164	20.5164	20.5279	20.5250	20.5308	20.5279	20.5221	20.5221	20.5135	(88)
util rest of house													
	0.8887	0.8066	0.6532	0.4631	0.3127	0.1807	0.1109	0.1207	0.2607	0.5038	0.7544	0.9038	(89)
MIT 2	20.3574	20.3785	20.3863	20.3983	20.3983	20.4125	20.4090	20.4161	20.4125	20.4053	20.4015	20.3692	(90)
Living area fraction									fLA = Living area / (4) =			0.2904	(91)
MIT	20.5144	20.5329	20.5404	20.5496	20.5497	20.5603	20.5576	20.5629	20.5603	20.5549	20.5511	20.5227	(92)
Temperature adjustment												-0.1500	
adjusted MIT	20.3644	20.3829	20.3904	20.3996	20.3997	20.4103	20.4076	20.4129	20.4103	20.4049	20.4011	20.3727	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8841	0.8013	0.6476	0.4580	0.3079	0.1760	0.1060	0.1155	0.2550	0.4973	0.7480	0.8994	(94)
Useful gains	579.6033	579.4942	521.9943	416.0565	293.2735	170.4250	97.5224	100.3237	201.3391	344.4750	478.1618	560.3459	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	623.8870	596.8830	524.5086	416.1369	293.2748	170.4250	97.5224	100.3237	201.3392	344.6067	485.3575	609.0951	(97)
Month fracti	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	(97a)
Space heating kWh													
	32.9471	11.6853	1.8707	0.0579	0.0009	0.0000	0.0000	0.0000	0.0000	0.0980	5.1809	36.2694	(98)
Space heating												88.1102	(98)
Space heating per m2											(98) / (4) =	1.1224	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 88.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 99.1116 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	32.9471	11.6853	1.8707	0.0579	0.0009	0.0000	0.0000	0.0000	0.0000	0.0980	5.1809	36.2694	(98)
Space heating efficiency (main heating system 1)													
	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)													
	37.0609	13.1443	2.1042	0.0652	0.0011	0.0000	0.0000	0.0000	0.0000	0.1102	5.8277	40.7980	(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

201.0394	177.2888	186.4089	167.4037	164.2677	147.0920	141.5636	154.9291	154.5270	173.5732	183.1582	196.3039 (64)

Efficiency of water heater 78.8000 (216)

(217)m 80.0811	79.3575	78.8890	78.8031	78.8001	78.8000	78.8000	78.8000	78.8000	78.8050	79.0470	80.2213 (217)

Fuel for water heating, kWh/month

187.4107	165.4051	171.6968	149.8527	143.7928	124.0823	114.9805	131.9418	133.5176	155.5920	169.3209	181.1800 (219)

Water heating fuel used 1828.7734 (219)
Annual totals kWh/year
Space heating fuel - main system 99.1116 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)
mechanical ventilation fans (SFP = 0.6875) 197.5256 (230a)
central heating pump 30.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler 600.0000 (230f)
Total electricity for the above, kWh/year 827.5256 (231)
Electricity for lighting (calculated in Appendix L) 354.1687 (232)
Total delivered energy for all uses 3109.5793 (238)

10a. Fuel costs - using BEDF prices (387)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	99.1116	4.3200	4.2816 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.7734	4.3200	79.0030 (247)
Mechanical ventilation fans	197.5256	15.3200	30.2609 (249)
Pumps and fans for heating	30.0000	15.3200	4.5960 (249)
Electric keep-hot	600.0000	15.3200	91.9200 (249)
Energy for lighting	354.1687	15.3200	54.2586 (250)
Additional standing charges			95.0000 (251)
Total energy cost			359.3202 (255)

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	99.1116	0.2160	21.4081 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.7734	0.2160	395.0151 (264)
Space and water heating			416.4232 (265)
Pumps and fans	827.5256	0.5190	429.4858 (267)
Energy for lighting	354.1687	0.5190	183.8135 (268)
Total kg/year			1029.7225 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	99.1116	1.2200	120.9161 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.7734	1.2200	2231.1036 (264)
Space and water heating			2352.0197 (265)
Pumps and fans	827.5256	3.0700	2540.5037 (267)
Energy for lighting	354.1687	3.0700	1087.2978 (268)
Primary energy kWh/year			5979.8211 (272)
Primary energy kWh/m2/year			76.1761 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 89

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered

Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 387 TEST (20 Jan 2016)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£181	£181	£0
Mains gas	£178	£178	£0
Space heating	£134	£134	£0
Water heating	£171	£171	£0
Lighting	£54	£54	£0
Total cost of fuels	£359	£359	£0
Total cost of uses	£359	£359	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	76 kWh/m²	76 kWh/m²	0 kWh/m²

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	310.86 (P1)
Transmission heat loss coefficient	22.00 (37)
Summer heat loss coefficient	332.86 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
West	11.3400	117.5071	0.6000	0.9000	0.9000	582.8487
total:						582.8487

	Jun	Jul	Aug	
Solar gains	619	583	513	(P3)
Internal gains	436	419	427	
Total summer gains	1055	1001	940	(P5)
Summer gain/loss ratio	3.17	3.01	2.82	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	19.42	21.16	20.87	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight