2 Templewood Avenue London, EC1M 4AJ

Energy Statement

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1. Executive Summary

This Energy Statement has been prepared to accompany the planning application for the proposed new development at 2 Templewood Avenue, NW3 7XA. It sets out the energy strategy for the site in compliance with the London Plan and the London Borough of Camden requirements for environmental sustainability and efficient energy design.

The Energy Statement contained herein describes the recommended solution to service the proposed development in the most energy efficient and sustainable manner as stipulated by the Greater London Authority (GLA) and The London Plan 2021.

SAP 10 Carbon Factors have been used for the assessment in line with GLA policy, and a SAP 10 worksheet has been provided in Appendix 7 and 8 for the refurbished existing building and new extension.

The existing building will be refurbished and will therefore be assessed against Part L1B of the building regulations. As part of the refurbishment works the existing glazing will be replaced with new. The existing MEP systems are to be stripped out, replaced and upgraded. This includes installation of a highly efficient air source heat pump system providing the space heating and cooling for the entirety of the proposed scheme.

The new extension on the ground floor is the only new build element of the development and will be assessed against Part L1A.

Refurbished Building Carbon Emissions

The table below shows the carbon emissions after each stage of the hierarchy for the existing refurbished building.

	Carbon dioxide e domestic (Tonnes of CC	missions for non- buildings)2 per annum)
	Regulated	Unregulated
Baseline: Part L 2013 of the Building		
Regulations Compliant Development	33.4	12.4
After energy demand reduction	19	12.4
After heat network / CHP	19	12.4
After renewable energy	6.7	12.4

Table 1 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings (refurbished building)

The table below shows the different savings at each stage of the energy hierarchy.

	Regulated non- dioxide	domestic carbon savings
	(Tonnes of CO₂ per annum)	(%)
Savings from energy demand reduction	14.4	43.2%
Savings from heat network / CHP	0.0	0.0%
Savings from renewable energy	12.22	36.6%
Cumulative on site savings	26.63	79.81%

Table 2 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings (refurbished building)

Note that the 'Baseline' for existing building is derived using notional values as per Appendix 4 of the GLA Energy Assessment Guidance.

Through energy efficiency techniques as well as the implementation of renewable technologies as mentioned above, the proposed development will reduce annual carbon emissions by 26.63 tonnes of CO₂. This accounts for a reduction of approximately 79.81 % of the proposed refurbishment's expected regulated energy carbon emissions.

There is a saving of 12.22 tonnes of CO₂, equivalent to 36.6% and therefore above the London Borough of Camden's minimum target of 20%.



Figure 1 – The Non-Domestic Energy Hierarchy (refurbishment)

dsa Ref: 21.17130.00



The table below shows the different savings at each stage of the energy hierarchy.

New Extension Carbon Emissions

The table below shows the carbon emissions after each stage of the hierarchy for the new extension.

	Carbon dioxide e domestic (Tonnes of CC	missions for non- buildings)2 per annum)
	Regulated	Unregulated
Baseline: Part L 2013 of the Building		
Regulations Compliant Development	0.24	1.49.
After energy demand reduction	0.24	1.49
After heat network / CHP	0.24	1.49
After renewable energy	0.14	1.49

Table 3 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings (new extension)

	Regulated non-o dioxide	lomestic carbon savings
	(Tonnes of CO₂ per annum)	(%)
Savings from energy demand reduction	0.00	0.0%
Savings from heat network / CHP	0.00	0.0%
Savings from renewable energy	0.10	42.1%
Cumulative on site savings	0.10	42.11%

Table 4 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings (new extension)

Through energy efficiency techniques as well as the implementation of renewable technologies as mentioned above, the proposed development will reduce annual carbon emissions by 0.1 tonnes of CO₂. This accounts for a reduction of approximately 42.11% of the proposed extension's expected regulated energy carbon emissions.

Despite not needing to comply with the 35% reduction in CO₂ emissions for major developments, the proposed development exceeds The London Plan 2021 target.



Figure 2 – The Non-Domestic Energy Hierarchy (new extension)



2. Introduction

This energy statement examines the potential for reduction of carbon emissions for the proposed development at 2 Templewood Avenue, London, NW7 7XA, and has been compiled to accompany the planning application.

The development proposals, designed by Marek Wojciechowski Architects, consist of a refurbishment of existing building and the erection of a lower ground floor extension.

This report follows the Greater London Authority's (GLA) planning guidance for residential developments.

The London Borough of Camden and The London Plan 2021 have specific requirements with regards to improvements on carbon emissions in comparison to 2013 Building Regulations Part L.

- In line with London Borough of Camden's Core Strategy and Camden Planning Guidance developments of more than 500sqm must submit an energy statement demonstrating how carbon emissions will be reduced.
- In line with London Borough of Camden's Core Strategy and Camden Planning Guidance there must be a 20% reduction in CO2 from onsite renewables for the existing refurbished building (after all other energy efficiency measures have been incorporated).
- For developments consisting of a refurbishment with a new build extension, the CO2 savings for the new and refurbished elements should be presented separately within the energy strategy. The new build elements should be assessed in line with the methodology for new build development and will be expected to comply with London Plan policy (note the new build element of the project is a minor development and required only to pass part L1A).
- The existing building's total floor area is > 1000m2 and the proposed development includes an extension, therefore the development is subject to consequential improvements as defined in Part L1B.

3. Legislation and Policy Framework

Approved Document Part L 2013

Approved Document Part L 2013 provides requirements and guidance on the Conservation of Fuel and Power. The new building elements (i.e. the extension) must meet or better the Target Emissions Rate (TER) of a notional building as specified by Part L 2013 building regulations approved software. In order to provide evidence of this, a Part L 2013 calculation is carried out both on a notional building with fixed parameters and the actual building.

The London Plan 2021

The London Plan 2021 is the overall strategic plan for London setting out an integrated economic, environmental, transport and social framework for the development of the capital to 2036. The Local plans of London Boroughs need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

The extension is a classed as a minor development and is therefore not required to meet the GLA's carbon emission reduction of 35%.

London Borough of Camden- Camden Local Plan 2017

The Local Plan seeks to minimise Camden's contribution to climate change and ensure that the borough develops in a way which respects environmental limits and improves quality of life. Its main aims and requirements for developments are summarised as follows: • Adapt to Camden's growing population and social change

- Supply and cost of housing in the borough
- Maintaining a successful economy and improving opportunities
- Inequalities
- Health and wellbeing
- Improving transport
- Quality of the environment
- Crime and safety

Additional London borough of Camden documentation providing further information on core strategy aims and requirements:

Energy Efficiency and Adaptation Camden Planning Guidance 2021

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4. Establishing CO₂ Emissions for a Part L Compliant Development

Part L 2013 calculations have been performed by using approved thermal modelling software (JPA Designer) in order to predict the carbon emissions of the proposed development. The development has been assessed as two entities; the existing refurbished building and the new extension.

To establish the regulated CO₂ emissions for a Part L 2013 compliant development, it has been assumed that the heating for the notional building will be provided by gas boilers and any active cooling will be provided by electrically powered equipment, in line with GLA guidance on preparing Energy Statements.

Existing Building

For the refurbished existing building, notional values have been used for the building fabric in line with GLA Energy Assessment Guidance Appendix 4. A SAP 10 Worksheet has been provided in Appendix 5.

Table 5 below shows the carbon emission rate for the existing portion of the development to meet 2013 Building Regulations (i.e. the Target Emission Rate based on SAP 10).

Baseline Emission Rate for Non-Domestic		
DER (Existing building)	9.16	kgCO ₂ /m ²

Table 5 – Annual carbon emissions for the existing portion of the development

New Extension

SAP 10 Carbon Factors have been used for the assessment in line with GLA policy, and a SAP 10 worksheet has been provided in Appendix 4.

Table 6 below shows the carbon emission rate for the proposed development required to meet 2013 Building Regulations (i.e. the Target Emission Rate based on SAP 10).

Target Emission R	ate for Non-Do	mestic
TER (Existing building)	9.16	kgCO ₂ /m ²

Table 6 – Annual carbon emissions for the extension



5. Energy Efficiency Measures and Sustainability Strategies - 'Be Lean'

The energy efficiency measures for the Proposed Development will be maximised through the use of passive design features including efficient building fabric, improved building air tightness and efficient lighting. These design features will minimise the active cooling and heating demand as far as possible.

Building fabric U-values

The thermal efficiency of the building elements affects the heating and cooling demand of the proposed development (and thereby affects the demand for natural gas and electricity). Below is a list of the building regulations, and the more stringent target U-values for the new thermal elements (within extension) of this development:

Element	Limiting Factors for Building Regulations (W/m ² K)	Concurrent Notional Building Specifications (W/m ² K)	Proposed for new elements of existing building (W/m ² K)	Proposed for new extension elements (W/m ² K)
Wall	0.35	0.25	-	0.25
Floor	0.25	0.22	-	0.22
Roof	0.25	0.18	0.18	0.18
Windows (overall)	2.20	1.60	1.30	1.30
Windows (g-Value)	N/A	0.40	0.36	0.36

Table 7 – U-Values for the proposed development comparison to Part L 2013

The walls and flooring of the refurbished building will be left as existing and have therefore been modelled using notional values under the GLA Energy Assessment Guidance Appendix 4.

Thermal Bridging

Existing thermal bridging within the extension is to be retained.

All thermal bridging will be mitigated through the use of accredited construction details within the new extension, or bespoke arrangements to ensure the fabrics efficiency is not compromised.

Air permeability

The air permeability (i.e. the tightness to the outdoor elements) of a building affects the heating and cooling demand of the building (and thereby affects the demand for natural gas and electricity).

The air permeability of the refurbished building will be left as existing.

The new extension on this development will achieve an air permeability which will be significantly more energy efficient than required by building control. The target air permeability rate for the new extension to this development is $3.0 \text{ m}^3/\text{h/m}^2$.

The limiting factors which could make it difficult to achieve this air permeability rate are the junctions between the windows, and openings such as external doors. The developer and the design team will include

this air permeability target in a detailed specification so that the contractor is required to build an airtight building in order to achieve the target set above.

HVAC systems

The efficiency of the mechanical systems has a significant impact on the amount of energy which the proposed development consumes in order to deliver the required heating and cooling loads. Highly efficient equipment will be specified for this development, and wherever practically possible equipment from the government's Energy Technology List will be selected.

Both the refurbished existing building and the new extension will be served by the same MEP plant. A highly efficient air source heat pump (ASHP) system has been proposed for the building with integral heat recovery and high SCOPs / SEERs. Domestic hot water requirements for the proposed development will be met using a high efficiency gas boiler.

All pumps and fans shall be selected with high efficiency variable drive motors.

Lighting systems

Lighting represents a significant portion of the annual carbon emissions of this development. In order to maximise the natural light and reduce the energy consumed in order to generate artificial light, high efficiency LED luminaires will be used throughout.



6. Cooling and Overheating

6.1. The Cooling Hierarchy

Minimising Internal Heat Generation through Energy Efficient Design

The servicing infrastructure will be designed to minimise heat gains within occupied spaces, and utilising highly efficient pipe insulation to minimise distribution heat losses.

Reducing the Amount of Heat Entering the Building in Summer

Through design development of the new extension's façade the amount of heat entering the building through the glazing has been significantly reduced, along with providing more energy efficient fabrics to all floors. The glazing on the refurbished existing building will not be increased.

The design of the proposed development will maximise the use of thermal mass where feasible to reduce peaks in cooling and heating requirements.

Passive Ventilation

All windows on both the new extension and refurbished existing building will be openable to allow for purge ventilation.

6.1. Overheating Risk Analysis

An overheating assessment within SAP has been carried out for both the new extension and refurbished existing building, incorporating the use of openable windows, cross ventilation and the VRF cooling system which shows the spaces are not at risk of overheating.

6.2. Active Cooling

Although energy efficient design has been one of the key principles for the proposed developments, due to the nature of a high end residential scheme, cooling will be provided.



7. Decentralised Energy (DE) Networks – 'Be Clean'

7.1. District Heating

System Description

The London Plan's Energy Hierarchy and LBI's Supplementary Planning Guidance encourages developments to connect to existing decentralised energy (DE) networks where these exist or are proposed in the vicinity of the scheme. These systems combine the energy demands and supplies of nearby developments to more efficiently serve the building service requirements of the community as a whole.

Technical Viability

The figure below is an excerpt from the London Heat Map highlighting any existing and proposed DE networks. The red pin indicates the location of the proposed development 2 Templewood Avenue, and shows that the site is currently outside the reach of any existing/proposed district heating networks.



Figure 3 – London Heat Map showing that the proposed development is outside the reach of any existing or proposed heat networks

Existing proposed site sits outside the catchment area of any existing or proposed district heating networks.

Therefore, connecting to an existing DE network is not a feasible solution for this development.



7.2. Combined Heat and Power (CHP)

CHP Description

Combined Heat and Power, or CHP as it is more commonly referred to, is the simultaneous generation of usable heat and power in a single process. In other words, it utilises the heat produced in electricity generation rather than releasing it wastefully into the atmosphere. In typical conventional power generation, much of the total energy input is wasted. CHP systems, where the heat produced in electricity generation is put to good use, can reach efficiencies up to 85%. A CHP can provide a secure and highly efficient method of generating electricity and heat at the point of use. Due to utilisation of heat from electricity generation and the avoidance of transmission losses because electricity is generated on site, CHP achieves a significant reduction in primary energy usage compared with power stations and heat only boilers. Typically a good CHP scheme can deliver an increase of around 20% in efficiency against the separate energy system it replaces and can result in savings of up to 50% of the annual CO₂ emissions from the site.

Feasibility

For a CHP to be practical for a development there should be a steady demand for hot water and electricity. A CHP should be designed to cope with 100% of the heat base load of a building (i.e. a load that is continuous and steady all year round), with boilers to supply the peaks in demand during the colder months of the year. The only demand for heat that remains constant year round is domestic hot water.

Single family dwellings do not have a constant demand for domestic hot water to enable the use of a CHP system.

The decarbonisation of the UK electrical grid will also reduce the benefits of carbon reduction of a gas fired CHP plant, whilst still coming at a premium in installation cost and plant space.

A CHP is therefore not a feasible solution for this development.

The tables below shows the savings on regulated carbon emissions after the 'Be Clean' stage of the energy hierarchy for the proposed development.

Existing Building

	Regulated non-d dioxide s	omestic carbon savings
	(Tonnes of CO ₂ per annum)	(%)
Savings from energy demand reduction	14.4	43.2%
Savings from heat network / CHP	0	0.0

Table 12 – Non Domestic Carbon emissions after the Be Clean Stage

New Extension

	Regulated non-de dioxide s	omestic carbon savings
	(Tonnes of CO ₂ per annum)	(%)
Savings from energy demand reduction	0.0	0.0%
Savings from heat network / CHP	0.0	0.0%

Table 13 – Non Domestic Carbon emissions after the Be Clean Stage



Bio-fuel CHP unit

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Typical CHP process



8. Low & Zero Carbon Technologies Feasibility Study – 'Be Green'

The definition of 'Renewable and low carbon energy' used in the National Planning Policy Framework is:

"Includes energy for heating and cooling as well as generating electricity. Renewable energy covers those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of the oceans, from the sun and also from biomass and deep geothermal heat. Low carbon technologies are those that can help reduce emissions (compared to conventional use of fossil fuels)."

This definition has been widened by the UK Government by the use of the term 'Low or Zero Carbon Energy Technologies" (LZCs) within the revised Approved Document L. The carbon emissions reduction from applying these technologies when compared to the conventional technologies has also been accepted as 'renewable energy' under the GLA's Energy Hierarchy.

In the following pages, the technical viability, indicative costs, and contribution towards the carbon emissions reduction are considered for the following systems:

- **1.** Wind Turbines;
- 2. Ground Source Heat Pumps (GSHPs);
- 3. Air Source Heat Pumps (ASHPs);
- 4. Solar Photovoltaic (PV) panels; and
- 5. Solar Water Heating Systems.



8.1. Wind Turbines

System Description

Wind turbines are modern, high-technology descendants of the old technology windmills that have been around for centuries. The difference is that now the kinetic energy of the wind is used to turn a turbine to generate electricity as opposed to moving water or turning a grist mill wheel. There are two types of wind turbine, one being the horizontal-axis variety which faces up-stream or downstream of the wind and where the rotational movement of the blade is connected to a generator to create electricity. The other type is the vertical-axis design, which is the most flexible type of wind turbine and is best suited for the more urban sites as it operates in any wind direction.

Summary of Factors Affecting Wind Tu		
Land Use	Foundation unless building mou	
Planning Issues	Potentially a problem with gain	
Noise	Problematic	
Tariffs	FiT 8.52 (5.57 for export) pence	



Horizontal-axis wind turbine

Vertical Axis Wind Turbine

Technical Viability

One of the largest issues with wind turbines is the available wind speed. Apart from the direction, approximately 4.0 m/s wind velocity is required as a minimum before the turbine will begin to generate electricity. Additionally, if this option were used for this development, the building would need wind turbines protruding from the roof. Wind turbines in urban centres can generate acoustic complaints from both the occupants and the surrounding commercial / residential units.

Wind turbines are therefore not recommended for this development.



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ing planning permission

/kWh

8.2. Ground Source Heat Pumps

System Description

Ground source heat pumps take advantage of the stable ground temperatures of 10-12°C to provide energy efficient heating and cooling to a building. The energy flow is driven by the temperature difference between the ground and the circulating fluid which can be used to reject heat into the ground and deliver heating or cooling to the proposed development.







System Schematic

Horizontal Pipe

Vertical Pipe Drilling Rig

Technical Viability

Proposals to install a Closed Loop Ground Source Heat Pump and/or a direct borehole system to satisfy a large percentage of the heating demand for the proposed development could be a cost-effective option. This system also offers the option of providing "free-cooling" to its occupants via the use of the constant 12°C deep-earth temperature.

The existing building and lack of adjacent space to the site prohibit a successful GSHP installation. Furthermore an ASHP with simultaneous heating and cooling will prove to be more cost effective than a GSHP.

A GSHP system is therefore not a viable solution for the proposed development.

Summary of Factors Affecting Ground Source Heat Pumps

Land Use	Below ground, minimal impact
Planning Issues	Minimal
Noise	Minimal noise in plant room
	The Non-Domestic Renewable (NDRHI) in Great Britain closed
	end of midnight on 31 March 2 writing, a replacement scheme
Tariffs	established.



t on future use of land

e Heat Incentive Scheme d to new applicants at the 2022. At the time of he has not been

8.3. Air Source Heat Pumps

System Description

Air source heat pumps use the atmosphere as a renewable source of heat to generate heating and cooling with a refrigeration machine. The heating and cooling is accomplished by moving refrigerant through the heat pump's various indoor and outdoor coils and components. A compressor, condenser, expansion valve and evaporator are used to change states of the refrigerant from liquid to hot gas and then back from gas to liquid. The refrigerant is used to heat or cool coils in a fan coil unit located in the conditioned space. An external heat exchanger is used to heat or cool the refrigerant by absorbing heat from or rejecting heat to the outside air. This use of outside air is considered renewable, and has lead to the term "Air Source" Heat Pump.





Integrated Heating, Cooling, and DHW ASHP Configuration

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Combined 4-Pipe Heat Pump Unit

Technical Viability

The Coefficient of Performance (COPs) achievable with modern ASHPs means that these units will produce about 80% of its energy output from the air, a renewable and clean energy source. This technology can benefit from the Renewable Heat Incentive.

Air sourced heating could provide a large proportion of the proposed development's annual energy demand without a large space requirement for mounting equipment.

Due to the high seasonal coefficient of performance generated (SCOP=3.88, an ASHP system will be more efficient than other heating systems. The table below demonstrates that the proposed Air Source Heat Pump system will produce approximately 71% less CO_2 emissions per kWh of heat generated than a conventional gas boiler system.

	Boiler (natural gas)	Boiler (electric)	ASHP (electric)
Coefficient of Performance (COP)	89%	1	3.88
SAP 10 Carbon Factor (kgCO ₂ /kWh)	0.21	0.233	0.233
Carbon Emissions (per kWh of heat generated)	0.236	0.233	0.060

Table 14 – Comparison of ASHP vs Conventional Gas Boiler

Summary of Factors Affecting Air Sourc		
Land Use	Requires external plant area	
Planning Issues	Potential issue if located in visil	
Noise	Noise issues will be evident	
	The Non-Domestic Renewable I (NDRHI) in Great Britain closed end of midnight on 31 March 20 writing, a replacement scheme	
Tariffs	established.	

Air source heat pumps providing the space heating and cooling for the development are therefore a viable option for the Proposed Development.



e Heat Pumps

ble position.

Heat Incentive Scheme to new applicants at the 2021. At the time of has not been

8.4. Solar Photovoltaic Panels

System Description

Solar photovoltaics panels (PVs) convert energy from daylight into electricity using a semiconductor material such as silicon. When light hits the semiconductor, the energy in the light is absorbed, 'exciting' the electrons in the semiconductor so that they break free from their atoms. This allows the electrons to flow through the semiconductor material producing electricity.





Rooftop Installation

PV Cells

Solar Glass

Technical Viability

Solar PV panels are best mounted at an incline with a southerly orientation, although orientations between south-east and south-west are viable. This technology can benefit from the Smart Export Guarantee tariff.

The proposed development has very little appropriate roof space for the PV.

Photovoltaics are therefore not a viable solution for the Proposed Development.

Summary of Factors Affecting Photovo		
Land Use	No land use (roof mounted)	
	Potential issue if located in visi	
Planning Issues	located in discrete position.	
Noise	None	
	Historic – FiT 2.38 (4.91 for exp	
	Current – Smart Export Guarar	
	effect 1 st January 2020, variabl	



ltaics

ible position. Can be

port) pence/kWh. ntee (SEG) came into le payment rate, contract

8.5. Solar Water Heating

System Description

Solar Water Heating systems convert solar radiation to heat carried by water for use in space heating or the provision of domestic hot water. Solar water heating systems normally operate with a back-up source of heat, such as gas condensing boilers. The solar water heating pre-heats the incoming water, which is topped-up by the back-up heat source when there is insufficient solar energy to reach the target water temperature.







System Diagram

Evacuated Tube Collector

Glazed Flat Panel Collector

Technical Viability

Solar Collectors perform most efficiently when mounted with a southerly orientation at an incline between 15 and 60 degrees, although orientations between south-east and south-west are viable. As solar radiation is greatest in the summer when demand is lowest, it is not possible to meet the entire annual demand by increasing the size of the system. It is therefore recommended that a solar hot water system meet no more than 65% of the domestic hot water demand.

The proposed development has very little appropriate roof space for installation of solar thermal panels.

Therefore the installation of Solar Thermal panels is not a viable solution.

Summary of Factors Affecting Solar Hot		
Land Use	No land use	
Planning Issues	Potential issue if visible. Can be location	
Noise	None	
	The Non-Domestic Renewable H (NDRHI) in Great Britain closed end of midnight on 31 March 20 writing a replacement scheme	
Tariffs	established.	



Water

located in discrete

Heat Incentive Scheme to new applicants at the 2021. At the time of has not been

8.6. Recommended Solution

DSA therefore recommends the following renewable energy strategy for the proposed development at 2 Templewood Avenue, London, NW3 7XA.

The proposed development will benefit from a large reduction in carbon emissions through the implementation of an Air Source Heat Pump System to provide the heating and cooling requirements of the proposed development.

The table below shows the savings on regulated carbon emissions after the 'Be Green' stage of the energy hierarchy.

Existing Building

	Regulated non-domestic carbon dioxide savings	
	(Tonnes of CO₂ per annum)	(%)
Savings from energy demand reduction	14.4	43.2%
Savings from heat network / CHP	0.0	0.0%
Savings from renewable energy	26.63	36.6%

Table 15 – Carbon emissions after the Be Green Stage

The carbon savings (26.63 tonnes of CO_2) for the Be Green stage of the Energy Hierarchy, can be attributed to the installation of ASHPs

New Extension

	Regulated non-domestic carbon dioxide savings	
	(Tonnes of CO ₂ per annum)	(%)
Savings from energy demand reduction	0.0	0.0%
Savings from heat network / CHP	0.0	0.0%
Savings from renewable energy	0.1	42.1%

Table 16 – Carbon emissions after the Be Green Stage

The carbon savings (0.1 tonnes of CO_2) for the Be Green stage of the Energy Hierarchy, can be attributed to the installation of ASHPs



9. Conclusion

In order for the proposed development to achieve minimum requirements of energy carbon reductions in line with planning policies the proposed development must achieve:

- In line with London Borough of Camden's Core Strategy and Camden Planning Guidance developments of more than 500sqm must submit an energy statement demonstrating how carbon emissions will be reduced.
- In line with London Borough of Camden's Core Strategy and Camden Planning Guidance there must be a 20% reduction in CO2 from onsite renewables for the existing refurbished building (after all other energy efficiency measures have been incorporated).
- For developments consisting of a refurbishment with a new build extension, the CO2 savings for the new and refurbished elements should be presented separately within the energy strategy. The new build elements should be assessed in line with the methodology for new build development and will be expected to comply with London Plan policy (note the new build element of the project is a minor development and required only to pass part L1A).
- The existing building's total floor area is > 1000m2 and the proposed development includes an • extension, therefore the development is subject to consequential improvements as defined in Part L1B.

In order to maximise carbon reductions, the design team has followed the "Be Lean, Be Clean, Be Green, Be Seen" energy hierarchy as advised by the London Plan. This included reducing the proposed developments energy demand through energy efficient techniques, exploring the possibility of using decentralised energy systems, and including renewable energy technologies on site.

The proposed development will benefit from a large reduction in carbon emissions through the implementation of an Air Source Heat Pump System to provide the heating and cooling requirements of the proposed development.

This will result in the following carbon emissions following the Be Lean, Be Clean, Be Green, Be Seen energy hierarchy for both regulated and unregulated use.

Existing Building Carbon Emissions

The table below shows the carbon emissions after each stage of the hierarchy for the refurbished existing building.

	Carbon dioxide emissions for non- domestic buildings (Tonnes of CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building		
Regulations Compliant Development	33.4	12.4
After energy demand reduction	19	12.4
After heat network / CHP	19	12.4
After renewable energy	6.7	12.4

Table 17 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings (refurbished building)

The table below shows the different savings at each stage of the energy hierarchy.

	Regulated non-domestic carbon dioxide savings	
	(Tonnes of CO₂ per annum)	(%)
Savings from energy demand reduction	14.4	43.2%
Savings from heat network / CHP	0.0	0.0%
Savings from renewable energy	12.22	36.6%
Cumulative on site savings	26.63	79.81%

Table 18 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings (refurbished building)

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2 Templewood Avenue, London, NW3 7XA **Energy Statement**

Extension Carbon Emissions

The table below shows the carbon emissions for the proposed development after each stage of the energy hierarchy.

	Carbon dioxide emissions for non- domestic buildings (Tonnes of CO ₂ per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013 of the Building			
Regulations Compliant Development	6	5	
After energy demand reduction	4	5	
After heat network / CHP	4	5	
After renewable energy	3	5	

Table 19 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings (New Extension)

The table below shows the different savings at each stage of the energy hierarchy for the proposed development.

	Regulated non-domestic carbon dioxide savings		
	(Tonnes of CO₂ per annum)	(%)	
Savings from energy demand reduction	0.00	0.0%	
Savings from heat network / CHP	0.00	0.0%	
Savings from renewable energy	0.10	42.1%	
Cumulative on site savings	0.10	42.11%	
Annual savings from offset payment	1.1		
Tonnes of CO ₂			
Cumulative savings from offset payment	33		

Table 20 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings (New Extension)

Through energy efficiency techniques as well as the implementation of renewable technologies as mentioned above, the proposed development will reduce annual carbon emissions by 0.1 tonnes of CO₂. This accounts for a reduction of approximately 42.11% of the proposed development's expected regulated energy carbon emissions.

Despite not needing to comply with the 35% reduction in CO₂ emissions for buildings of a larger size, the proposed development exceeds The London Plan 2021 target, and has a further carbon saving requirement of 1.1 tonnes of carbon in line with The London Plan 2021 policies in order to achieve net-zero emissions.

Domestic Energy Hierarchy and Targets



Figure 1 – The Domestic Energy Hierarchy for the extension

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Energy Statement

10. Appendix

10.1. Appendix 1 – SAP Worksheet 'Baseline' Existing Building



Project Information

Building type Detached house

Reference			
Date	18 January 2022		
Client	Marek Wojciechowski Architects 66-68 Margaret Street London W1W 8SR	Project	2 Templewood Avenue LONDON NW3 7XA
Tel:	02075809336		

SAP 2012 worksheet for New dwelling as designed - calculation of energy ratings

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	233.18	3.65	851.11	(3a)
Second floor	259.91	3.30	857.70	(3b)
Thirdfloor	244.49	3.28	801.93	(3c)
Fourth and other floors	233.34	2.78	648.69	(3d)
	970.92			(4)
			3159.42	(5)

2. Ventilation rate

											m³ per ho	bur
							main + s heating	seonda	ry + othe	er		
Numbe	of chim	neys					0 + 0 + 0)	x 40		0.00	(6a)
Numbe	er of open	flues					2 + 0 + 0)	x 20		40.00	(6b)
Numbe	er of interr	nittent fa	ans				8		x 10		80.00	(7a)
Numbe	rofpassi	vevents					0		x 10		0.00	(7b)
Numbe	er of fluele	ess gas f	ires				0		x 40		0.00	(7c)
											Air chang	ges per hour
_											0.04	(8)
Pressu	re test, re	esult q50)						17.00			(17)
Airperr	neability										0.89	(18)
											2.00	(19)
				_							0.85	(20)
Infiltrat Infiltrat	ion rate ir ion rate n	ncorpora nodified	ting shell for month	ter factor nly wind s	speed						0.75	(21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Wind E	actor										52.50	(22)
					1			1				
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
Δdiusta	od infiltrat	tion rate	(allowing	forshel	ter and w	vind sne	ed)				13.13	(22a)
0.96	0.94	0.92	0.83	0.81	0.72	0.72	0.70	0.75	0.81	0.85	0.89	
Vontilo	tion . not	urolvoot	ilation in	tormitto	nt ovtrog	tfono					9.91	(22b)
		urar vent	nation, Ir	nemnite	ntextiat	anans						
Enectiv	reaircna	ngerate			- I	10						()
0.96	0.95	0.93	0.84	0.83	0.76	0.76	0.74	0.78	0.83	0.86	0.89	(25)

3. Heat losses and	heat los	ss paramete	r					
Element Gro	DSS	Openings	Netarea	U-value	ΑxU	kappa-value	ΑxΚ	
are	a, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window-Triple-glaz	ed,		2.400	1.68 (1.80)	4.03			(27)
air-filled, low-E, En=	0.2,							
hard coat (SouthWe	st)							
New Build U=1.3; 0	G=0.36 -							
U=0.24(1.36); SHO	GC=0.36;	VT=0.60,						
02-BED-5								
Window - Triple-glaz	ed,		7.700	1.68 (1.80)	12.93			(27)
air-filled, low-E, En=	0.2,							
hard coat (SouthEas	st)							
New Build U=1.3; (G=0.36 -							
U=0.24(1.36); SHO	GC=0.36;	VT=0.60,						
LG-BED-STAFF								
Window-Triple-glaz	ed,		4.290	1.68 (1.80)	7.20			(27)
air-filled, low-E, En=	0.2,							
hard coat (NorthEast	t)							
New Build U=1.3; (G=0.36 -							
U=0.24(1.36); SHO	GC=0.36;	VT=0.60,						
01-STAIRS								
Window-Triple-glaz	ed,		1.700	1.68 (1.80)	2.85			(27)
air-filled, low-E, En=	0.2,							
hard coat (NorthWes	st)							
New Build U=1.3; (G=0.36 -							
U=0.24(1.36); SHG	GC=0.36;	VT=0.60,						
02-BATH-FAMILY								
Window-Triple-glaz	ed,		1.700	1.68 (1.80)	2.85			(27)
air-filled, low-E, En=	0.2,							
hard coat (NorthWes	st)							
New Build U=1.3; (G=0.36 -							
U=0.24(1.36); SHO	GC=0.36;	VT=0.60,						
02-BED-06								
Window-Triple-glaz	ed,		1.260	1.68 (1.80)	2.12			(27)
air-filled, low-E, En=	0.2,							
hard coat (SouthWe	st)							
New Build U=1.3; (G=0.36 -							
U=0.24(1.36); SHO	GC=0.36;	VT=0.60,						
00-BREAKFASTR	OOM							
Window-Triple-glaz	ed,		2.530	1.68 (1.80)	4.25			(27)
air-filled, low-E, En=	0.2,							
hard coat (SouthEas	st)							
New Build U=1.3; (G=0.36 -							
U=0.24(1.36); SHO	GC=0.36;	VT=0.60,						
02-BED-04								
Window - Triple-glaz	ed,		1.120	1.68 (1.80)	1.88			(27)
air-filled, low-E, En=	0.2,							
hard coat (NorthWes	st)							
New Build U=1.3; 0	G=0.36 -							
U=0.24(1.36); SHO	GC=0.36;	VT=0.60,						
00-ANTE ROOM								

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SAP 2012 worksheet for New dw	velling as designed -	· calculation of	energy ratings
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4. Wate	er heating	g energ	y requir	ements							kWh/year	(12
Annual	average	hot wate	r usage ir	n litres pe	er day Vd	,average	9				136.10	(42
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	er usage	in litres	ber day f	or each r	nonth				A		·	
149.71	144.27	138.83	133.38	127.94	122.49	122.49	127.94	133.38	138.83	144.27	149.71	(44
Energy	content c	of hot wat	ter used			J		J	J		i	
222.02	194.18	200.38	174.69	167.62	144.65	134.04	153.81	155.64	181.39	198.00	215.02	
Energy Distribu	content (a tion loss	annual)			д	JL		я	л		2141.43	(4
33.30	29.13	30.06	26.20	25.14	21.70	20.11	23.07	23.35	27.21	29.70	32.25	(46
Cylinde	r volume,	I					210.00					(47
Manufa	cturer's d	leclared	cylinderl	oss facto	or (kWh/c	lay)	1.42					(48
Temper	ature Fac	tor					0.5400					(49
Energy Total sto	lost from orage los	hot wate s	er cylinde	er (kWh/c	lay)						0.77	(5
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(56
Net stor	age loss											
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(5
Primary	loss	я			A	J			я			
43.31	39.12	43.31	41.92	43.31	41.92	43.31	43.31	41.92	43.31	41.92	43.31	(59
Total he	at require	ed for wa	ter heati	ng calcul	ated for e	each mo	nth	л	л	Л		
289.10	254.77	267.46	239.61	234.71	209.57	201.12	220.89	220.56	248.47	262.92	282.10	(62
Output f	from wate	er heater	for each	month, k	Wh/mor	, nth	1	л	л	Л		
289.10	254.77	267.46	239.61	234.71	209.57	201.12	220.89	220.56	248.47	262.92	282.10	(64
L	JL	л	JL	JL	л	л	JL	д	л	л	2931.29	(6
Heat ga	ins from	water he	ating, kV	/h/month	า							
127.49	113.04	120.29	110.02	109.40	100.03	98.23	104.81	103.69	113.98	117.77	125.16	(65

5. Internal gains

	-										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	ic gains,	Watts									
240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25
Lighting	gains										
442.83	393.32	319.87	242.16	181.02	152.82	165.13	214.64	288.09	365.80	426.94	455.14
Appliand	ces gains	6									
1335.92	1349.78	1314.85	1240.48	1146.60	1058.37	999.43	985.56	1020.50	1094.87	1188.75	1276.98
Cooking	gains										
63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03
Pumps a	and fans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lossese	e.g. evap	oration (r	negative	values)							
-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17
Water he	eating ga	ains									
171.36	168.21	161.68	152.81	147.05	138.93	132.03	140.87	144.01	153.20	163.57	168.23
Total inte	ernal gai	ns									
2096.2	2057.4	1942.51	1781.56	1620.78	1496.24	1442.70	1487.19	1598.71	1759.98	1925.37	2046.5

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.400 36.79	0.40 x 0.80	0.77	19.5826
En=0.2, hard coat (SouthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.60	0, 02-BED-5		
Window - Triple-glazed, air-filled, low-E,	0.9 x 7.700 36.79	0.40 x 0.80	0.77	62.8274
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.6	0,		
LG-BED-STAFF				
Window - Triple-glazed, air-filled, low-E,	0.9 x 4.290 11.28	0.40 x 0.80	0.77	10.7340
En=0.2, hard coat (NorthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.60	0,01-STAIRS		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.700 11.28	0.40 x 0.80	0.77	4.2536
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.6	0,		
02-BATH-FAMILY				
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.700 11.28	0.40 x 0.80	0.77	4.2536
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.60	0,02-BED-06		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.260 36.79	0.40 x 0.80	0.77	10.2808
En=0.2, hard coat (SouthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.6	0,		
00-BREAKFASTROOM				
Window-Triple-glazed, air-filled, low-E,	0.9 x 2.530 36.79	0.40 x 0.80	0.77	20.6433
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.60	0,02-BED-04		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.120 11.28	0.40 x 0.80	0.77	2.8024
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.60	0, 00-ANTE		
ROOM				

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6. Solar gains (calculation for January)				
Window - Triple-glazed, air-filled, low-E,	Area & Flux 0.9 x 1.680 11.28	g & FF 0.40 x 0.80	Shading 0.77	Gains 4.2035
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60	,00-ANTE		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.680 11.28	0.40 x 0.80	0.77	4.2035
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60	,00-ANTE		
Window - Triple-glazed, air-filled, low-E, En=0.2, hard coat (SouthWest)	0.9 x 1.800 36.79	0.40 x 0.80	0.77	14.6869
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60	, RF-PLAY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.160 36.79	0.40 x 0.80	0.77	17.6243
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,02-BED-04		
Window - Triple-glazed, air-filled, low-E, En=0.2, hard coat (SouthEast)	0.9 x 1.430 36.79	0.40 x 0.80	0.77	11.6679
New Build U=1.3; G=0.36 - U=0.24(1.36); SH 00-POWDER ROOM-01	IGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.732 11.28	0.40 x 0.80	0.77	4.3336
En=0.2, hard coat (NorthEast)				
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.100 11.28	0.40×0.80	0.77	2,7523
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 02-BED-5		
Window-Triple-glazed, air-filled, low-E, En=0.2, hard coat (NorthWest)	0.9 x 1.120 11.28	0.40 x 0.80	0.77	2.8024
New Build U=1.3; G=0.36 - U=0.24(1.36); SF 00-BREAKFAST ROOM	IGC=0.36; V1=0.60	3		
Window - Triple-glazed, air-filled, low-E, En=0.2 hard coat (NorthWest)	0.9 x 1.680 11.28	0.40 x 0.80	0.77	4.2035
New Build U=1.3; G=0.36 - U=0.24(1.36); SH 00-BREAKFAST ROOM	IGC=0.36; VT=0.60	3		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.680 11.28	0.40 x 0.80	0.77	4.2035
En=0.2, hard coat (NorthWest) New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
00-BREAKFASTROOM				
Window - Triple-glazed, air-filled, low-E, En=0.2, hard coat (NorthWest)	0.9 x 1.155 11.28	0.40 x 0.80	0.77	2.8899
New Build U=1.3; G=0.36 - U=0.24(1.36); SH 00-BREAKFAST ROOM	IGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.155 11.28	0.40 x 0.80	0.77	2.8899
En=0.2, nard coat (NorthWest) New Build U=1.3; G=0.36 - U=0.24(1.36); SF 00-BREAKFAST ROOM	IGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.430 36.79	0.40 x 0.80	0.77	11.6679
En=0.2, hard coat (SouthEast) New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
00-RECEPTION ROOM		0.40.000		
Window - I riple-glazed, air-filled, low-E,	0.9 x 1.020 36.79	0.40 x 0.80	0.77	8.3226
En= 0.2 , naro coar (SouthEast) New Build L=1 3: G=0.36 - L=0.24(1.36): SE	IGC=0 36· \/T-0 60			
00-RECEPTION ROOM	Barro C of 40	3		
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6. Solar gains (calculation for January)		. ==	o	. .
Window Triple glazed air filled low F	Area & Flux	g & FF	Shading	Gains
Fr=0.2 bard cost (SouthEast)	0.9 X 2.975 36.79	0.40 X 0.80	0.77	24.2742
$N_{PW} = 0.2$, hard coar (SouthEast)				
00-RECEPTION ROOM	100-0.50, v1-0.00	',		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.020 36.79	0.40 x 0.80	0.77	8.3226
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60),		
00-RECEPTION ROOM				
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.155 11.28	0.40 x 0.80	0.77	2.8899
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S⊢	IGC=0.36; VT=0.60	, 00-LIVING		
ROOM	0.0.445544.00	0.40 0.00	0.77	0 0000
VVIndow - I riple-glazed, air-filled, low-E,	0.9 x 1.155 11.28	0.40 x 0.80	0.77	2.8899
$E_{1}=0.2$, $H_{2}=0.26$, $H_{2}=0.24(1.36)$; $S_{1}=0.24(1.36)$; $S_{2}=0.26$	ICC-0 36. VT-0 60			
ROOM $C = 1.3, C = 0.30 - 0 = 0.24(1.30), ST$	IGC=0.30, VT=0.00	,00-LIVING		
Window-Triple-glazed air-filled low-F	0 9 x 3 675 11 28	0 40 x 0 80	0 77	9 1952
En=0.2. hard coat (NorthWest)			0.11	0.1002
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,00-LIVING		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.260 11.28	0.40 x 0.80	0.77	3.1527
En=0.2, hard coat (NorthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60),		
01-BED-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.020 36.79	0.40 x 0.80	0.77	8.3226
En=0.2, nard coat (SouthEast)				
New Build $U = 1.3$, $G = 0.36 - U = 0.24(1.36)$, $S = 0.00$	IGC=0.36, V I =0.60,	, 00-DINING		
Window-Triple-glazed air-filled low-F	0 9 x 2 975 36 79	0 40 x 0 80	0.77	24 2742
En=0.2, hard coat (SouthEast)	0.0 x 2.07 0 00.7 0	0.10 × 0.00	0.11	21.2712
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	00-DINING		
ROOM	, , ,	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.020 36.79	0.40 x 0.80	0.77	8.3226
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60;	,00-DINING		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.150 36.79	0.40 x 0.80	0.77	25.7021
En=0.2, hard coat (SouthEast)				
New Build $U=1.3$; $G=0.36 - U=0.24(1.36)$; SF Window Triple glazed air filled low E	1GC=0.36; VI=0.60	,01-BED-01	0.77	0 0100
En=0.2 bard cost (SouthEast)	0.9 X 1.000 30.79	0.40 X 0.60	0.77	0.0122
New Build U=1.3: G=0.36 - U=0.24(1.36): SH	IGC=0.36 [.] VT=0.60	01-BED-01		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.080 36.79	0.40 x 0.80	0.77	8.8122
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,01-BED-01		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.815 11.28	0.40 x 0.80	0.77	4.5413
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60), RF-PLAY		
ROOM				
vvindow - I riple-glazed, air-filled, low-E,	U.9 X 1.190 36.79	0.40 x 0.80	0.77	9.7097
$E_{II}=0.2$, naro coat (SouthVVest)				
NEW DUIIU U= 1.3, G=0.30 - U=0.24(1.36); SF 01_RΔTH-MΔSTER	130=0.30, VI=0.60	',		
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Area & Flux	g & FF	Shading	Gains
0.9 x 1.190 36.79	0.40 x 0.80	0.77	9.7097
IGC=0.36; V I =0.60	,		
0 0 v 1 700 11 28	0.40 x 0.80	0.77	1 2536
0.5 × 1.700 11.20	0.40 x 0.00	0.11	4.2000
IGC=0.36 VT=0.60	02-STAIRS		
0.9 x 1.050 11.28	0.40 x 0.80	0.77	2.6272
GC=0.36; VT=0.60,	00-LIVING		
0.9 x 1.155 11.28	0.40 x 0.80	0.77	2.8899
IGC=0.36; VT=0.60	,		
0.9 x 2.200 11.28	0.40 x 0.80	0.77	5.5046
IGC=0.36; VI=0.60	,		
0 0 v 1 815 36 70	0 40 v 0 80	0.77	1/1 8003
0.3 × 1.013 30.73	0.40 × 0.00	0.77	14.0035
IGC=0.36·VT=0.60			
	,		
0.9 x 1.087 11.28	0.40 x 0.80	0.77	2.7198
IGC=0.36; VT=0.60	,		
0.9 x 2.970 11.28	0.40 x 0.80	0.77	7.4313
IGC=0.36; VT=0.60	,		
0 0 0 500 00 70	0.40.0.00	0.77	00.0400
0.9 X 2.530 36.79	0.40 X 0.80	0.77	20.6433
$0.9 \times 1.815 36 70$	02-000-03	0.77	1/1 8003
0.9 × 1.015 50.79	0.40 x 0.00	0.77	14.0095
IGC=0.36 VT=0.60			
100-0.00, 11-0.00	,		
0.9 x 0.990 36.79	0.40 x 0.80	0.77	8.0778
IGC=0.36; VT=0.60	,		
0.9 x 1.087 11.28	0.40 x 0.80	0.77	2.7198
IGC=0.36; VT=0.60	,		
	0.40.0.00	0.77	0 7000
0.9 X 1.080 11.28	0.40 X 0.80	0.77	2.7023
100-0.00, v 1=0.00	,		
	Area & Flux $0.9 \times 1.190 \ 36.79$ IGC=0.36; VT=0.60 $0.9 \times 1.700 \ 11.28$ GC=0.36; VT=0.60, $0.9 \times 1.050 \ 11.28$ GC=0.36; VT=0.60 $0.9 \times 1.155 \ 11.28$ IGC=0.36; VT=0.60 $0.9 \times 2.200 \ 11.28$ IGC=0.36; VT=0.60 $0.9 \times 1.087 \ 11.28$ IGC=0.36; VT=0.60 $0.9 \times 2.970 \ 11.28$ IGC=0.36; VT=0.60 $0.9 \times 2.970 \ 11.28$ IGC=0.36; VT=0.60 $0.9 \times 2.530 \ 36.79$ IGC=0.36; VT=0.60 $0.9 \times 1.815 \ 36.79$ IGC=0.36; VT=0.60 $0.9 \times 2.530 \ 36.79$ IGC=0.36; VT=0.60 $0.9 \times 1.087 \ 11.28$ IGC=0.36; VT=0.60	Area & Flux g & FF 0.9 x 1.190 36.79 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.700 11.28 0.40 x 0.80 GC=0.36; VT=0.60, 02-STAIRS 0.9 x 1.050 11.28 0.40 x 0.80 GC=0.36; VT=0.60, 00-LIVING 0.9 x 1.155 11.28 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.815 36.79 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.087 11.28 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 2.970 11.28 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 2.530 36.79 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.815 36.79 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 0.990 36.79 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.087 11.28 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.815 36.79 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 0.990 36.79 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.087 11.28 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.087 11.28 0.40 x 0.80 IGC=0.36; VT=0.60, 0.9 x 1.080 11.28 0.40 x 0.80 IGC=0.36; VT=0.60,	Area & Flux g & FF Shading 0.9 x 1.190 36.79 0.40 x 0.80 0.77 IGC=0.36; VT=0.60, 0.40 x 0.80 0.77 GC=0.36; VT=0.60, 02-STAIRS 0.77 GC=0.36; VT=0.60, 00-LIVING 0.77 GC=0.36; VT=0.60, 00-LIVING 0.77 GC=0.36; VT=0.60, 00-LIVING 0.77 IGC=0.36; VT=0.60, 0.40 x 0.80 0.77 IGC=0.36; VT=0.60, 0.4

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6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.080 11.28	0.40 x 0.80	0.77	2.7023
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60	,		
01-LIVING-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.970 11.28	0.40 x 0.80	0.77	7.4313
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-LIVING-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 11.28	0.40 x 0.80	0.77	2.7023
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-BED-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 11.28	0.40 x 0.80	0.77	2.7023
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60	,		
01-BED-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.060 11.28	0.40 x 0.80	0.77	7.6564
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	HGC=0.36; VT=0.60	,		
01-BED-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 7.700 36.79	0.40 x 0.80	0.77	62.8274
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; V1=0.60	,		
LG-GYM-CROSSFII		0.40.0.00	o 77	0 0 5 0 0
Window - I riple-glazed, air-filled, low-E,	0.9 x 3.220 11.28	0.40 x 0.80	0.77	8.0568
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; V1=0.60	,		
LG-GYM-CARDIO		0.40.0.00	o 77	0.0400
Window - I riple-glazed, air-filled, low-E,	0.9 x 1.080 36.79	0.40 x 0.80	0.77	8.8122
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VI=0.60	,01-BED-02	o 77	05 7004
Window - I riple-glazed, air-filled, low-E,	0.9 x 3.150 36.79	0.40 x 0.80	0.77	25.7021
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VI=0.60	,01-BED-02	0.77	0.0400
Window - I riple-glazed, air-filled, low-E,	0.9 X 1.080 36.79	0.40 X 0.80	0.77	8.8122
En=0.2, hard coat (SouthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VI=0.60	,01-BED-02	0.77	0 4005
VVINDOW - I riple-glazed, air-filled, low-E,	0.9 X 1.120 36.79	0.40 X 0.80	0.77	9.1385
En=0.2, hard coat (Southwest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	1GC=0.36; V1=0.60	,		
01-ENSULLE-01 Mindaw Triple placed air filled law E	0.04.455.00.70	0.040.00	0.77	4 - 0700
window - I riple-glazed, air-filled, low-E,	0.9 X 1.155 36.79	0.64 X 0.80	0.77	15.0786
En=0.2, hard coat (Southwest)				
New Dulia $U = 1.3$; $G = 0.36 - U = 0.24(1.36)$; SF	190=0.30; V I =0.60,	, UU-LIVING		
	0.0 x 0.000 0.00	0.00 × 0.00	0.77	0 0000
	0.9 X Z.ZUU U.UU	0.00 x 0.00	0.77	0.0000

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7. Mean internal temperature

Temper Heating	ature dur system r	ring heati esponsiv	ng period veness	dsinthel	living are	a, Th1 (°	C)				21.0 1.0)0)0	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau		A			л				л				
19.02	19.19	19.37	20.25	20.42	21.27	21.27	21.44	20.94	20.42	20.08	19.72		
alpha	n	A			л				л				
2.27	2.28	2.29	2.35	2.36	2.42	2.42	2.43	2.40	2.36	2.34	2.31		
Utilisatio	on factor	for gains	forliving	area	A				Α				
1.00	1.00	0.99	0.99	0.97	0.94	0.89	0.91	0.97	0.99	1.00	1.00		(86)
Meanin	ternal ter	nperatur	e in living	area T1	А	J							
17.38	17.60	18.04	18.73	19.40	20.08	20.47	20.41	19.87	19.01	18.14	17.43		(87)
Temper	ature dur	ring heati	ngperio	ds in rest	ofdwelli	ng Th2							
19.96	19.97	19.98	20.02	20.03	20.07	20.07	20.07	20.05	20.03	20.01	19.99		(88)
Utilisatio	on factor	for gains	for rest of	of dwellir	ng	J							
1.00	0.99	0.99	0.98	0.96	0.92	0.84	0.87	0.96	0.99	0.99	1.00		(89)
Mean in	ternal ter	mperatur	e in the r	est of dw	velling T2	2							
16.58	16.81	17.25	17.97	18.65	19.34	19.72	19.67	19.13	18.25	17.38	16.65		(90)
Livinga	rea fractio	on (36.43	3/970.92	2)	д	1		-r.	д	Ju	0.0)4	(91)
Mean internal temperature (for the whole dwelling)													
16.61 16.84 17.28 18.00 18.68 19.37 19.75 19.70 19.15 18.28 17.41 16.68											(92)		
Apply ad	djustmen	t to the m	nean inte	rnal tem	perature,	, where a	ppropria	ate					
17.21	17.44	17.88	18.60	19.28	19.97	20.35	20.30	19.75	18.88	18.01	17.28		(93)

8. Space heating requirement

-											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisatio	on factor	for gains				-					
0.99	0.99	0.99	0.98	0.96	0.92	0.86	0.88	0.95	0.98	0.99	1.00
Useful g	ains	A									
2723.1	3171.2	3578.2	3979.4	4184.5	3953.6	3530.7	3357.7	3315.4	2999.9	2682.6	2578.4
Monthly	average	external	tempera	ture							
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat los	s rate for	mean in	ternal te	mperatur	e						
26170.9	25166.8	22644.5	18452.0	14295.6	9726.9	6793.0	7007.7	10408.4	15628.0	20937.5	25555.5
Fraction	of montl	n for heat	ting								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space h	eating re	quireme	nt for eac	ch month	, kWh/m	onth					
17445.1	1 14781.0	14185.3	10420.3	7522.7	-	-	-	-	9395.3	13143.5	17095.0
Total sp	ace heat	ing requi	rementp	oer year (kWh/yea	ar) (Octo	ber to Ma	ay)			103988.23
Space h	leating re	quireme	nt per m ²	²(kWh/m	²/year)						107.10

8c. Space cooling requirement - not applicable

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9a. Energy requirements

	57 1										kWh/year	
No seco Fraction Efficien	ondary he n of space icy of mai	eating sy e heat fro n heating	stem sel om main g system	ected system(:	s)			7	1.0000 9.00%			(202) (206)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space	neating re	quireme	nt	<u>, </u>		JL	<u>, -</u>	,		1		
17445.	1 14781.0	14185.3	10420.3	7522.7	-	-	-	-	9395.3	13143.5	17095.0	(98)
Append	dix Q - mo	onthly ene	ergy save	ed (main	heating	system '	1)	J	я			
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space I	heating fu	iel (main	heating	system 2	1)				я			
22082.	5 18710.2	17956.1	13190.2	9522.4	-	-	-	-	11892.8	16637.4	21639.2	(211)
Append	dix Q - mo	onthly ene	ergy save	ed (main	heating	system 2	2)		я		·	
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space I	heating fu	iel (main	heating	system 2	2)				A			
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Append	dix Q - mo	nthly ene	ergy save	ed (seco	ndary he	ating sys	stem)					
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space	neating fu	el (secor	ndary)						,			
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Waterh	eating											
Waterh	eating re	quiremer	nt	n 		7		1		1		
289.10	254.77	267.46	239.61	234.71	209.57	201.12	220.89	220.56	248.47	262.92	282.10	(64)
Efficien	cy of wate	er heater	, 	n 	7			1		1	65.00	(216)
65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	(217)
Waterh	neating fu	el		n 			7	1	7	1		
444.78	391.96	411.48	368.64	361.09	322.41	309.41	339.83	339.33	382.27	404.49	434.00	(219)
Annual Space I Space I Water h Electric	totals heating fu neating fu neating fu ity for pu	uel used, el (secor el mps, fans	main sy ndary) s and ele	stem 1 ectric kee	ep-hot						kWh/year 131630.67 0.00 4509.68	(211) (215) (219)
centra	l heating	pump									39.00	(230c)
I otal el Electric Energy	ectricity fo ity for ligh saving/ge tix O -	or the ab hting (0.0 eneration	ove, kWI 10% fixed 1 technold	h/year I LEL) ogies							39.00 3128.22	(231) (232)
Energ	y saved o y used ()	or genera ::	ated ():								0.000 0.000	(236a) (237a)
Total de	elivered e	nergy for	alluses								139307.57	(238)

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10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	131630.674	3.480	4580.75	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating cost	4509.68	3.480	156.94	(247)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	39.000	13.190	5.14	(249)
Energy for lighting	3128.218	13.190	412.61	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			5275.44	(255)
11a. SAP rating				

	0.42	(256)
	2.18	(257)
SAPvalue	69.58	. ,
	70	(258)
SAP band	С	

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	131630.67	0.216	28432.23	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	4509.68	0.216	974.09	(264)
Space and water heating			29406.32	(265)
Electricity for pumps and fans	39.00	0.519	20.24	(267)
Electricity for lighting	3128.22	0.519	1623.55	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			31050.10	(272)
			kg/m²/yea	ar
CO2 emissions per m ²			31.98	(273)
Elvalue			58.91	(273a)
El rating			59	(274)
El band			D	

Calculation of stars for heating and DHW

(3.48 / 0.8400) x (1 + (0.29 x 0.00)) = 4.1429, stars = 4 (0.2160 / 0.8400) x (1 + (0.29 x 0.00)) = 0.2571, stars = 4 3.48 / 0.7000 = 4.9714, stars = 4 0.2160 / 0.7000 = 0.3086, stars = 4

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10.2. Appendix 2 – SAP Worksheet 'Be Lean' Refurbished Existing Building



Project Information

Building type Detached house

Reference Date	18 January 2022		
Client	Marek Wojciechowski Architects 66-68 Margaret Street London W1W 8SR	Project	2 Templewood Avenue LONDON NW3 7XA
Tel:	02075809336		

SAP 2012 worksheet for New dwelling as designed - calculation of energy ratings

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	233.18	3.65	851.11	(3a)
Second floor	259.91	3.30	857.70	(3b)
Thirdfloor	244.49	3.28	801.93	(3c)
	970.92			(4)
			2510.74	(5)

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2. Ventilation rate

											m³ per ho	our
							main + s heating	eonda	ry + othe	er		
Number	r of chimi	neys					0 + 0 + 0)	x 40		0.00	(6a)
Number	rofopen	flues					2 + 0 + 0)	x 20		40.00	(6b)
Number	rofinterr	nittent fa	ans				8		x 10		80.00	(7a)
Number	ofpassi	ve vents					0		x 10		0.00	(7b)
Number	Number of flueless gas fires					0		x 40		0.00	(7c)	
											Air chang	jes per hour
Drocour	o toot r		`						17.00		0.05	(8) (17)
Airporg	e lest, re	suit qot)						17.00		0.00	(17)
Airpein	leability										0.90	(10)
											2.00	(19)
Infiltratio	on rata in	cornora	ting shalt	orfactor							0.85	(20)
Infiltratio	on rate m	nodified	for month	ly wind s	speed						0.70	(21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
											52.50	(22)
vvind Fa	actor							-1r		-		
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
											13.13	(22a)
Adjuste	d infiltrat	ion rate	(allowing	forshel	ter and w	vind spe	ed)					
0.97	0.95	0.93	0.84	0.82	0.72	0.72	0.71	0.76	0.82	0.86	0.90	
][]		J[]][I		J	JL	10.02	(22b)
Ventilat	ion : natu	ural vent	ilation, ir	termitte	nt extrac	t fans						
Effective	e air chai	ngerate	·									
0.97	0.95	0.94	0.85	0.84	0.76	0.76	0.75	0.79	0.84	0.87	0.90	(25)

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3. Heat losses	and heat los	ss paramete	r					
Element	Gross	Openings	Netarea	U-value	AxU	kappa-value	AxK	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window-Triple-	glazed,		2.400	1.24 (1.30)	2.97			(27)
air-filled, low-E,	En=0.2,							
hard coat (West)							
New Build U=1	I.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
02-BED-5								
Window-Triple-	glazed,		7.700	1.24 (1.30)	9.52			(27)
air-filled, low-E,	En=0.2,							
hard coat (South	ı)							
New Build U=1	.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36:	VT=0.60.						
LG-BED-STAF	F	,						
Window - Triple-	alazed.		4.290	1.24 (1.30)	5.30			(27)
air-filled.low-E.	En=0.2.							()
hard coat (Fast)	,							
New Build U=1	1 3 [.] G=0 36 -							
U=0.24(1.36)	SHGC=0.36	VT=0.60						
01-STAIRS	0.100 0.00,							
Window - Triple-	alazed		1 700	1 24 (1 30)	2 10			(27)
air-filled low-F	914204, En=0.2		1.700	1.24 (1.50)	2.10			(21)
hard coat (North)							
New Build LI-1	/ 3·G=0 36 -							
11-0.24(1.36)	SHGC-0 36.	VT-0.60						
$02-B\Delta TH = F\Delta M$	U ∨	v1=0.00,						
Window - Triple-	alazed		1 700	1 24 (1 20)	2 10			(27)
air filled low E	giazeu, En-0.2		1.700	1.24 (1.30)	2.10			(27)
bard coat (North	EII=0.2,							
Now Build L	/ 1 2 · C - 0 26							
11-0.24(1.26)	SHCC-0 36-	VT-0.60						
0=0.24(1.30),	SI IGC=0.30,	v 1=0.00,						
Window Triplo	alozod		1 260	1 24 (1 20)	1 56			(27)
vindow - mpie-	glazed, Ep=0.2		1.200	1.24 (1.30)	06.1			(27)
all-Illieu, IUW-E,	EII=0.2,							
Now Duild LL								
	1.3, G=0.30 -							
0=0.24(1.30),	SHGC=0.30,	v i =0.00,						
Window Triple			2 5 2 0	4 04 (4 00)	2 4 2			(07)
vvindow - Triple-	giazed, Em 0.2		2.530	1.24 (1.30)	3.13			(27)
alf-Illied, IOW-E,	En=0.2,							
nard coat (South								
	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VI=0.60,						
02-BED-04					0.00			
vvindow - I riple-	giazed,		1.680	1.24 (1.30)	2.08			(27)
air-filled, low-E,	En=0.2,							
nard coat (North)							
New Build U=1	I.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-ANTE ROO	M							

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SAP 2012 worksheet for New dw	velling as designed -	· calculation of	energy ratings
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4. Wate	er heating	g energ y	y require	ements							kWh/year	(42)
Annual	average l	not water	r usage ir	n litres pe	er day Vd	,average)				129.30	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	er usage	in litres p	ber day f	or each r	nonth						·	
142.23	137.06	131.88	126.71	121.54	116.37	116.37	121.54	126.71	131.88	137.06	142.23	(44)
Energy	content c	of hot wat	ter used			5			31		، ۱	
210.92	184.47	190.36	165.96	159.24	137.41	127.33	146.12	147.86	172.32	188.10	204.26	
Energy Distribu	content (a tion loss	annual)			a				J		2034.36	(45)
31.64	27.67	28.55	24.89	23.89	20.61	19.10	21.92	22.18	25.85	28.22	30.64	(46)
Cylinde	r volume,	I					210.00					(47)
Manufa	cturer's d	eclared	cylinderl	oss facto	or (kWh/c	lay)	1.42					(48)
Temper	ature Fac	tor					0.5400				0.77	(49)
Energy Total sto	lost from brage los	hot wate s	er cylinde	er (kVVh/c	lay)						0.77	(55)
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(56)
Net stor	age loss								,			
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(57)
Primary	loss		л	1		л	1	л	л	1		
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	at require	ed for wa	ter heati	ng calcul	ated for e	each moi	nth	л	J	J		
257.95	226.95	237.39	211.47	206.27	182.93	174.37	193.15	193.38	219.35	233.62	251.30	(62)
Output f	from wate	er heater	for each	month, k	wh/mor	nth						
257.95	226.95	237.39	211.47	206.27	182.93	174.37	193.15	193.38	219.35	233.62	251.30	(64)
											2588.14	(64)
Heat ga	ins from v	water he	ating, kW	/h/month	า							
107.76	95.32	100.92	91.59	90.57	82.10	79.97	86.21	85.58	94.92	98.96	105.54	(65)

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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	lic gains,	Watts									
240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25
Lighting	gains										
423.85	376.46	306.16	231.78	173.26	146.27	158.05	205.44	275.75	350.12	408.65	435.63
Applian	ces gains	6									
1335.92	1349.78	1314.85	1240.48	1146.60	1058.37	999.43	985.56	1020.50	1094.87	1188.75	1276.98
Cooking	gains										
63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03
Pumps	and fans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Losses	e.g. evap	oration (r	egative	/alues)							
-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17
Water h	eating ga	ains									
144.84	141.85	135.65	127.21	121.74	114.03	107.48	115.87	118.86	127.58	137.44	141.86
Total int	ernal gai	ns									
2050.7	2014.2	1902.77	1745.59	1587.71	1464.79	1411.07	1452.99	1561.21	1718.69	1880.94	2000.6

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.400 19.64	0.64 x 0.80	0.77	16.7248
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 02-BED-5		
Window - Triple-glazed, air-filled, low-E,	0.9 x 7.700 46.75	0.64 x 0.80	0.77	127.7305
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.6	0,		
LG-BED-STAFF				
Window - Triple-glazed, air-filled, low-E,	0.9 x 4.290 19.64	0.64 x 0.80	0.77	29.8956
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 01-STAIRS		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.700 10.63	0.64 x 0.80	0.77	6.4139
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.6	0,		
02-BATH-FAMILY				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.700 10.63	0.64 x 0.80	0.77	6.4139
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 02-BED-06		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.260 19.64	0.64 x 0.80	0.77	8.7805
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.6	0,		
00-BREAKFASTROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.530 46.75	0.64 x 0.80	0.77	41.9686
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 02-BED-04		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.680 10.63	0.64 x 0.80	0.77	6.3385
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 00-ANTE		
ROOM				

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6. Solar gains (calculation for January)				
Window - Triple-glazed, air-filled, low-E,	Area & Flux 0.9 x 1.680 10.63	g & FF 0.64 x 0.80	Shading 0.77	Gains 6.3385
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60	,00-ANTE		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.120 10.63	0.64 x 0.80	0.77	4.2256
New Build U=1.3; G=0.36 - U=0.24(1.36); SF ROOM	IGC=0.36; VT=0.60	,00-ANTE		
Window - Triple-glazed, air-filled, low-E, En=0.2, hard coat (West)	0.9 x 1.800 19.64	0.64 x 0.80	0.77	12.5436
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	HGC=0.36; VT=0.60	, RF-PLAY		
Window - Triple-glazed, air-filled, low-E, En= 0.2 , bard coat (West)	0.9 x 2.160 19.64	0.64 x 0.80	0.77	15.0523
Now Build L-1 2: C-0 26 LL-0 24(1 26): SE		02 BED 04		
Window - Triple-glazed, air-filled, low-E, En=0.2 hard coat (South)	0.9 x 1.430 46.75	0.64 x 0.80	0.77	23.7214
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.732 19.64	0.64 x 0.80	0.77	12.0732
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-BAR		
Window - Triple-glazed, air-filled, low-E, En=0.2, hard coat (North)	0.9 x 1.100 10.63	0.64 x 0.80	0.77	4.1502
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 02-BED-5		
Window - Triple-glazed, air-filled, low-E, En=0.2, hard coat (North)	0.9 x 1.155 10.63	0.64 x 0.80	0.77	4.3577
New Build U=1.3; G=0.36 - U=0.24(1.36); SH 00-BREAKFAST ROOM	HGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.155 10.63	0.64 x 0.80	0.77	4.3577
En=0.2, hard coat (North)				
00-BREAKFASTROOM	1GC=0.36; V1=0.60	,		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.680 10.63	0.64 x 0.80	0.77	6.3385
En=0.2, hard coat (North) New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36: VT=0.60			
00-BREAKFASTROOM	,,	,		
Window - Triple-glazed, air-filled, low-E, En=0.2 hard coat (North)	0.9 x 1.680 10.63	0.64 x 0.80	0.77	6.3385
New Build $I = 1.3$: G=0.36 - $I = 0.24(1.36)$: SE	HGC-0 36: VT-0 60			
00-BREAKFAST ROOM	0.0	,	0.77	4 0050
Fn=0.2 hard coat (North)	0.9 X 1.120 10.63	0.64 x 0.80	0.77	4.2256
New Build U=1.3; G=0.36 - U=0.24(1.36); SH 00-BREAKFAST ROOM	HGC=0.36; VT=0.60	3		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.020 46.75	0.64 x 0.80	0.77	16.9201
En=0.2, hard coat (South) New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60	3		
00-RECEPTION ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.975 46.75	0.64 x 0.80	0.77	49.3504
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF 00-RECEPTION ROOM	1GC=0.36; VT=0.60	3		
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6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
VVIndow - I riple-glazed, air-filled, low-E,	0.9 x 1.020 46.75	0.64 x 0.80	0.77	16.9201
En=0.2, nard coat (South)				
New Build $U=1.3$, $G=0.30 - U=0.24(1.30)$, Sr	1GC=0.30, VI=0.00),		
Window-Triple-glazed air-filled low-E	0 9 v 1 /30 /6 75	0.64 x 0.80	0.77	23 721/
$F_{n=0.2}$ hard coat (South)	0.5 X 1.450 40.75	0.04 × 0.00	0.11	20.7214
New Build U=1 3: $G=0.36 - U=0.24(1.36)$: St	HGC=0.36.VT=0.60)		
00-RECEPTION ROOM		,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.675 10.63	0.64 x 0.80	0.77	13.8654
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-LIVING		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.155 10.63	0.64 x 0.80	0.77	4.3577
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-LIVING		
ROOM	0.0.445540.00	0.04 0.00	0.77	4 0577
VVINDOW - I riple-glazed, air-filled, low-E,	0.9 X 1.155 10.63	0.64 X 0.80	0.77	4.3577
En=0.2, naro coat (North)				
ROOM	IGC=0.30, VI=0.00	,00-LIVING		
Window-Triple-glazed air-filled low-F	0 9 x 1 260 19 64	0 64 x 0 80	0.77	8 7805
$F_{n=0.2}$ hard coat (East)	0.0 X 1.200 10.04	0.04 × 0.00	0.11	0.7000
New Build U=1.3: G=0.36 - U=0.24(1.36): SH	HGC=0.36: VT=0.60).		
01-BED-MASTER		,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.020 46.75	0.64 x 0.80	0.77	16.9201
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-DINING		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.975 46.75	0.64 x 0.80	0.77	49.3504
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VT=0.60	, 00-DINING		
ROOM	0.04.000.40.75	0.040.00	0 77	40.0004
VVINDOW - I riple-glazed, air-filled, low-E,	0.9 X 1.020 46.75	0.64 X 0.80	0.77	16.9201
$E_{11}=0.2$, fiald Coal (South) New Build II = 1.3: G=0.36 - II = 0.24(1.36): SE				
ROOM	100-0.30, v1-0.00	,00-DINING		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.080 46.75	0.64 x 0.80	0.77	17.9155
En=0.2. hard coat (South)			0.1.1	11.0100
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,01-BED-01		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 46.75	0.64 x 0.80	0.77	17.9155
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,01-BED-01		
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.150 46.75	0.64 x 0.80	0.77	52.2534
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,01-BED-01		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.815 10.63	0.64 x 0.80	0.77	6.8478
En=0.2, hard coat (North)				
New Build $U=1.3$; $G=0.36 - U=0.24(1.36)$; SF	1GC=0.36; VI=0.60	J, RF-PLAY		
Nindow Triplo glazad air fillad low E	0 0 x 1 100 10 64	0.64 x 0.80	0.77	Q 2027
Fn=0.2 hard coat (West)	0.3 × 1.130 13.04	0.04 × 0.00	0.11	0.2921
New Build U=1 3: G=0.36 - U=0.24(1.36): SI	HGC=0.36.VT=0.60).		
01-BATH-MASTER		• •		
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6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.190 19.64	0.64 x 0.80	0.77	8.2927
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VT=0.60	,		
01-BATH-MASTER				
Window - I riple-glazed, air-filled, low-E,	0.9 x 1.700 19.64	0.64 x 0.80	0.77	11.8468
En=0.2, hard coat (East)		AN OTAIDO		
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VI=0.60	,02-STAIRS	0.77	70474
VVIndow - I riple-glazed, air-filled, low-E,	0.9 X 1.050 19.64	0.64 X 0.80	0.77	7.3171
En=0.2, naro coat (East)				
New Build $0=1.3$, $G=0.30 - 0=0.24(1.30)$, SF	IGC=0.30, VI=0.00,	, UU-LIVING		
Window-Triple-glazed air-filled low-E	0 0 v 1 155 10 61	0.64×0.80	0.77	8 0/88
$F_{n=0.2}$ bard cost (East)	0.9 × 1.155 19.04	0.04 × 0.00	0.77	0.0400
New Build $U=1.3$: $G=0.36 - U=0.24(1.36)$: SE	IGC-0 36· VT-0 60			
00-BREAKFASTROOM	100-0.00, 11-0.00	,		
Window-Triple-glazed air-filled low-F	0 9 x 2 200 19 64	0 64 x 0 80	0 77	15 3311
En=0.2. hard coat (East)			••••	
New Build U=1.3: G=0.36 - U=0.24(1.36): SH	IGC=0.36: VT=0.60			
RF-STAIRS	,	,		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.815 46.75	0.64 x 0.80	0.77	30.1079
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-BED-02-LIVING				
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.087 19.64	0.64 x 0.80	0.77	7.5784
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-ENSUITE-02				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.970 10.63	0.64 x 0.80	0.77	11.2055
En=0.2, hard coat (North)				
New Build $U=1.3$; $G=0.36 - U=0.24(1.36)$; SF	IGC=0.36; V1=0.60	,		
U1-BED-MASTER-DRESSING	0.00.500.40.75	0.010.00	0.77	44.0000
VVIndow - I ripie-glazed, air-filled, low-E,	0.9 X 2.530 46.75	0.64 X 0.80	0.77	41.9686
$E_{1}=0.2$, $H_{1}=0.2$, $H_{2}=0.26$, $H_{2}=0.24(1.26)$; $S_{2}=0.26$		02 BED 02		
Window_Triple_diazed air-filled low_E	$0.0 \times 0.000 46.75$	02-BED-03	0.77	16 1225
$F_{n=0.2}$ bard cost (South)	0.9 × 0.990 40.75	0.04 × 0.00	0.77	10.4223
New Build $I = 1.3$: G=0.36 - $I = 0.24(1.36)$: SE	IGC-0 36· VT-0 60			
01-BED-01-LIVING	100-0.00, 11-0.00	,		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.815 46.75	0.64 x 0.80	0.77	30,1079
En=0.2. hard coat (South)			••••	
New Build U=1.3: G=0.36 - U=0.24(1.36): SH	IGC=0.36: VT=0.60			
01-BED-01-LIVING	,	,		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.087 19.64	0.64 x 0.80	0.77	7.5784
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-LIVING-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.970 10.63	0.64 x 0.80	0.77	11.2055
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-LIVING-MASTER				

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6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 10.63	0.64 x 0.80	0.77	4.0747
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VT=0.60	,		
01-LIVING-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 10.63	0.64 x 0.80	0.77	4.0747
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; V1=0.60	,		
01-LIVING-MASTER			o 77	
VVIndow - I riple-glazed, air-filled, low-E,	0.9 X 3.060 10.63	0.64 X 0.80	0.77	11.5451
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	1GC=0.36; V1=0.60	,		
UI-BED-MASTER	0.0	0.010.00	0 77	4 07 47
VVIndow - I riple-glazed, air-filled, low-E,	0.9 X 1.080 10.63	0.64 X 0.80	0.77	4.0747
En=0.2, naro coat (North)				
New Build U=1.3, G=0.36 - U=0.24(1.36), Sr	1GC=0.36, V I =0.60	,		
VI-DED-WASTER	0.0 × 1.000.10.62	0.64 × 0.90	0.77	4 0747
Fr=0.2 bard cost (North)	0.9 X 1.060 10.63	0.64 X 0.60	0.77	4.0747
$E_{1}=0.2$, $H_{1}=0.24(1.36)$: $S_{1}=0.24(1.36)$: $S_{2}=0.26$				
01 RED MASTED	190=0.30, v1=0.00	,		
Window-Triple-glazed air-filled low-E	0 0 v 7 700 /6 75	0.64×0.80	0.77	127 7305
En=0.2 bard cost (South)	0.9 X 7.700 40.75	0.04 × 0.00	0.77	121.1305
New Build $I = 1.3$: $G = 0.36 \cdot I = 0.24(1.36)$: SE				
I G-GYM-CROSSFIT	100-0.00, 11-0.00	,		
Window-Triple-glazed air-filled low-F	0 9 x 3 220 10 63	0.64 x 0.80	0 77	12 1487
$E_n=0.2$ hard coat (North)	0.0 x 0.220 10.00	0.01 × 0.00	0.11	12.1107
New Build U=1.3: G=0.36 - U=0.24(1.36): SE	IGC=0.36 [.] VT=0.60	1		
		,		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.080 46.75	0.64 x 0.80	0.77	17.9155
En=0.2. hard coat (South)				
New Build U=1.3: G=0.36 - U=0.24(1.36): SH	IGC=0.36: VT=0.60	.01-BED-02		
Window - Triple-glazed, air-filled, low-E.	0.9 x 3.150 46.75	0.64 x 0.80	0.77	52.2534
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,01-BED-02		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 46.75	0.64 x 0.80	0.77	17.9155
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,01-BED-02		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.120 19.64	0.64 x 0.80	0.77	7.8049
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-ENSUITE-01				
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.155 19.64	0.64 x 0.80	0.77	8.0488
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-LIVING		
ROOM				
Soliddoor	0.9 x 2.200 0.00	0.00 x 0.80	0.77	0.0000
2013 Door, 00-ENTRANCE LOBBY				

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7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) Heating system responsiveness											21.0 1.0)0)0	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau		л			л	л			χ				
21.68	21.87	22.06	22.98	23.16	24.04	24.04	24.22	23.70	23.16	22.80	22.43		
alpha		л			л								
2.45	2.46	2.47	2.53	2.54	2.60	2.60	2.61	2.58	2.54	2.52	2.50		
Utilisati	on factor	for gains	forliving	area		J							
1.00	0.99	0.99	0.97	0.95	0.89	0.81	0.84	0.94	0.98	0.99	1.00		(86)
Meanin	ternal ter	nperatur	e in living	garea T1					х				
17.74	17.98	18.43	19.10	19.73	20.33	20.66	20.60	20.12	19.30	18.45	17.77		(87)
Temper	ature du	ring heati	ing perio	ds in rest	ofdwelli	ng Th2			х				
19.45	19.46	19.47	19.52	19.53	19.58	19.58	19.58	19.56	19.53	19.51	19.49		(88)
Utilisati	on factor	for gains	for rest of	of dwellin	ng				х				
1.00	0.99	0.98	0.97	0.93	0.83	0.67	0.73	0.90	0.97	0.99	1.00		(89)
Mean in	ternal ter	mperatur	e in the r	est of dw	velling T2	2			л				
15.17	15.53	16.19	17.18	18.10	18.96	19.37	19.32	18.68	17.49	16.24	15.23		(90)
Livinga	rea fracti	on (36.43	3/970.92	2)	д					Ju.	0.0)4	(91)
Meanin	ternal ter	nperatur	e (for the	whole d	welling)								
15.26	15.62	16.28	17.26	18.16	19.01	19.42	19.37	18.73	17.56	16.33	15.32		(92)
Apply a	djustmen	it to the m	nean inte	rnal tem	perature	, where a	ppropria	ate					
15.11	15.47	16.13	17.11	18.01	18.86	19.27	19.22	18.58	17.41	16.18	15.17		(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisatio	on factor	for gains							A		
0.99	0.98	0.97	0.94	0.89	0.79	0.63	0.68	0.86	0.95	0.98	0.99
Useful g	ains								A		
3168.7	3930.9	4553.7	5037.4	5111.8	4448.1	3427.5	3425.4	3981.2	3758.0	3212.6	2957.5
Monthly	average	external	tempera	ture					A		
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat los	s rate for	mean in	ternal te	mperatu	re			л			
19215.7	18631.7	16817.7	13760.0	10503.8	6831.2	4272.2	4481.8	7290.3	11321.9	15340.9	18850.8
Fraction	of montl	n for heat	ting								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space h	eating re	quireme	nt for eac	ch month	, kWh/m	onth		л	J		
11939.0	9878.9	9124.4	6280.3	4011.6	-	-	-	-	5627.5	8732.3	11824.6
Total sp	ace heat	ing requi	rementp	oer year (kWh/yea	ar) (Octo	ber to Ma	ay)	<i></i>		67418.7
Space h	leating re	quireme	nt per m ²	² (kWh/m	²/year)						69.4

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Feb Mar Jan Apr May Jun Jul Aug Sep Oct Nov Dec External temperaturers 14.60 16.60 16.40 _ Heat loss rate W (100)15065.0 11859.7 12094.3 ---_ Utilisation factor for loss (101)0.39 0.47 0.43 _ _ Useful loss W 5949.5 5522.0 5204.4 -(102)_ -_ Internal gains W 0.00 0.00 0.00 0.00 1461.79 1408.07 1449.99 0.00 0.00 0.00 0.00 0.00 Solar gains W 0.00 0.00 0.00 0.00 0.00 4894.7 4691.2 4192.3 0.00 0.00 0.00 0.00 Gains W 6356.5 6099.3 5642.3 (103)_ Fraction of month for cooling 1.00 0.00 0.00 0.00 0.00 0.00 1.00 1.00 0.00 0.00 0.00 0.00 (103a) Space heating kWh 1262.16 165.50 59.48 (98) _ _ Space cooling kWh (104)_ 293.02 429.52 325.82 -Total 1048.36 (104) 0.10 Cooled fraction (105)Intermittency factor 0.25 0.25 0.25 (106)-I - I _ Space cooling requirement for month 7.33 10.74 8.15 -_ _ Space cooling (June to August) 26.21 (107)Space cooling requirement per m² (kWh/m²/year) 0.03 (108)

8c. Space cooling requirement

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responsible for the accuracy of the data. The results of the calculation should not be accepted without first checking the input data.

9a. Energy requirements

	quironion									kWh/year	
No secondary Fraction of spa Efficiency of m Cooling system	heating sy ace heat fro ain heatin n energy e	stem sel om main g system fficiency	ected system(: ratio	S)			9 4	1.0000 3.90% .29%		·	(202) (206) (209)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	requireme	nt			5		J	я	JI		
11939.0 9878.	9 9124.4	6280.3	4011.6	-	-	-	-	5627.5	8732.3	11824.6	(98)
Appendix Q - r	nonthly en	ergy save	ed (main	heating	system 1	1)	д	л	Ju		
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating	fuel (main	heating	system 1)	J	JL	А	л			
12714.6 1052	0.7 9717.2	6688.3	4272.3	-	-	-	-	5993.1	9299.6	12592.8	(211)
Appendix Q - r	nonthly en	ergy save	ed (main	heating	system 2	2)		,	JL		
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating	fuel (main	heating	system 2	<u>2</u>)	л	Л	А	л			
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - r	nonthly en	ergy save	ed (seco	ndary he	ating sys	stem)	л	л	Л		
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating	fuel (seco	ndary)	1	л	J	Л	л	л	Л		
0.00 0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating Water heating	requireme	nt	<u></u>	л	JL	J	JL	л	Л		
257.95 226.9	5 237.39	211.47	206.27	182.93	174.37	193.15	193.38	219.35	233.62	251.30	(64)
Efficiency of w	ater heater	•	1	л	1	Л	л	л	Л	65.00	(216)
65.00 65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	(217)
Water heating	fuel	<u></u>	1		1	JL	л		JL		
396.85 349.1	6 365.22	325.35	317.35	281.43	268.26	297.15	297.51	337.47	359.41	386.61	(219)
Annualtatala	I		1	Л	J	JL	Л	Л	Л		
Space heating Water heating Space cooling	fuel used, fuel (seco fuel fuel used	, main sy: ndary)	stem 1							71798.46 0.00 3981.75 6.11	(211) (215) (219) (221)
	-	-	-	1.71	2.50	1.90	-	-	-	-	(221)
Electricity for p central heatin boiler with a f Total electricity Electricity for li Energy saving	pumps, fan ng pump an-assiste y for the ab ghting (9.0 generatior	s and ele d flue ove, kWP 00% fixed technolo	∟ ctric kee h/year I LEL) ogies	["] ₽p-hot	<u>, -</u>		1		1	30.00 45.00 75.00 2994.14	(230c) (230e) (231) (232)
Energy save	d or genera I ():	ated ():								0.000 0.000	(236a) (237a)
Total delivered	l energy fo	r all uses								78855.47	(238)

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10a. Fuel costs using Table 12 prices

kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1 71798.458	3.480	2498.59	(240)
Space heating - main system 2 0.000	0.000	0.00	(241)
Water heating cost 3981.75	3.480	138.56	(247)
Space cooling 6.113	13.190	0.81	(248)
Mech vent fans cost 0.000	13.190	0.00	(249)
Pump/fan energy cost 75.000	13.190	9.89	(249)
Energy for lighting 2994.143	13.190	394.93	(250)
Additional standing charges		120.00	(251)
Electricity generated - PVs 0.000	0.000	0.00	(252)
Appendix Q -			
Energy saved or generated (): 0.000	0.000	0.00	(253)
Energy used (): 0.000	0.000	0.00	(254)
Total energy cost		3162.78	(255)

11a. SAP rating

	0.42	(256) (257)
SAPvalue	81.76	(257)
SAP band	82 B	(258)

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12a. Carbon dioxide emissions

	Energy	Emission factor	Emissions		
	kWh/year	kg CO2/kWh	kg CO2/y	ear	
Space heating, main system 1	71798.46	0.216	15508.47	(261)	
Space heating, main system 2	0.00	0.000	0.00	(262)	
Space heating, secondary	0.00	0.519	0.00	(263)	
Waterheating	3981.75	0.216	860.06	(264)	
Space and water heating			16368.53	(265)	
Space cooling	6.11	0.519	3.17	(266)	
Electricity for pumps and fans	75.00	0.519	38.93	(267)	
Electricity for lighting	2994.14	0.519	1553.96	(268)	
Electricity generated - PVs	0.00	0.519	0.00	(269)	
Electricity generated - µCHP	0.00	0.000	0.00	(269)	
Appendix Q -				. ,	
Energy saved ():	0.00	0.000	0.00	(270)	
Energy used ():	0.00	0.000	0.00	(271)	
Total CO2, kg/year			17964.58	(272)	
			kg/m²/yea	r	
CO2 emissions per m ²			18.50	(273)	
Elvalue			76.30	(273a)	
El rating			76	(274)	
El band			С		
Calculation of stars for beating and DHW					

Calculation of stars for heating and DHW

Main heating energy efficiency Main heating environmental impact Water heating energy efficiency Water heating environmental impact (3.48 / 0.9090) x (1 + (0.29 x 0.00)) = 3.8284, stars = 4 (0.2160 / 0.9090) x (1 + (0.29 x 0.00)) = 0.2376, stars = 4 3.48 / 0.6500 = 5.3538, stars = 3 0.2160 / 0.6500 = 0.3323, stars = 3

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10.3. Appendix 2 – SAP Worksheet 'Be Clean' Refurbished Existing Building

(Refer to Appendix 1. 'Be Clean' and 'Be Lean' SAP Worksheets are identical)



10.4. Appendix 3 – SAP Worksheet 'Be Green' Refurbished Existing Building



Project Information

Building type Detached house

Reference			
Date	18 January 2022		
Client	Marek Wojciechowski Architects	Project	2 Templewood Avenue
	66-68 Margaret Street		LONDON
	London		NW37XA
	W1W 8SR		
Tel:	02075809336		

SAP 2012 worksheet for New extension to existing dwelling - calculation of energy ratings

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	233.18	3.65	851.11	(3a)
Second floor	259.91	3.30	857.70	(3b)
Thirdfloor	244.49	3.28	801.93	(3c)
	970.92			(4)
			2510.74	(5)

2. Ventilation rate

											m³ per ho	bur
							main + s heating	seonda	ry + othe	er		
Numbe	er of chim	neys					0 + 0 + 0)	x 40		0.00	(6a)
Numbe	er of open	flues					2 + 0 + 0)	x 20		40.00	(6b)
Numbe	er of inter	mittent fa	ans				8		x 10		80.00	(7a)
Numbe	rofpass	ive vents					0		x 10		0.00	(7b)
Numbe	er of fluele	ess gas f	ires				0		x 40		0.00	(7c)
											Air chang	ges per hour
											0.05	(8)
Pressu	re test, r	esult q50)						5.00			(17)
Airperr	neability										0.30	(18)
											2.00	(19)
											0.85	(20)
Infiltrat Infiltrat	ion rate ir ion rate r	ncorpora nodified	ting shel [:] for month	ter factor	speed						0.25	(21)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
	4							- K			52.50	(22)
	actor											
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
											13.13	(22a)
Adjuste	ed infiltra	tion rate	(allowing	g for shel	ter and v	vind spe	ed)					
0.32	0.32	0.31	0.28	0.27	0.24	0.24	0.23	0.25	0.27	0.28	0.30	
][]][I	3.32	(22b)
Ventila	tion : nat	ural vent	ilation, ir	ntermitte	nt extrac	rt fans						
Effectiv	/e air cha	nge rate										
0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.54	(25)

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3. Heat losses	and heat los	ss paramete	r					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-value	AxK	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Triple-	glazed,		2.400	1.24 (1.30)	2.97			(27)
air-filled, low-E,	En=0.2,							
hard coat (West	.)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
02-BED-5								
Window - Triple-	glazed,		7.700	1.24 (1.30)	9.52			(27)
air-filled, low-E,	En=0.2,			· · ·				· ,
hard coat (South	n)							
New Build U=	í.3: G=0.36 -							
U=0.24(1.36):	SHGC=0.36:	VT=0.60.						
LG-BED-STAF	F	,						
Window - Triple-	alazed		4 290	1 24 (1 30)	5 30			(27)
air-filled low-F	Fn=0.2		11200	1124 (1100)	0.00			(,
hard coat (East)	,							
New Build LI-	1 3.6-0 36-							
11-0.24(1.36)	SHGC-0 36	VT-0.60						
01-STAIRS	01100=0.00,	v1=0.00,						
Window_Triple-	alazad		1 700	1 24 (1 20)	2 10			(27)
air filled low E	giazeu, En-0.2		1.700	1.24 (1.30)	2.10			(27)
bord coot (North	LII=0.2,							
Now Puild L) 1 2· C_0 26							
	SHCC 0.30-							
0=0.24(1.30),	SПGC=0.30,	v I =0.60,						
UZ-BATH-FAIV			4 700	4 0 4 (4 00)	0.40			(07)
vvindow - i ripie-	giazed,		1.700	1.24 (1.30)	2.10			(27)
air-filled, IOW-E,	En=0.2,							
nard coat (North)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VI=0.60,						
02-BED-06								(
Window - Triple-	glazed,		1.260	1.24 (1.30)	1.56			(27)
air-filled, low-E,	En=0.2,							
hard coat (West	.)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-BREAKFA	STROOM							
Window - Triple-	glazed,		2.530	1.24 (1.30)	3.13			(27)
air-filled, low-E,	En=0.2,							
hard coat (South	ר)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
02-BED-04								
Window - Triple-	glazed,		1.680	1.24 (1.30)	2.08			(27)
air-filled, low-E,	En=0.2,							
hard coat (North)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-ANTE ROC	M							

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4. Wate	er heating	g energ ancy N	y requir	ements							kWh/year 4 00	(42)
Annual	average	not water	r usage ir	n litres pe	er day Vd	,average	;				129.30	(42)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wat	er usage	in litres	ber day f	or each r	nonth							
142.23	137.06	131.88	126.71	121.54	116.37	116.37	121.54	126.71	131.88	137.06	142.23	(44)
Energy	content c	of hot wat	ter used					л	A			
210.92	184.47	190.36	165.96	159.24	137.41	127.33	146.12	147.86	172.32	188.10	204.26	
Energy Distribu	content (a tion loss	annual)			Р			я	J		2034.36	(45)
31.64	27.67	28.55	24.89	23.89	20.61	19.10	21.92	22.18	25.85	28.22	30.64	(46)
Cylinde	r volume,	I					210.00					(47)
Manufa	cturer's d	eclared	cylinderl	oss facto	or (kWh/c	lay)	1.42					(48)
Temper	ature Fac	tor		<i></i>			0.5400					(49)
Energy Total sto	lost from orage los	hot wate s	er cylinde	er (kWh/c	lay)						0.77	(55)
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(56)
Net stor	age loss											
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(57)
Primary	loss		л	1	д	л	1	л	л	Л		
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	at require	ed for wa	ter heati	ng calcul	ated for e	each moi	nth	Л	,	Л		
257.95	226.95	237.39	211.47	206.27	182.93	174.37	193.15	193.38	219.35	233.62	251.30	(62)
Output f	from wate	er heater	for each	month, k	wh/mor	hth			J			
257.95	226.95	237.39	211.47	206.27	182.93	174.37	193.15	193.38	219.35	233.62	251.30	(64)
·	JI	n	J	JL	я	л		л	л	л	2588.14	(64)
Heat ga	ins from	water he	ating, kV	h/month	า							
107.76	95.32	100.92	91.59	90.57	82.10	79.97	86.21	85.58	94.92	98.96	105.54	(65)

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5. Internal gains

	-										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	ic gains,	Watts				<u> </u>					
240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25	240.25
Lighting	gains					<u> </u>					
221.42	196.66	159.93	121.08	90.51	76.41	82.57	107.32	144.05	182.90	213.47	227.57
Appliand	ces gains	5									,
1335.92	1349.78	1314.85	1240.48	1146.60	1058.37	999.43	985.56	1020.50	1094.87	1188.75	1276.98
Cooking	gains										
63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03	63.03
Pumps a	and fans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lossese	e.g. evap	oration (r	egative	values)							
-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17	-160.17
Water he	eating ga	ins									
144.84	141.85	135.65	127.21	121.74	114.03	107.48	115.87	118.86	127.58	137.44	141.86
Totalint	ernal gai	ns		,		<u>.</u>	<u> </u>	·			
1848.28	1834.40	1756.54	1634.89	1504.96	1394.93	1335.58	1354.87	1429.51	1551.46	1685.77	1792.52

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.400 19.64	0.64 x 0.80	0.77	16.7248
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 02-BED-5		
Window - Triple-glazed, air-filled, low-E,	0.9 x 7.700 46.75	0.64 x 0.80	0.77	127.7305
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60	0,		
LG-BED-STAFF				
Window - Triple-glazed, air-filled, low-E,	0.9 x 4.290 19.64	0.64 x 0.80	0.77	29.8956
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0.60), 01-STAIRS		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.700 10.63	0.64 x 0.80	0.77	6.4139
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60	0,		
02-BATH-FAMILY				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.700 10.63	0.64 x 0.80	0.77	6.4139
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0.60), 02-BED-06		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.260 19.64	0.64 x 0.80	0.77	8.7805
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60	0,		
00-BREAKFAST ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.530 46.75	0.64 x 0.80	0.77	41.9686
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0.60), 02-BED-04		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.680 10.63	0.64 x 0.80	0.77	6.3385
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0.60), 00-ANTE		
ROOM				

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6. Solar gains (calculation for January)		~ ~ ГГ	Choding	Coine
Window-Triple-glazed air-filled low-F	A 1 CA A FIUX	у & гг 0 64 x 0 80	0 77	6 3385
$F_n=0.2$ hard coat (North)	0.0 X 1.000 10.00	0.04 × 0.00	0.77	0.0000
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60	,00-ANTE		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.120 10.63	0.64 x 0.80	0.77	4.2256
En=0.2, hard coat (North) New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,00-ANTE		
ROOM Window Triple glazed oir filled low E	0.0 × 1.900.10.64	0.64 × 0.90	0.77	10 5 400
En=0.2, hard coat (West)	0.9 X 1.600 19.64	0.04 x 0.00	0.77	12.0430
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60), RF-PLAY		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.160 19.64	0.64 x 0.80	0.77	15.0523
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VT=0.60	,02-BED-04		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.430 46.75	0.64 x 0.80	0.77	23.7214
En=0.2, nard coat (South)				
New Build $U=1.3$; $G=0.36 - U=0.24(1.36)$; Sf	1GC=0.36; V I =0.60	,		
Window Triple glazad oir filled low E	0 0 y 1 722 10 64	0.64 x 0.90	0.77	10 0700
En=0.2 bard cost (East)	0.9 X 1.732 19.04	0.04 X 0.00	0.77	12.0732
$E_{11}=0.2$, fiald $C_{12}=0.26$, $E_{12}=0.24(1.36)$; SE				
Window-Triple-glazed air-filled low-F	0 9 x 1 100 10 63	0.64×0.80	0.77	4 1502
$F_n=0.2$ hard coat (North)	0.3 × 1.100 10.03	0.04 × 0.00	0.77	4.1502
New Build U=1 3: $G=0.36 - U=0.24(1.36)$: SE	IGC=0.36·VT=0.60	02-BED-5		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.155 10.63	0.64 x 0.80	0.77	4.3577
En=0.2. hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60),		
00-BREAKFAST ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.155 10.63	0.64 x 0.80	0.77	4.3577
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60),		
00-BREAKFAST ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.680 10.63	0.64 x 0.80	0.77	6.3385
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); Sł	HGC=0.36; VT=0.60	,		
00-BREAKFAST ROOM				
Window - I riple-glazed, air-filled, low-E,	0.9 x 1.680 10.63	0.64 x 0.80	0.77	6.3385
En=0.2, nard coat (North)				
00-BREAKFASTROOM	1GC=0.36; VI=0.60	, 	- 	4 0050
VVIndow - I riple-glazed, air-filled, low-E,	0.9 X 1.120 10.63	0.64 X 0.80	0.77	4.2250
En=0.2, nard coat (North)				
$M_{\rm ew}$ Build $U = 1.3, G = 0.30 - U = 0.24(1.30), SI = 0.24(1.30), SI$	IGC=0.30, V1=0.00	',		
Window-Triple-glazed air-filled low-F	0 9 x 1 020 46 75	0.64×0.80	0.77	16 9201
$F_n=0.2$ hard coat (South)	0.0 X 1.020 40.70	0.04 × 0.00	0.77	10.5201
New Build $U=1.3$; $G=0.36 - U=0.24(1.36)$; SI	HGC=0.36.VT=0.60			
00-RECEPTION ROOM		,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.975 46.75	0.64 x 0.80	0.77	49.3504
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60),		
00-RECEPTION ROOM	D - 0 111			
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6. Solar gains (calculation for January)	Area & Flux	a & FF	Shading	Gains
Window-Triple-glazed air-filled low-F	0.9×1.0204675	0.64×0.80	0.77	16 9201
$F_{n=0.2}$ hard coat (South)	0.0 X 1.020 40.70	0.04 X 0.00	0.77	10.0201
New Build U=1.3; G=0.36 - U=0.24(1.36); SH 00-RECEPTION ROOM	HGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.430 46.75	0.64 x 0.80	0.77	23.7214
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH 00-RECEPTION ROOM	HGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E, En=0.2, bard coat (North)	0.9 x 3.675 10.63	0.64 x 0.80	0.77	13.8654
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-LIVING		
Window-Triple-glazed air-filled low-F	0 0 v 1 155 10 63	0.64 x 0.80	0.77	1 3577
$F_n=0.2$ hard coat (North)	0.9 × 1.155 10.05	0.04 × 0.00	0.77	4.5577
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60	,00-LIVING		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.155 10.63	0.64 x 0.80	0.77	4.3577
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-LIVING		
ROOM	0.0 × 1.000.10.01	0.04 × 0.00	0.77	0 7005
Ep=0.2 bard cost (East)	0.9 X 1.260 19.64	0.64 X 0.80	0.77	8.7805
$E_{1}=0.2$, $Hard Coar (East)$				
01-BED-MASTER		,	- 	
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.020 46.75	0.64 x 0.80	0.77	16.9201
En=0.2, nard coat (South) New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60,	00-DINING		
Window-Triple-glazed air-filled low-F	0 9 x 2 975 46 75	0 64 x 0 80	0 77	49 3504
En=0.2. hard coat (South)	0.0 X 2.010 10.10	0.01 × 0.00	0.77	10.0001
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	00-DINING		
ROOM				
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.020 46.75	0.64 x 0.80	0.77	16.9201
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60;	,00-DINING		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.080 46.75	0.64 x 0.80	0.77	17.9155
En=0.2, hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,01-BED-01		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 46.75	0.64 x 0.80	0.77	17.9155
En=0.2, hard coat (South)				
New Build U=1.3; G= $0.36 - 0=0.24(1.36)$; SF	1GC=0.36; VI=0.60	,01-BED-01	0.77	ED 0ED 4
Fr=0.2 bard cost (South)	0.9 X 3.150 46.75	0.64 X 0.80	0.77	52.2534
New Build $II = 1.3$: G=0.36 - $II = 0.24(1.36)$: SE	IGC-0 36·VT-0 60	01-BED-01		
Window - Triple-glazed air-filled low-F	0 9 x 1 815 10 63	0.64×0.80	0 77	6 8478
$E_n=0.2$, hard coat (North)		0.01 × 0.00	0.77	0.0110
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60	, RF-PLAY		
Window - Triple-glazed, air-filled. low-E.	0.9 x 1.190 19.64	0.64 x 0.80	0.77	8.2927
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60) ,		
01-BATH-MASTER	Done 7 of 44			
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6. Solar gains (calculation for January)		. FF	0, "	o :
Martine Transformed at the Clinic Line of the	Area & Flux	g & FF	Shading	Gains
Window - I riple-glazed, air-filled, low-E,	0.9 x 1.190 19.64	0.64 x 0.80	0.77	8.2927
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VI=0.60	,		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.700 19.64	0.64 x 0.80	0.77	11.8468
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VT=0.60	,02-STAIRS		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.050 19.64	0.64 x 0.80	0.77	7.3171
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH ROOM	IGC=0.36; VT=0.60	, 00-LIVING		
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.155 19.64	0.64 x 0.80	0.77	8.0488
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
00-BREAKFASTROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.200 19.64	0.64 x 0.80	0.77	15.3311
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH RF-STAIRS	IGC=0.36; VT=0.60	,		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.815 46.75	0.64 x 0.80	0.77	30.1079
En=0.2. hard coat (South)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36: VT=0.60	l.		
01-BED-02-LIVING	,	,		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.087 19.64	0.64 x 0.80	0.77	7.5784
En=0.2. hard coat (East)				
New Build U=1 3: G=0 36 - U=0 24(1 36): St	IGC=0 36 [.] VT=0 60			
01-ENSUITE-02		,		
Window-Triple-glazed air-filled low-F	0 9 x 2 970 10 63	0 64 x 0 80	0.77	11 2055
En=0.2 hard coat (North)			0.11	11.2000
New Build U=1 3: G=0 36 - U=0 24(1 36): St	IGC=0.36 [.] VT=0.60			
01-BED-MASTER-DRESSING		,		
Window-Triple-glazed air-filled low-F	0 9 x 2 530 46 75	0 64 x 0 80	0 77	41 9686
$E_n=0.2$ hard coat (South)	0.0 X 2.000 10.10	0.01 × 0.00	0.11	11.0000
New Build U=1 3: G=0 36 - U=0 24(1 36): SE	IGC=0.36·VT=0.60	02-BED-03		
Window-Triple-glazed air-filled low-F	0.9×0.9904675	0.64×0.80	0.77	16 4225
$E_n=0.2$ hard coat (South)	0.0 x 0.000 10.10	0.01 × 0.00	0.11	10.1220
New Build $I = 1.3$: G=0.36 - $I = 0.24(1.36)$: SE	IGC-0 36: VT-0 60			
01-BED-01-LIV/ING	100-0.00, 11-0.00	,		
Window-Triple-glazed air-filled low-F	0 9 x 1 815 46 75	0 64 x 0 80	0.77	30 1079
$E_{n-0.2}$ hard coat (South)	0.0 X 1.010 40.70	0.04 X 0.00	0.11	00.1070
New Build $I = 1.3$: G=0.36 - $I = 0.24(1.36)$: SE				
01-BED-01-LIV/ING	100-0.00, 11-0.00	,		
Window-Triple-glazed air-filled low-E	0 9 v 1 087 19 6/	0.64×0.80	0.77	7 578/
En=0.2 hard coat (East)	0.3 × 1.007 13.04	0.04 × 0.00	0.77	1.5704
New Build $I = 1.3$; G=0.36 - $I = 0.24(1.36)$; SE				
01_1 IV/ING_MASTER	100-0.00, v1-0.00	,		
Window-Triple-diazed air-filled low-F	0 0 x 2 070 10 62	0 64 x 0 80	0.77	11 2055
$F_n=0.2$ hard cost (North)	0.0 X 2.070 10.00	0.04 × 0.00	0.11	11.2000
New Build I = 1 3: G=0.36 - I I=0.27(1.36): SE	1GC-0 36· \/T-0 60			
01-LIVING-MASTER		,		

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6. Solar gains (calculation for January)				
	Area & Flux	g & FF	Shading	Gains
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.080 10.63	0.64 x 0.80	0.77	4.0747
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-LIVING-MASTER				
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.080 10.63	0.64 x 0.80	0.77	4.0747
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,		
01-LIVING-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.060 10.63	0.64 x 0.80	0.77	11.5451
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VT=0.60	,		
01-BED-MASTER				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.080 10.63	0.64 x 0.80	0.77	4.0747
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; V1=0.60	,		
01-BED-MASTER				
Window - I riple-glazed, air-filled, low-E,	0.9 x 1.080 10.63	0.64 x 0.80	0.77	4.0747
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SF	IGC=0.36; VI=0.60	,		
UI-BED-MASTER	0.07 700 40 75	0.010.00	0 77	407 7005
window - I riple-glazed, air-filled, low-E,	0.9 X 7.700 46.75	0.64 X 0.80	0.77	127.7305
En=0.2, nard coat (South)				
New Dulla U=1.3, G=0.30 - U=0.24(1.30), Sr	1GC=0.36, V1=0.60	,		
Window Triple glazed air filled low E	0.0 x 2 220 10 62	0.64 x 0.90	0.77	10 1/07
En-0.2 bord cost (North)	0.9 X 3.220 10.03	0.04 X 0.00	0.77	12.1407
$E_{II}=0.2$, $H_{II}=0.24(1.26)$; $E_{II}=0.24(1.26)$; $E_{II}=0.24(1.$				
New Build $0 = 1.3$, $G = 0.30 - 0 = 0.24(1.30)$, SI	190=0.30, 1 = 0.00	,		
Window-Triple-glazed air-filled low-F	0 0 v 1 080 /6 75	0.64 v 0.80	0.77	17 0155
$F_{n-0.2}$ hard cost (South)	0.3 × 1.000 40.73	0.04 × 0.00	0.77	17.3155
New Build $I = 1.3$; G=0.36 $\cdot I = 0.24(1.36)$; SE		01-BED-02		
Window-Triple-glazed air-filled low-F	$0.0 \times 3.150 I = 0.00$	064×0.80	0.77	52 2534
$F_{n-0.2}$ hard cost (South)	0.3 × 3.130 40.73	0.04 × 0.00	0.77	52.2554
New Build $I = 1.3$: G=0.36 - $I = 0.24(1.36)$: SE	IGC-0 36· VT-0 60	01-BED-02		
Window-Triple-diazed air-filled low-F	0 9 x 1 080 46 75	0.64×0.80	0.77	17 9155
$F_n=0.2$ hard coat (South)	0.0 × 1.000 +0.70	0.04 X 0.00	0.77	17.0100
New Build U=1 3: $G=0.36 - U=0.24(1.36)$: SE	IGC=0.36·VT=0.60	01-BED-02		
Window - Triple-glazed air-filled low-F	$0.9 \times 1.120 19.64$	0 64 x 0 80	0 77	7 8049
$E_{n=0.2}$, hard coat (West)	0.0 x 1.120 10.01	0.01 × 0.00	0.11	1.0010
New Build U=1.3: G=0.36 - U=0.24(1.36): SH	IGC=0.36: VT=0.60	L		
01-ENSUITE-01		,		
Window - Triple-glazed, air-filled, low-E.	0.9 x 1.155 19.64	0.64 x 0.80	0.77	8.0488
En=0.2, hard coat (West)			-	
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60.	,00-LIVING		
ROOM	,,			
Solid door	0.9 x 2.200 0.00	0.00 x 0.80	0.77	0.0000
2013 Door, 00-ENTRANCE LOBBY				

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7. Mean internal temperature

Temper Heating	ature dui system r	ring heati esponsiv	ing period /eness	dsinthel	living are	a, Th1 (°	C)				21.0 1.0)0)0	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau		A			л				л				
31.64	31.68	31.73	31.93	31.97	32.15	32.15	32.18	32.08	31.97	31.89	31.81		
alpha		A			л				л				
3.11	3.11	3.12	3.13	3.13	3.14	3.14	3.15	3.14	3.13	3.13	3.12		
Utilisati	on factor	for gains	forliving	area	A				Α				
1.00	1.00	0.99	0.97	0.94	0.86	0.75	0.80	0.93	0.98	1.00	1.00		(86)
Meanin	ternal ter	nperatur	e in living	area T1	A				Α				
18.53	18.76	19.13	19.64	20.16	20.59	20.82	20.78	20.41	19.74	19.04	18.50		(87)
Temper	ature du	ring heati	ingperio	ds in rest	ofdwelli	ng Th2			λ				
19.88	19.88	19.88	19.89	19.89	19.89	19.89	19.89	19.89	19.89	19.88	19.88		(88)
Utilisati	on factor	for gains	for rest of	of dwellir	ng				A				
1.00	0.99	0.99	0.97	0.92	0.80	0.63	0.69	0.89	0.98	0.99	1.00		(89)
Mean in	iternal tei	mperatur	re in the r	est of dw	velling T2	2			я				
16.55	16.87	17.43	18.17	18.91	19.50	19.78	19.73	19.28	18.32	17.30	16.50		(90)
Livinga	rea fracti	on (36.43	3/970.92	2)	А				Я		0.0)4	(91)
Meanin	ternal ter	nperatur	e (for the	whole d	welling)								
16.62	16.94	17.49	18.23	18.96	19.55	19.82	19.77	19.32	18.37	17.36	16.57		(92)
Apply a	djustmen	t to the m	nean inte	rnal tem	perature	, where a	ppropria	ate					
16.62	16.94	17.49	18.23	18.96	19.55	19.82	19.77	19.32	18.37	17.36	16.57		(93)

8. Space heating requirement

-											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisatio	on factor	for gains						л			
0.99	0.99	0.98	0.95	0.89	0.78	0.62	0.68	0.87	0.96	0.99	1.00
Useful g	ains							Α			
2983.5	3779.8	4447.9	4969.5	5051.3	4359.6	3336.7	3348.6	3901.2	3636.4	3040.3	2763.0
Monthly	average	external	tempera	ture				Α			
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
Heat los	s rate for	mean in	ternal tei	mperatu	re						
15009.1	14649.7	13351.6	11258.2	8747.7	5928.4	3854.4	4039.0	6268.8	9367.8	12400.4	14987.0
Fraction	ofmont	n for heat	ing								
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space h	eating re	quireme	nt for eac	ch month	, kWh/m	onth					
8947.0	7304.6	6624.3	4527.9	2750.1	-	-	-	-	4264.2	6739.3	9094.7
Total sp	ace heat	ing requi	rementp	er year (kWh/yea	ar) (Octo	ber to Ma	ay)			50252.0
Space h	eating re	quireme	nt per m ²	[:] (kWh/m	²/year)						51.7

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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Extern	altemper	aturers		·					·		
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat lo	oss rate V	V][JL	1	л			
-	-	-	-	-	11268.3	8870.8	9101.1	-	-	-	-
Utilisat	ion facto	for loss	JJ.	JL		Л	1	л		JL	I
-	-	-	-	-	0.51	0.60	0.55	-	-	-	-
Useful	loss W				.н	J					
-	-	-	-	-	5799.2	5306.8	5021.4	-	-	-	-
Interna	l gains W	1				J			я		K
0.00	0.00	0.00	0.00	0.00	1391.93	1332.58	1351.87	0.00	0.00	0.00	0.00
Solar g	jains W							A			
0.00	0.00	0.00	0.00	0.00	4894.7	4691.2	4192.3	0.00	0.00	0.00	0.00
Gains	Ŵ		л					л			
-	-	-	-	-	6286.7	6023.8	5544.2	-	-	-	-
Fractic	n of mon	th for co	oling								
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space	heating k	Wh									
-	-	-	-	-	872.03	123.93	47.42	-	-	-	-
Space	cooling k	Wh		·					·		
-	-	-	-	-	350.94	533.45	388.95	-	-	-	-
Total								<u>,</u>			1273.34
Coolec	fraction										0.10
Interm	ittency fac	ctor						1			
-		-	-	-	0.25	0.25	0.25	-	-	-	-
Space	coolingre	equirem	ent for m	onth				η <u></u>			
-	-	-	-	-	8.77	13.34	9.72	-	-	-	-
Space	cooling (June to A	August)	-2 /1.1 /1 /	2/						31.83
Space	cooling re	equirem	ent per n	<u>ר≁ (KVVh/r</u>	n≁/year)						0.03

8c. Space cooling requirement

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9a. Energy requirements

	57 1										kWh/year	
No secor Fraction Efficiency Cooling s	ndary he of space y of main system e	ating system heat from heating energy ef	stem sele om main s g system ficiency	ected system(s ratio	5)			2 6	1.0000 49.90% .22%			(202) (206) (209)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space he	eating re	quireme	nt	<u> </u>	J	J			я			
8947.0	7304.6	6624.3	4527.9	2750.1	-	-	-	-	4264.2	6739.3	9094.7	(98)
Appendix	k Q - mo	nthly ene	ergy save	ed (main	heating	system 1	1)	л		1		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space he	eating fu	el (main	heating	system 1)	Л	Л	л	л	J		
3580.2	2923.0	2650.8	1811.88	1100.50) -	-	-	-	1706.35	2696.8	3639.3	(211)
Appendix	k Q - mo	nthly ene	ergy save	ed (main	heating	system 2	2)	Л	J	J		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space he	eating fu	el (main	heating	system 2	2)	J][J	JL	J		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix	x Q - mo	nthly ene	ergy save	ed (seco	ndary he	ating sys	stem)		JL	J	JLJ	. ,
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space he	eating fu	el (secor	ndary)		J	JL	JL		JL	J][]	· · /
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Waterhe	ating				J	JL][1			· · /
Waterhe	ating red	quiremer	nt									
257.95	226.95	237.39	211.47	206.27	182.93	174.37	193.15	193.38	219.35	233.62	251.30	(64)
Efficienc	y of wate	rheater	1		л	J	Л		л	JL	65.00	(216)
65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	(217)
Waterhe	ating fue	el				J	Л	л	л	JL		
396.85	349.16	365.22	325.35	317.35	281.43	268.26	297.15	297.51	337.47	359.41	386.61	(219)
Annual to Space he Space he	otals eating fu	el used, el (secor	main sys	stem 1		JL				1	kWh/year 20108.86 0.00	(211) (215)
Water he	atingfue	el									3981.75	(219)
Space co	oling fu	elused			Y		1				5.12	(221)
-	-	-	-	-	1.41	2.14	1.56	-	-	-	-	(221)
Electricity central I Total electricity Energy sa	y for pur neating (ctricity fo y for ligh aving/ge	nps, fans oump or the ab- ting (100 eneration	s and ele ove, kWł).00% fix technolo	ctric kee n/year ed LEL) ogies	p-hot						30.00 30.00 1564.10	(230c) (231) (232)
Energy	saved c used ()	or genera :	ated ():								0.000 0.000	(236a) (237a)
Total deli	vereder	nergy for	alluses								25689.83	(238)

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10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price	£/year	
Space heating - main system 1	20108.861	13.190	2652.36	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
High-rate percentage	0.000%			(243)
Low-rate percentage	0.000%			(244)
High-rate cost	0.00	0.000	0.00	(245)
Low-rate	0.00	0.000	0.00	(246)
Space cooling	5.115	13.190	0.67	(248)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	30.000	13.190	3.96	(249)
Energy for lighting	1564.105	13.190	206.31	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			3121.86	(255)

11a. SAP rating

	0.42	(256)
	1.29	(257)
SAP value	82.00	
	82	(258)
SAP band	В	

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12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	20108.86	0.519	10436.50	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	3981.75	0.216	860.06	(264)
Space and water heating			11296.56	(265)
Space cooling	5.12	0.519	2.65	(266)
Electricity for pumps and fans	30.00	0.519	15.57	(267)
Electricity for lighting	1564.10	0.519	811.77	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			12126.55	(272)
			kg/m²/yea	ır
CO2 emissions per m ²			12.49	(273)
Elvalue			84.01	(273a)
El rating			84	(274)
El band			В	
Coloulation of stars for besting and DUW				

Calculation of stars for heating and DHW

Main heating energy efficiency Main heating environmental impact Water heating energy efficiency Water heating environmental impact (13.19 / 2.4990) x (1 + (0.29 x 0.00)) = 5.2781, stars = 4 (0.5190 / 2.4990) x (1 + (0.29 x 0.00)) = 0.2077, stars = 5 3.48 / 0.6500 = 5.3538, stars = 3 0.2160 / 0.6500 = 0.3323, stars = 3

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10.1. Appendix 4 – SAP Worksheet 'Be Lean' New Extension



Project Information

Building type Detached house

Reference Date	18 January 2022		
Client	Marek Wojciechowski Architects 66-68 Margaret Street London W1W 8SR	Project	2 Templewood Avenue LONDON NW3 7XA
Tel:	02075809336		

SAP 2012 worksheet for New dwelling as designed - calculation of energy ratings

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	159.39	3.17	505.27	(3a)
Firstfloor	58.58	2.80	164.02	(3b)
	217.97			(4)
			669.29	(5)

2. Ventilation rate

											m³ per ho	bur
							main + s heating	seonda	ry + othe	er		
Numbe	er of chim	neys					0 + 0 + 0)	x 40		0.00	(6a)
Numbe	er of open	flues					2 + 0 + 0)	x 20		40.00	(6b)
Numbe	er of inter	mittent fa	ans				2		x 10		20.00	(7a)
Numbe	rofpass	ive vents					0		x 10		0.00	(7b)
Numbe	er of fluele	ess gas f	ires				0		x 40		0.00	(7c)
											Air chang	ges per hour
											0.09	(8)
Pressu	re test, r	esult q50)						5.00			(17)
Air perr	neability										0.34	(18)
											2.00	(19)
											0.85	(20)
Infiltrat	ion rate ir	ncorpora	ting shelt	ter factor	Nacad						0.29	(21)
IIIIIIIai	Ionnaten			ily wind s	speed							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Wind E	octor										52.50	(22)
vviriu r												
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
A .P			(- II	(·	11				13.13	(22a)
Adjuste	ed infiltra	tion rate	(allowing	for shel	ter and v	vina spe	ea)					
0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34	
-						,				.	3.79	(22b)
Ventila	tion : nat	ural vent	ilation, ir	ntermitte	nt extrac	t fans						
Effectiv	/e air cha	nge rate										
0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses	and heat los	ss paramete	r					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-value	АхК	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Triple-	·glazed,		3.360	1.24 (1.30)	4.15			(27)
air-filled, low-E,	En=0.2,							
hard coat (North	ı)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-STUDY								
Window - Triple-	glazed,		18.340	1.24 (1.30)	22.66			(27)
air-filled, low-E,	En=0.2,							
hard coat (East))							
New Build U=	, 1.3: G=0.36 -							
U=0.24(1.36):	SHGC=0.36:	VT=0.60.						
LG-POOL	000 0.000,							
Window - Triple-	alazed		2 640	1 24 (1 30)	3 26			(27)
air-filled low-F	$E_n=0.2$		2.040	1.24 (1.00)	0.20			(21)
hard coat (West	E11=0.2, t)							
New Build LI-	1 3·C-0 36 -							
11=0.24(1.36)	SHCC-0 36	VT-0.60						
0 = 0.24(1.30),	51160-0.50,	v1=0.00,						
Window Triplo	alazad		4 950	4 04 (4 00)	1 60			(07)
window - mpie-			1.330	1.24 (1.30)	1.00			(27)
air-illied, low-E,	En=0.2,							
nard coat (North								
	1.3; G=0.36 -	VT 0.00						
U=0.24(1.36);	SHGC=0.36;	VI = 0.60,						
00-STUDY								()
Window - Triple-	glazed,		2.640	1.24 (1.30)	3.26			(27)
air-filled, low-E,	En=0.2,							
hard coat (West	t)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-BOOTROC	MC							
Window - Triple-	glazed,		2.640	1.24 (1.30)	3.26			(27)
air-filled, low-E,	En=0.2,							
hard coat (West	t)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-BOOTROO	DM							
Window - Triple-	glazed,		6.160	1.24 (1.30)	7.61			(27)
air-filled, low-E,	En=0.2,			、				· · ·
hard coat (West	t)							
New Build U=	1.3: G=0.36 -							
U=0.24(1.36):	SHGC=0.36:	VT=0.60.						
LG-POOL	000 0.000,							
Window - Triple-	alazed		1.358	1.24 (1.30)	1 68			(27)
air-filled low-F	Fn=0.2		1.000	+ (1.00)	1.00			(44)
hard cost (North								
	1 3. 6-0 36							
	SHCC_0 20-							
0 01000	3000=0.30;	v i =0.60,						
00-31001								

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SAP 2012 worksheet for New dw	velling as designed -	calculation of	energy ratings
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4. Wate	r heating	g energ y ancy N	y require	ements							kWh/year	(42)
Annual average hot water usage in litres per day Vd, average										106.05	(43)	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wate	er usage	in litres p	ber day f	or each r	nonth			л	A			
116.66	112.41	108.17	103.93	99.69	95.45	95.45	99.69	103.93	108.17	112.41	116.66	(44)
Energy	content c	of hot wat	er used		4	J			я			
173.00	151.30	156.13	136.12	130.61	112.71	104.44	119.85	121.28	141.34	154.28	167.54	
Energy of Distribut	content (a tion loss	annual)			Р			я			1668.59	(45)
25.95	22.70	23.42	20.42	19.59	16.91	15.67	17.98	18.19	21.20	23.14	25.13	(46)
Cylinder	rvolume,	I					210.00					(47)
Manufa	cturer's d	eclared	cylinderl	oss facto	or (kWh/c	lay)	1.42					(48)
Tempera	ature Fac	tor					0.5400				0.77	(49)
Energy I Total sto	lost from prage los	hot wate s	er cylinde	er (KVVh/c	lay)						0.77	(55)
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(56)
Net stor	age loss				A			A				
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(57)
Primary	loss				A	J		л	я			
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	at require	ed for wa	ter heati	ng calcul	ated for e	each mo	nth	л	л	1		
220.03	193.79	203.17	181.64	177.64	158.22	151.47	166.88	166.79	188.37	199.80	214.57	(62)
Output f	rom wate	er heater	for each	month, k	(Wh/mor	nth						
220.03	193.79	203.17	181.64	177.64	158.22	151.47	166.88	166.79	188.37	199.80	214.57	(64)
					n	,			л		2222.37	(64)
Heat ga	ins from v	water he	ating, kW	/h/month	<u>ן</u>		1	1)r	n.		
95.15	84.29	89.54	81.67	81.05	73.89	72.35	77.48	76.74	84.62	87.71	93.33	(65)

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5. Internal gains

	-										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	ic gains,	Watts									
181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52
Lighting	gains										
86.44	76.77	62.43	47.27	35.33	29.83	32.23	41.90	56.23	71.40	83.33	88.84
Appliand	ces gains	6									
578.83	584.84	569.70	537.48	496.81	458.58	433.04	427.03	442.17	474.39	515.07	553.29
Cooking	gains										
56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18
Pumps a	and fans	gains									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lossese	e.g. evap	oration (r	negative	values)							
-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01
Water he	eating ga	ains									
127.89	125.44	120.35	113.43	108.94	102.62	97.25	104.13	106.58	113.74	121.82	125.45
Total inte	ernal gai	ns									
912.84	906.73	872.17	817.87	760.77	710.71	682.20	692.74	724.66	779.21	839.90	887.26

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.360 10.63	0.64 x 0.80	0.77	12.6769
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 00-STUDY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 18.340 19.64	4 0.64 x 0.80	0.77	127.8056
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.60	0, LG-POOL		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.640 19.64	0.64 x 0.80	0.77	18.3973
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0.60	0,		
00-GARAGE				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.358 11.28	0.64 x 0.80	0.77	5.4350
En=0.2, hard coat (NorthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 00-STUDY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.640 19.64	0.64 x 0.80	0.77	18.3973
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60	0, 00-BOOT		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.640 19.64	0.64 x 0.80	0.77	18.3973
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60	0, 00-BOOT		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 6.160 19.64	0.64 x 0.80	0.77	42.9271
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60	0, LG-POOL		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.358 11.28	0.64 x 0.80	0.77	5.4350
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=0.60), 00-STUDY		

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6. Solar gains (calculation for January)												
	Area & Flux	g & FF	Shading	Gains								
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.120 10.	63 0.64 x 0.80	0.77	30.6359								
En=0.2, hard coat (North)												
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0).60, LG-POOL										
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.120 10.	63 0.64 x 0.80	0.77	30.6359								
En=0.2, hard coat (North)												
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0).60, LG-POOL										
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.120 10.	63 0.64 x 0.80	0.77	30.6359								
En=0.2, hard coat (North)												
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0).60, LG-POOL										
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.120 10.	63 0.64 x 0.80	0.77	30.6359								
En=0.2, hard coat (North)												
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0).60, LG-POOL										
Window - Triple-glazed, air-filled, low-E,	0.9 x 4.200 10.	63 0.64 x 0.80	0.77	15.8462								
En=0.2, hard coat (North)												
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0).60, LG-POOL										
Solid door	0.9 x 2.160 0.0	0 0.00 x 0.80	0.77	0.0000								
2013 Door, 00-BOOT ROOM												
Total solar gains, January				387.86 (83-1)								
Color acino				, , , , , , , , , , , , , , , , , , ,								
		rr										
387.86 752.78 1258.27 1914.95 2450.4 25	61.9 2416.5 2	000.7 1484.90 895.	11 481.74	320.60 (83)								
Total gains												
1300.70 1659.51 2130.4 2732.8 3211.2 32	72.6 3098.7 2	693.5 2209.6 1674	4.32 1321.64	1207.87 (84)								

Lighting calculations

	Area	g	FF x Shading	
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.36	0.70	0.80 x 0.83	1.41
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0).60,00-STUDY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 18.34	0.70	0.80 x 0.83	7.67
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0).60, LG-POOL		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.64	0.70	0.80 x 0.83	1.10
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0	0.60,		
00-GARAGE		-		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.36	0.70	0.80 x 0.83	0.57
En=0.2, hard coat (NorthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0).60,00-STUDY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.64	0.70	0.80 x 0.83	1.10
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0).60, 00-BOOT		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.64	0.70	0.80 x 0.83	1.10
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36; VT=0).60, 00-BOOT		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 6.16	0.70	0.80 x 0.83	2.58
En=0.2, hard coat (West)				
New Build U=1 3 G=0 36 - U=0 24(1 36)	SHGC=0.36.VT=0) 60 G-POOI		

New Build U=1.3; G=0.36 - U=0.24(1.36); SHGC=0.36; VT=0.60, LG-POOL

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Lighting calculations

	Area	g	FF x Shading	
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.36	0.70	0.80 x 0.83	0.57
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,00-STUDY		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 4.20	0.70	0.80 x 0.83	1.76
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
GL = 31.45 / 217.97 = 0.144				
C1 = 0.500				
C2 = 0.960				
EI = 611				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C)21.00Heating system responsiveness1.00) (85))	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
27.88	27.93	27.98	28.22	28.26	28.47	28.47	28.51	28.39	28.26	28.17	28.08	
alpha												
2.86	2.86	2.87	2.88	2.88	2.90	2.90	2.90	2.89	2.88	2.88	2.87	
Utilisatio	on factor	for gains	for living	area								
0.99	0.97	0.94	0.85	0.71	0.54	0.42	0.49	0.73	0.92	0.98	0.99	(86)
Meanin	ternal ter	nperatur	e in living	area T1								
18.62	18.93	19.46	20.12	20.61	20.87	20.96	20.93	20.68	19.98	19.17	18.56	(87)
Temper	ature dur	ing heati	ngperio	ds in rest	ofdwelli	ng Th2						
19.72	19.72	19.72	19.73	19.73	19.74	19.74	19.74	19.74	19.73	19.73	19.72	(88)
Utilisatio	on factor	for gains	for rest of	of dwellir	ng							
0.98	0.97	0.92	0.82	0.65	0.46	0.31	0.37	0.65	0.90	0.97	0.99	(89)
Mean in	ternal ter	nperatur	e in the r	est of dw	elling T2	2						
16.58	17.03	17.79	18.71	19.35	19.64	19.72	19.71	19.46	18.55	17.39	16.50	(90)
Living ai Mean in	Living area fraction (11.36/217.97) 0.05 Mean internal temperature (for the whole dwelling)											5 (91)
16.68	17.13	17.88	18.79	19.41	19.71	19.78	19.77	19.53	18.62	17.48	16.61	(92)
Apply ad	djustmen	t to the m	nean inte	rnal tem	perature,	, where a	ppropria	ite	-			
16.53	16.98	17.73	18.64	19.26	19.56	19.63	19.62	19.38	18.47	17.33	16.46	(93)

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.97	0.95	0.89	0.78	0.62	0.44	0.30	0.36	0.63	0.87	0.95	0.98	(94)
Useful gains												
1262.47	1570.58	1902.96	2139.7	1999.61	1447.60	924.41	965.67	1385.11	1449.18	1259.78	1178.31	(95)
Monthly	average	external	temperat	ture								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat los	s rate for	mean in	ternal ter	nperatur	e							
3895.0	3839.1	3562.4	3062.3	2375.1	1545.60	945.69	1002.19	1649.05	2472.4	3223.6	3875.5	(97)
Fraction	of month	n for heat	ing									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space h	eating re	quireme	nt for eac	ch month	, kWh/m	onth						
1958.63	1524.42	1234.66	664.26	279.36	-	-	-	-	761.30	1413.96	2006.7	
Total spa Space h	Fotal space heating requirement per year (kWh/year) (October to May)9843.29Space heating requirement per m² (kWh/m²/year)45.16										9 (98) 6 (99)	
8c. Space cooling requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Externa	al tempera	aturers						л	- 	- A	
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-
Heat lo	ss rate W	Î				J		<u>, </u>	FL	<u> </u>	
-	-	-	-	-	2930.1	2306.7	2365.8	-	-	-	-
Jtilisati	on factor	for loss	-)L		я	J					
-	-	-	-	-	0.82	0.87	0.83	-	-	-	-
Jseful I	oss W										
-	-	-	-	-	2411.5	2014.8	1956.75	ş -	-	-	-
nterna	l gains W										
0.00	0.00	0.00	0.00	0.00	707.71	679.20	689.74	0.00	0.00	0.00	0.00
Solar g	ains W										
0.00	0.00	0.00	0.00	0.00	2994.4	2824.5	2338.5	0.00	0.00	0.00	0.00
Gains V	N										
-	-	-	-	-	3702.1	3503.7	3028.3	-	-	-	-
Fraction	n of mont	h for coo	ling								
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Space I	neating k	Wh									
-	-	-	-	-	149.28	23.93	1.23	-	-	-	-
Space	cooling k ^v	Wh									
-	-	-	-	-	929.28	1107.73	797.21	-	-	-	-
Total									- A		2834.22
Cooled	fraction	1									0.10
Intermit	tency fac	tor			1			η <u></u>	-)r	-1(
-	- 	[-	-	-	0.25	0.25	0.25	-	-	-	-
Space	cooling re	quireme	nt for mo	nth	1			γ <u> </u>		1	
-	-	-	-	-	23.23	27.69	19.93	-	-	-	-
Space (cooling (J	lune to A	ugust)	?(k\//h/m	2/voar)						70.86 0.33
Space	Joonny re	quirente	ntperm*	וו/וועעיאן/	-year)						0.33

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9a. Energy requirements

our Enorgy	i oquii oinion									kWh/year	
No secondar Fraction of s Efficiency of Cooling syst	ry heating sy pace heat fro main heating em energy e	stem sele om main : g system fficiency	ected system(s ratio	s)			9: 4	1.0000 3.90% .29%		ŗ	(202) (206) (209)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heatir	ng requireme	nt	<u>.</u>	<u>д</u>	1		д	1	JL		
1958.63 152	4.42 1234.66	664.26	279.36	-	-	-	-	761.30	1413.96	2006.7	(98)
Appendix Q	- monthly en	ergy save	ed (main	heating	system 1	1)	д	9	JL		
0.00 0.0	0 0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating	ng fuel (main	heating	system 1	Í)				3			
2085.9 162	3.45 1314.86	707.41	297.51	-	-	-	-	810.75	1505.82	2137.1	(211)
Appendix Q	- monthly en	ergy save	ed (main	heating	system 2	2)		,			
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating	ng fuel (main	heating	system 2	2)				,			
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q	- monthly en	ergy save	ed (seco	ndary he	ating sys	stem)		,			
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heatin	ng fuel (secor	ndary)		А			Л	,			
0.00 0.0	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heatin Water heatin	ig Ig requireme	nt		A				A			
220.03 193	3.79 203.17	181.64	177.64	158.22	151.47	166.88	166.79	188.37	199.80	214.57	(64)
Efficiency of	water heater		<u>.</u>	л	1	Л	л	J	л	65.00	(216)
65.00 65.	00 65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	(217)
Water heatin	ng fuel	JL	<u>.</u>	<u>д</u>	1		д	1	JL		
338.51 298	3.13 312.56	279.44	273.30	243.42	233.03	256.74	256.60	289.80	307.38	330.11	(219)
Appual total		л	<u>u</u>		1	ļi.	л	1	ļi.		
Space heatin Space heatin Water heatin	ng fuel used, ng fuel (secor ng fuel ng fuel used	main sys ndary)	stem 1							10482.74 0.00 3419.03 16.53	(211) (215) (219) (221)
				E 42	6.46	1 65				10.55	(221)
Electricity fo central hea boiler with a Total electric Electricity fo	r pumps, fan ting pump a fan-assiste sity for the ab r lighting (10	<u>-</u> s and ele d flue ove, kWł 0.00% fix	ctric kee /year ed LEL)	p-hot	6.46	4.65	<u> </u>	-		30.00 45.00 75.00 610.59	(230c) (230e) (231) (232)
Energy savin Appendix Q Energy sav Energy use	ng/generation - ved or genera ed (): ed enerav for	technolo ated ():	ogies [′]							0.000 0.000 14603.89	(236a) (237a) (238)
											()

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10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price	£/year	
Space heating - main system 1	10482 740	3 480	364 80	(240)
Space heating - main system 2	0,000	0.000	0.00	(241)
Water heating cost	3419.03	3.480	118.98	(247)
Space cooling	16.526	13.190	2.18	(248)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	75.000	13.190	9.89	(249)
Energy for lighting	610.594	13.190	80.54	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			696.39	(255)

11a. SAP rating

	0.42 1.11	(256) (257)
SAPvalue	84.48	(201)
SAP band	84 B	(258)

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12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
	kWh/year	kg CO2/kWh	kg CO2/y	ear
Space heating, main system 1	10482.74	0.216	2264.27	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	3419.03	0.216	738.51	(264)
Space and water heating			3002.78	(265)
Space cooling	16.53	0.519	8.58	(266)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	610.59	0.519	316.90	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			3367.18	(272)
			kg/m²/yea	ar
CO2 emissions per m ²			15.45	(273)
Elvalue			82.84	(273a)
El rating			83	(274)
El band			В	
Calculation of stars for heating and DHW				

Main heating energy efficiency Main heating environmental impact Water heating energy efficiency Water heating environmental impact $(3.48 / 0.9090) \times (1 + (0.29 \times 0.00)) = 3.8284$, stars = 4 (0.2160 / 0.9090) x (1 + (0.29 x 0.00)) = 0.2376, stars = 4 3.48 / 0.6500 = 5.3538, stars = 3 0.2160 / 0.6500 = 0.3323, stars = 3

Approval of JPA Designer by BRE applies only to the software, data is not subject to quality control procedures, users are themselves responsible for the accuracy of the data. The results of the calculation should not be accepted without first checking the input data.

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10.2. Appendix 5 – SAP Worksheet 'Be Clean' New Extension

(Refer to Appendix 4. 'Be Clean' and 'Be Lean' SAP Worksheets are identical)



10.3. Appendix 6 – SAP Worksheet 'Be Green' New Extension



Project Information

Building type Detached house

Reference			
Date	18 January 2022		
Client	Marek Wojciechowski Architects 66-68 Margaret Street London W1W 8SR	Project	2 Templewood Avenue LONDON NW3 7XA
Tel:	02075809336		

SAP 2012 worksheet for New extension to existing dwelling - calculation of energy ratings

1. Overall dwelling dimensions

	Area	Av. Storey	Volume	
	(m²)	height (m)	(m³)	
Ground floor (1)	159.39	3.17	505.27	(3a)
Firstfloor	58.58	2.80	164.02	(3b)
	217.97			(4)
			669.29	(5)

2. Ventilation rate

											m³ per ho	bur
							main + s heating	seonda	ry + othe	er		
Numbe	er of chim	neys					0 + 0 + 0)	x 40		0.00	(6a)
Numbe	er of open	flues					2 + 0 + 0)	x 20		40.00	(6b)
Numbe	er of inter	mittent fa	ans				2		x 10		20.00	(7a)
Numbe	rofpass	ive vents					0		x 10		0.00	(7b)
Numbe	er of fluele	ess gas f	ires				0		x 40		0.00	(7c)
											Air chang	ges per hour
											0.09	(8)
Pressu	re test, r	esult q50)						5.00			(17)
Air perr	neability										0.34	(18)
											2.00	(19)
											0.85	(20)
Infiltrat	ion rate ir	ncorpora	ting shelt	ter factor	Nacad						0.29	(21)
IIIIIIIai	Ionnaten			ily wind s	speed							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Wind E	octor										52.50	(22)
vviriu r												
1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
A .P			(- II	(·	11				13.13	(22a)
Adjuste	ed infiltra	tion rate	(allowing	for shel	ter and v	vina spe	ea)					
0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34	
-						,				.	3.79	(22b)
Ventila	tion : nat	ural vent	ilation, ir	ntermitte	nt extrac	t fans						
Effectiv	/e air cha	nge rate										
0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses	and heat los	ss paramete	r					
Element	Gross	Openings	Netarea	U-value	ΑxU	kappa-value	ΑxΚ	
	area, m²	m²	A, m²	W/m²K	W/K	kJ/m²K	kJ/K	
Window - Triple-	glazed,		3.360	1.24 (1.30)	4.15			(27)
air-filled, low-E,	En=0.2,							
hard coat (North)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-STUDY								
Window - Triple-	glazed,		18.340	1.24 (1.30)	22.66			(27)
air-filled, low-E,	En=0.2,			· · /				. ,
hard coat (East)								
New Build U=	1.3: G=0.36 -							
U=0.24(1.36):	SHGC=0.36:	VT=0.60.						
LG-POOL	,	,						
Window - Triple-	alazed		2 640	1 24 (1 30)	3 26			(27)
air-filled low-F	Fn=0.2		21010	1124 (1100)	0.20			(,)
hard coat (West								
New Build LI-	·/ 1 3·G=0 36 -							
11-0.24(1.36)	SHCC-0 36.	VT-0.60						
0 = 0.2 + (1.30),	51100-0.50,	v1=0.00,						
	alazod		1 250	1 24 (1 20)	1 69			(27)
oir filled low E	giazeu, En-0.2		1.330	1.24 (1.30)	1.00			(27)
all-Illieu, IOW-E,	$E_{0,2}$							
naro coat (North								
	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VI=0.60,						
								(07)
Window - I riple-	glazed,		2.640	1.24 (1.30)	3.26			(27)
air-filled, low-E,	En=0.2,							
hard coat (West	;) 							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-BOOTROC	DM							
Window - Triple-	glazed,		2.640	1.24 (1.30)	3.26			(27)
air-filled, low-E,	En=0.2,							
hard coat (West	:)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
00-BOOTROC	DM							
Window - Triple-	glazed,		6.160	1.24 (1.30)	7.61			(27)
air-filled, low-E,	En=0.2,							
hard coat (West	:)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36);	SHGC=0.36;	VT=0.60,						
LG-POOL								
Window - Triple-	glazed,		1.358	1.24 (1.30)	1.68			(27)
air-filled, low-E.	En=0.2,			. ,				. /
hard coat (North	West)							
New Build U=	1.3; G=0.36 -							
U=0.24(1.36):	SHGC=0.36:	VT=0.60.						
00-STUDY	0.00,	,						

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4. Wate Assume	er heating	g energ ancv. N	y require	ements							kWh/year 3.03	(42)
Annuala	average	not water	[.] usage ir	n litres pe	er day Vd	,average	9				106.05	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot wate	er usage	in litres p	ber day f	or each r	nonth							
116.66	112.41	108.17	103.93	99.69	95.45	95.45	99.69	103.93	108.17	112.41	116.66	(44)
Energy content of hot water used												
173.00	151.30	156.13	136.12	130.61	112.71	104.44	119.85	121.28	141.34	154.28	167.54	
Energy of Distribut	content (a tion loss	annual)									1668.59	(45)
25.95	22.70	23.42	20.42	19.59	16.91	15.67	17.98	18.19	21.20	23.14	25.13	(46)
Cylinder	r volume,	I					210.00					(47)
Manufacturer's declared cylinder loss factor (kWh/day) 1.42												(48)
Tempera	ature Fac	tor	roulinda	r (k)Mb/c			0.5400				0.77	(49)
Total sto	brage los	S	i cynnue		iay)						0.77	(55)
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(56)
Net stor	age loss											
23.77	21.47	23.77	23.00	23.77	23.00	23.77	23.77	23.00	23.77	23.00	23.77	(57)
Primary	loss							л	,			
23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Total he	atrequire	ed for wa	ter heati	ng calcul	ated for e	each moi	nth					
220.03	193.79	203.17	181.64	177.64	158.22	151.47	166.88	166.79	188.37	199.80	214.57	(62)
Output f	rom wate	er heater	for each	month, k	Wh/mor	nth						
220.03	193.79	203.17	181.64	177.64	158.22	151.47	166.88	166.79	188.37	199.80	214.57	(64)
											2222.37	(64)
Heat ga	ins from v	water he	ating, kW	/h/month	1	1	1		1			
95.15	84.29	89.54	81.67	81.05	73.89	72.35	77.48	76.74	84.62	87.71	93.33	(65)

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5. Internal gains

	-										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabol	lic gains,	Watts						~			R
181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52	181.52
Lighting	gains							~			R
86.44	76.77	62.43	47.27	35.33	29.83	32.23	41.90	56.23	71.40	83.33	88.84
Applian	ces gains	6						~			R
578.83	584.84	569.70	537.48	496.81	458.58	433.04	427.03	442.17	474.39	515.07	553.29
Cooking	gains							~			N
56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18
Pumps a	and fans	gains									n
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lossese	e.g. evap	oration (r	negative	values)							
-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01	-121.01
Waterh	eating ga	ains						n			n
127.89	125.44	120.35	113.43	108.94	102.62	97.25	104.13	106.58	113.74	121.82	125.45
Total int	ernal gai	ns									n
912.84	906.73	872.17	817.87	760.77	710.71	682.20	692.74	724.66	779.21	839.90	887.26

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Triple-glazed, air-filled, low-E,	0.9 x 3.360 10.63	0.64 x 0.80	0.77	12.6769
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60,	,00-STUDY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 18.340 19.64	0.64 x 0.80	0.77	127.8056
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.640 19.64	0.64 x 0.80	0.77	18.3973
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	HGC=0.36; VT=0.60	3		
Window Triple glazed oir filled low E	0.0 x 4.250.44.20	0.64 × 0.90	0.77	E 42E0
Fr=0.2 bord cost (North Foot)	0.9 X 1.550 11.20	0.04 X 0.00	0.77	5.4550
EII=0.2, Italu Coal (Nottheast)				
New Bullu U=1.5, G=0.50 - U=0.24(1.50), SF	100=0.30, VI=0.00, 0.0	0.64 x 0.80	0.77	10 2072
Vindow - Triple-glazed, all-filled, low-E,	0.9 X 2.640 19.64	0.64 X 0.80	0.77	18.3973
En=0.2, hard coat (vvest)				
ROOM	1GC=0.36; V I =0.60;	,00-8001		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.640 19.64	0.64 x 0.80	0.77	18.3973
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, 00-BOOT		
ROOM				
Window - Triple-glazed, air-filled, low-E,	0.9 x 6.160 19.64	0.64 x 0.80	0.77	42.9271
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.358 11.28	0.64 x 0.80	0.77	5.4350
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60,	,00-STUDY		

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6. Solar gains (calculation for January)						
	Area & F	lux	g & FF	Shading	Gains	
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.1	20 10.63	0.64 x 0.8	0.77	30.6359	
En=0.2, hard coat (North)						
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36	; VT=0.60	, LG-POOL			
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.1	20 10.63	0.64 x 0.8	0.77	30.6359	
En=0.2, hard coat (North)						
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36	; VT=0.60	, LG-POOL			
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.1	20 10.63	0.64 x 0.80	0.77	30.6359	
En=0.2, hard coat (North)						
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36	; VT=0.60	, LG-POOL			
Window - Triple-glazed, air-filled, low-E,	0.9 x 8.1	20 10.63	0.64 x 0.80	0.77	30.6359	
En=0.2, hard coat (North)						
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36	;VT=0.60	, LG-POOL			
Window - Triple-glazed, air-filled, low-E,	0.9 x 4.2	00 10.63	0.64 x 0.80	0.77	15.8462	
En=0.2, hard coat (North)						
New Build U=1.3; G=0.36 - U=0.24(1.36);	SHGC=0.36	;VT=0.60	, LG-POOL			
Solid door	0.9 x 2.1	60 0.00	0.00 x 0.8	0.77	0.0000	
2013 Door, 00-BOOT ROOM						
Total solar gains, January					387.86	(83-1)
Solargains						
387.86 752.78 1258.27 1914.95 2450.4 2	2561.9 241	6.5 2000.	7 1484.90	895.11 481.74	320.60	(83)
Total gains				J		
1300.70 1659.51 2130.4 2732.8 3211.2	3272.6 309	8.7 2693.	5 2209.6	1674.32 1321.6	4 1207.87	(84)
						~ /
l ighting calculations						
Lighting baloulations	Area		a	FF x Sha	dina	
Window - Triple-glazed, air-filled, low-F	0.9 x 3 3	6	9 0.70	0.80 x 0 8	33 1.41	
En=0.2 hard coat (North)	0.0 / 0.0	-	0.10			
New Build $I = 1.3$: G=0.36 $\cdot I = 0.24(1.36)$:		· \/T_0 60		/		

New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VI=0	J.60,00-STUDY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 18.34	0.70	0.80 x 0.83	7.67
En=0.2, hard coat (East)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0	0.60, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 2.64	0.70	0.80 x 0.83	1.10
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); \$	SHGC=0.36; VT=	0.60,		
00-GARAGE				
Window - Triple-glazed, air-filled, low-E,	0.9 x 1.36	0.70	0.80 x 0.83	0.57
En=0.2, hard coat (NorthEast)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0).60,00-STUDY		
Window - Triple-glazed, air-filled, low-E,	0.9 x 2.64	0.70	0.80 x 0.83	1.10
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0	D.60, 00-BOOT		
ROOM				
Window-Triple-glazed, air-filled, low-E,	0.9 x 2.64	0.70	0.80 x 0.83	1.10
En=0.2, hard coat (West)				
New Build U=1.3; G=0.36 - U=0.24(1.36); S	SHGC=0.36; VT=0	D.60, 00-BOOT		
ROOM				
Window-Triple-glazed, air-filled, low-E,	0.9 x 6.16	0.70	0.80 x 0.83	2.58
En=0.2, hard coat (West)				
New Build I = 1 3 G=0 36 - 1 I=0 24(1 36) 9				

New Build U=1.3; G=0.36 - U=0.24(1.36); SHGC=0.36; VT=0.60, LG-POOL

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Lighting calculations

	Area	g	FF x Shading	
Window-Triple-glazed, air-filled, low-E,	0.9 x 1.36	0.70	0.80 x 0.83	0.57
En=0.2, hard coat (NorthWest)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	,00-STUDY		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 8.12	0.70	0.80 x 0.83	3.40
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
Window-Triple-glazed, air-filled, low-E,	0.9 x 4.20	0.70	0.80 x 0.83	1.76
En=0.2, hard coat (North)				
New Build U=1.3; G=0.36 - U=0.24(1.36); SH	IGC=0.36; VT=0.60	, LG-POOL		
GL = 31.45 / 217.97 = 0.144				
C1 = 0.500				
C2 = 0.960				
El = 611				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) Heating system responsiveness							21.0 1.0	0 (85) 0				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
27.51	27.56	27.61	27.84	27.88	28.09	28.09	28.13	28.01	27.88	27.79	27.70	
alpha												
2.83	2.84	2.84	2.86	2.86	2.87	2.87	2.88	2.87	2.86	2.85	2.85	
Utilisatio	on factor	for gains	for living	area								
0.99	0.97	0.94	0.85	0.71	0.55	0.42	0.49	0.74	0.92	0.98	0.99	(86)
Meanin	ternal ter	nperatur	e in living	area T1								
18.59	18.90	19.43	20.10	20.60	20.86	20.95	20.93	20.67	19.96	19.14	18.53	(87)
Temper	ature du	ring heati	ingperio	ds in rest	ofdwelli	ng Th2			л			
19.70	19.70	19.71	19.72	19.72	19.73	19.73	19.73	19.72	19.72	19.71	19.71	(88)
Utilisatio	on factor	for gains	for rest of	of dwellir	ng							
0.98	0.97	0.92	0.82	0.65	0.46	0.31	0.37	0.66	0.90	0.97	0.99	(89)
Mean in	ternal ter	mperatur	e in the r	est of dw	elling T2	2						
16.53	16.98	17.74	18.67	19.32	19.62	19.70	19.69	19.44	18.51	17.34	16.45	(90)
Living a Mean in	rea fractio ternal ter	on (11.36 nperatur	6/217.97 e (for the	') whole dv	welling)						0.0	5 (91)
16.63	17.08	17.83	18.75	19.38	19.69	19.77	19.75	19.50	18.59	17.44	16.56	(92)
Apply adjustment to the mean internal temperature, where appropriate							· · ·					
16.63	. 17.08	17.83	18.75	19.38	19.69	19.77	19.75	19.50	18.59	17.44	16.56	(93)
L		ــــــــــــــــــــــــــــــــــــــ	ــــــال		ــــــار	ــــــال		ــــــار	ــــــال	ــــــــــــــــــــــــــــــــــــــ		. ,

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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisatio	on factor	for gains										
0.97	0.95	0.90	0.79	0.63	0.46	0.31	0.38	0.64	0.87	0.95	0.98	(94)
Useful g	ains											
1263.37	1572.93	1909.62	2157.7	2034.4	1494.72	974.48	1013.24	1416.02	1457.92	1261.69	1178.99	(95)
Monthly	average	external	temperat	ture								
4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat los	s rate for	mean in	ternal ter	mperatur	е							
3979.4	3922.7	3643.4	3139.0	2446.2	1608.25	1001.22	1058.23	1711.63	2542.2	3301.0	3959.7	(97)
Fraction	of month	n for heat	ing									
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space h	eating re	quireme	nt for eac	ch month	, kWh/m	onth						
2020.7	1579.08	1289.94	706.52	306.39	-	-	-	-	806.74	1468.33	2068.8	
Total spa Space h	ace heati eating re	ing requi quireme	rement p nt per m²	er year ((kWh/m	kWh/yea ²/year)	r) (Octol	per to Ma	iy)			10246.59 47.01	9 (98) 1 (99)

Feb Mar Sep Jan Apr May Jun Jul Aug Oct Nov Dec External temperaturers 14.60 16.60 16.40 _ Heat loss rate W (100)2970.5 2338.5 2398.4 _ -_ Utilisation factor for loss (101)0.82 0.87 0.82 _ _ Useful loss W 2426.8 2030.7 (102)_ 1969.47 --_ Internal gains W 0.00 0.00 0.00 0.00 707.71 679.20 689.74 0.00 0.00 0.00 0.00 0.00 Solar gains W 0.00 0.00 0.00 0.00 0.00 2994.4 2824.5 2338.5 0.00 0.00 0.00 0.00 Gains W 3702.1 3503.7 3028.3 (103)_ Fraction of month for cooling 1.00 0.00 0.00 0.00 0.00 0.00 1.00 1.00 0.00 0.00 0.00 0.00 (103a) Space heating kWh 154.60 24.65 1.86 (98) _ _ Space cooling kWh (104)_ 918.20 1095.93 787.75 -Total 2801.88 (104) 0.10 Cooled fraction (105)Intermittency factor 0.25 0.25 0.25 (106)-I - I _ Space cooling requirement for month 22.96 27.40 19.69 _ _ _ Space cooling (June to August) 70.05 (107)Space cooling requirement per m² (kWh/m²/year) 0.32 (108)

8c. Space cooling requirement

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responsible for the accuracy of the data. The results of the calculation should not be accepted without first checking the input data.

9a. Energy requirements

	gyroqu										kWh/year	
No secon Fraction of Efficiency Cooling s	ndary he of space y of main system e	ating sys heat fro heating nergy ef	stem sele om main s g system ficiency	ected system(: ratio	s)			2 6	1.0000 49.90% .22%			(202) (206) (209)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Spacehe	eating red	quireme	nt			J	,		J	Л	JJ	
2020.7	1579.08	1289.94	706.52	306.39	-	-	-	-	806.74	1468.33	2068.8	(98)
Appendix	(Q - mo	nthly ene	ergy save	ed (main	heating	system 1	1)	Л	J	JL	JJ	
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space he	eating fu	el (main	heating	system 1	1)	JI	JL	Л	J	JI]]	
808.61	631.89	516.18	282.72	122.61	-	-	-	-	322.83	587.57	827.87	(211)
Appendix	(Q - mo	nthly ene	ergy save	ed (main	heating	system 2	2)	JL	J	JI]]	
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space he	eating fu	el (main	heating	system 2	2)	Л	Л	Л	J	Л		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix	(Q - mo	nthly ene	ergy save	ed (seco	ndary he	ating sys	stem)	Л	J	Л		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Spacehe	eating fu	el (secor	ndary)		Л	JL	Л	Л	J	Л		
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Waterhe	ating				Л	JL	Л	Л	J	Л		
Waterhea	atingree	quiremer	nt									
220.03	193.79	203.17	181.64	177.64	158.22	151.47	166.88	166.79	188.37	199.80	214.57	(64)
Efficiency	y of wate	er heater									65.00	(216)
65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	(217)
Waterhe	atingfue	el										
338.51	298.13	312.56	279.44	273.30	243.42	233.03	256.74	256.60	289.80	307.38	330.11	(219)
Annual to Space he Space he Water he Space co	otals eating fu eating fue ating fue poling fue	el used, el (secor el el used	main sys ndary)	stem 1							kWh/year 4100.28 0.00 3419.03 11.26	(211) (215) (219) (221)
-	-	-	-	-	3.69	4.40	3.16	-	-	-	-	(221)
Electricity central h Total elec Electricity Energy sa	y for pur neating p ctricity fo y for ligh aving/ge	nps, fans oump or the abo ting (100 neration	s and ele ove, kWh).00% fix technolo	ctric kee n/year ed LEL) ogies	p-hot				л	J	30.00 30.00 610.59	(230c) (231) (232)
Energy	saved o used ()	r genera :	ated ():								0.000 0.000	(236a) (237a)
Total deli	vered er	nergy for	alluses								8171.15	(238)

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10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	4100.275	13.190	540.83	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
High-rate percentage	0.000%			(243)
Low-rate percentage	0.000%			(244)
High-rate cost	0.00	0.000	0.00	(245)
Low-rate	0.00	0.000	0.00	(246)
Space cooling	11.255	13.190	1.48	(248)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	30.000	13.190	3.96	(249)
Energy for lighting	610.594	13.190	80.54	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			865.79	(255)

11a. SAP rating

1.38	(257)
80.71	. ,
81	(258)
В	
	1.38 80.71 81 B

0.42

(256)

12a. Carbon dioxide emissions

	Energy	Emission factor	Emission	S
Space besting main system 1	4100.29	0.510	2129 04	(261)
Space heating, main system 1	4100.20	0.519	2120.04	(201)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Waterheating	3419.03	0.216	738.51	(264)
Space and water heating			2866.55	(265)
Space cooling	11.26	0.519	5.84	(266)
Electricity for pumps and fans	30.00	0.519	15.57	(267)
Electricity for lighting	610.59	0.519	316.90	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			3204.86	(272)
			kg/m²/yea	r
CO2 emissions per m ²			14.70	(273)
Elvalue			83.67	(273a)
El rating			84	(274)
El band			В	()
Calculation of stars for heating and DHW				

Main heating energy efficiency Main heating environmental impact Water heating energy efficiency Water heating environmental impact $(13.19 / 2.4990) \times (1 + (0.29 \times 0.00)) = 5.2781$, stars = 4 (0.5190 / 2.4990) x (1 + (0.29 x 0.00)) = 0.2077, stars = 5 3.48 / 0.6500 = 5.3538, stars = 3 0.2160 / 0.6500 = 0.3323, stars = 3

10.4. Appendix 7 – SAP 10 Conversion Worksheet Existing Building



SAP 2012 Performance

Domestic

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)				
	Regulated	Unregulated			
Baseline: Part L 2013 of the Building Regulations Compliant Development	34.0				
After energy demand reduction (be lean)	19.8				
After heat network connection (be clean)	19.8				
After renewable energy (be green)	13.5				

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

	Regulated domestic carbon dioxide savings			
	(Tonnes CO ₂ per annum)	(%)		
Be lean: savings from energy demand reduction	14.2	42%		
Be clean: savings from heat network	0.0	0%		
Be green: savings from renewable energy	6.3	19%		
Cumulative on site savings	20.6	60%		
Annual savings from off- set payment	13.5	-		
	(Tonne	es CO ₂)		
Cumulative savings for off-set payment	404	-		
Cash in-lieu contribution (£)	38,365			

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

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

	Carbon Dioxide Emission (Tonnes CO	ns for domestic buil 2 per annum)
	Regulated	Unregulate
Baseline: Part L 2013 of the Building Regulations Compliant Development	32.2	
After energy demand reduction (be lean)	18.3	
After heat network connection (be clean)	18.3	
After renewable energy (be green)	6.5	

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

	Regulated domestic carbon dioxide savi	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	13.8	43%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	11.8	37%
Cumulative on site savings	25.6	80%
Annual savings from off- set payment	6.5	-
	(Tonne	es CO ₂)
Cumulative savings for off-set payment	196	-
Cash in-lieu contribution (£)	18,594	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SAP 10.0 Performance



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10.5. Appendix 8 – SAP 10 Conversion Worksheet New Extension



SAP 2012 Performance

Domestic

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	2.1	
After energy demand reduction (be lean)	2.0	
After heat network connection (be clean)	2.0	
After renewable energy (be green)	1.9	

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

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.0	1%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.1	5%
Cumulative on site savings	0.1	6%
Annual savings from off- set payment	1.9	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	58	-
Cash in-lieu contribution (£)	5,520	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

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

	Carbon Dioxide Emissions for domestic bui (Tonnes CO ₂ per annum)	
	Regulated	Unregulate
Baseline: Part L 2013 of the Building Regulations Compliant Development	1.9	
After energy demand reduction (be lean)	1.9	
After heat network connection (be clean)	1.9	
After renewable energy (be green)	1.1	

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

	Regulated domestic carbon dioxide savi	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	0.0	1%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	0.8	41%
Cumulative on site savings	0.8	42%
Annual savings from off- set payment	1.1	-
	(Tonne	es CO ₂)
Cumulative savings for off-set payment	33	-
Cash in-lieu contribution (£)	3,110	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SAP 10.0 Performance



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