



Energy & Sustainability Statement

for

Healey Development Solutions (Hayes) Ltd

9 Nestles Avenue

London Borough of Hillingdon
Hayes, London UB3 4SA

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EXECUTIVE SUMMARY

Mecserve have been appointed by Healey Development Solutions (Hayes) Ltd to prepare an Energy and Sustainability Statement to support the planning application for proposed development site at 9 Nestle Avenue in London Borough of Hillingdon.

This Energy and Sustainability Statement, prepared in line with the Energy Assessment Guidance of Greater London Authority (October 2018), outlines the key features and strategies adopted by the development team to enhance the environmental performance of the proposed 9 Nestle Avenue Scheme. The scheme complies with all relevant policies with regards to Energy and Sustainability set by London Plan and London Borough of Hillingdon Local Plan. Sections 2 and 3 review these policies and demonstrate how the design meets planning targets and the requirements in terms of energy and sustainability.

The strategy for reducing energy use and associated carbon emissions through the design of the scheme follows the London Plan energy hierarchy, namely:

- Be Lean – Reduce energy demand through passive design strategies and best practice design of building services, lighting and controls;
- Be Clean – Reduce energy consumption further by connecting to an existing district heating system and exploit provision of Combined Heat and Power (CHP) systems;
- Be Green – Generate power on site through Renewable Energy Technologies.

The following passive and active energy efficiency features have been considered in the proposed strategy for the proposed scheme:

- High performance building fabric in terms of U-values and thermal bridging to reduce heating demand;
- Excellent air tightness to reduce heat losses through infiltration;
- Highly efficient building services systems for heating, cooling and ventilation that exceed minimum Part L standards in terms of performance;
- Low energy light fittings with occupancy and daylight sensors.

The following Low/Zero Carbon Technologies proposed will provide heat or generate energy on site:

- A Combined Heat and Power (CHP) unit will be the lead heating system to provide useful heat while producing electrical power;
- Photovoltaic panels installed on the roof will generate renewable energy thus providing electricity to be consumed on site.

Following the proposed energy strategy, the building achieves significant carbon savings that exceed both the Building Regulations' Target Emission Rate and the London Plan Target Reduction in terms of CO₂ emissions.

The following tables demonstrate the overall reduction in the regulated and unregulated carbon emission of the development after each stage of the London Plan Energy Hierarchy. Results are presented separately for the domestic and non-domestic elements of the development.

Table 1 Regulated carbon dioxide emissions after each stage of the energy hierarchy for domestic buildings

	Regulated domestic carbon dioxide emissions (Tonnes CO ₂ per annum)
Baseline CO ₂ emissions (Part L 2013 of the Building Regulations Compliant Development)	79
CO ₂ emissions after energy demand reduction (be lean)	70
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean)	46
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	41

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	10	12%
Be clean: Savings from heat network	24	30%
Be green: Savings from renewable energy	5	6%
Cumulative on site savings	38	48%
Carbon shortfall	41	
	(Tonnes CO ₂ per annum)	
Cumulative savings for off-set payment	1234	

Table 3 Regulated carbon dioxide emissions after each stage of the energy hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide emissions (Tonnes CO ₂ per annum)
Baseline CO ₂ emissions (Part L 2013 of the Building Regulations Compliant Development)	17
CO ₂ emissions after energy demand reduction (be lean)	14
CO ₂ emissions after heat network (be clean)	14
CO ₂ emissions after renewable energy (be green)	11

Table 4 Regulated carbon dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	3	17%
Be clean: Savings from heat network	0	0%
Be green: Savings from renewable energy	3	18%
Total cumulative savings	6	35%

Table 5 Site wide regulated carbon dioxide emissions and savings

	Total regulated emissions	CO ₂ savings	Percentage saving
	(Tonnes CO ₂ /year)	(Tonnes CO ₂ /year)	(%)
Part L 2013 baseline	96		
Be lean	84	12	13%
Be clean	60	24	25%
Be green	52	8	8%
	CO ₂ savings offset (Tonnes CO ₂)		
Offset	1234		

Results show demonstrate the total regulated CO₂ savings from each stage of the Energy Hierarchy for the domestic and non-domestic elements of the development separately. A reduction of 35% and 48% over the London Plan Baseline Emission Rate can be achieved for the domestic and non-domestic elements respectively after applying the proposed strategy.

The figures below show the total carbon savings achieved for the domestic and non-domestic elements of the 9 Nestle Avenue scheme over the London Plan's Baseline Emission Rate at each stage of the proposed London Plan Energy Hierarchy as a result of the energy strategy proposed for the scheme.



Figure 1 Domestic carbon savings at each stage of the London Plan Hierarchy



Figure 2 Non-domestic carbon savings at each stage of the London Plan Hierarchy

1. INTRODUCTION

Over recent years, global public opinion has been increasingly concerned with the state of the environment and the impact of climate change. Buildings are responsible for a significant proportion of the world's energy consumption. In the United Kingdom, domestic, commercial buildings and industry contribute 43%¹ of the total CO₂ emissions. These figures highlight the need for building owners, developers and designers to design environmentally sustainable buildings.

This report provides a review of the sustainability and efficiency benchmarks for the scheme and sets out targets for the development in terms of both sustainability and energy. An overview of different sustainability and energy-efficiency technologies that are likely to be appropriate for the development are also included in this statement.

As the design progresses, the strategies outlined in this report will be further developed and subjected to detailed financial feasibility studies. The environmental strategies and options outlined in this report are based on the current information available and are likely to evolve during the detailed design stage. The energy calculations presented in this report will need to be continually updated through the detailed design stages to reflect any changes. The energy analysis presented here should be treated as preliminary information based on the currently available concept design data.

1.1 PROPOSED DEVELOPMENT

Existing site:

The 0.22 hectares site is currently occupied by a single-storey industrial building dating from the late 1940's, with a two-storey administration block to the Nestles Avenue frontage.

The elevation has Art Deco influenced styling and is set 15 meters back from Nestles Avenue with a largely hard landscaped forecourt. It was until recently, used as a printing works until the company went into administration early in 2018.

To the west is a similar industrial building with planning consent for educational use. To the east is a sports field, part of the former Nestles Factory site. The entire Nestles Factory site forms the Nestles Conservation Area (Botwell).

To the north is the Squirrels Trading Estate comprising of seven late 20th century light industrial units, which are in use as furniture manufacturers and car repair workshops. The northern part of the site extends approximately three meters into the Squirrels site, but development on this strip of land is prevented by a rights of way for the Squirrel's owners.

¹ Department for Environment, Food and Rural Affairs, <http://www.defra.gov.uk/>, 2008

To the south are two storey semi-detached 1930's houses with forecourt parking.

Proposed site: The development proposal planning application seeks the demolition of the existing building and redevelopment to provide a building up to 10 storeys, with 868 sqm of Class B floorspace at ground and first floor level and 81 residential units to the upper floors, with associated landscaping, access, car parking and cycle parking. The site forms part of the wider masterplan for mixed use residential led redevelopment.

More information can be found on the Design & Access Statement prepared by Brimelow McSweeney Architects Limited



Figure 3 Existing site



Figure 4 Proposed scheme

2. OVERVIEW OF ENVIRONMENTAL STANDARDS, TARGETS AND POLICIES

2.1 NATIONAL POLICIES

ENERGY WHITE PAPER

The Energy White Paper: Our Energy Future – Creating a Low Carbon Economy² is an energy policy in response to the increasing challenges faced by the UK, including climate change, decreasing domestic supplies of fossil fuel and escalating energy prices. The Energy White Paper sets four priorities:

- Cutting the UK's carbon dioxide emissions - the main contributor to global warming - by some 60% by about 2050, with real progress by 2020;
- Security of supply;
- A competitive market for the benefit of businesses, industries and households;
- Affordable energy for the poor.

CLIMATE CHANGE ACT 2008

Published in 2008 by the UK Government, Climate Change Act³ is the world's first long-term legally binding framework to mitigate against climate change. The Act sets legally binding targets to increase greenhouse gas emission reductions through action in the UK and abroad from the 60% target to 80% by 2050.

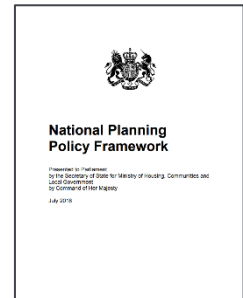
In addition to the standards, targets and policies discussed above, the relevant British Standards and CIBSE Guidelines were used to assist in determining the most appropriate Ecologically Sustainable Design (ESD) initiatives for the development.

² Dti, (2003); Energy White Paper Our Energy Future - Creating a Low Carbon Economy. TSO.

³ OPSI, (2008); Climate Change Act. HMSO.

NATIONAL PLANNING POLICY FRAMEWORK (NPPF) (JULY 2018)

The Government has developed the National Planning Policy Framework (NPPF) which plays a key role in delivering the Government's objectives on sustainable development. The framework encourages ownership at the local level and provides guidance to promote effective environmental protection, economic growth and ensuring a better quality of life for all, both now and in future generations.



- a) an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
- b) a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
- c) an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

2.2 REGIONAL POLICIES

THE LONDON PLAN (MARCH 2016)

The London Plan, prepared by the Mayor of London's office, deals with matters that are of strategic importance to Greater London. The London Plan is the overall strategic plan setting out an integrated social, economic and environmental framework for the future development of London, looking forward until 2036.

Chapter 5 of the London Plan deals with matters related to climate change.

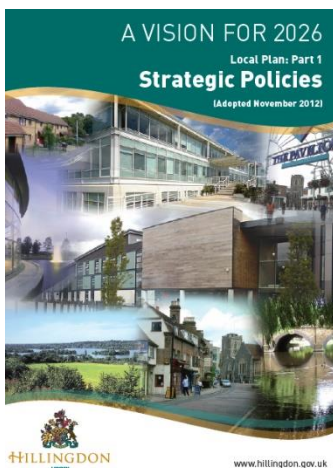


Supplementary Planning Guidance, Sustainable Design and Construction (April 2014) provides framework for implementing the London policies.

The current 2016 Plan (The London Plan consolidated with alterations since 2011) is still the adopted Development Plan, but the Draft London Plan is a material consideration in planning decisions. The significance given to it is a matter for the decision maker, but it gains more weight as it moves through the process to adoption.

2.3 LOCAL POLICIES

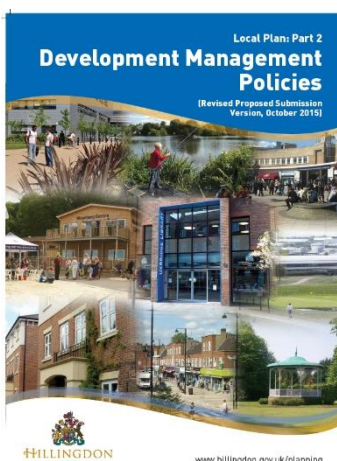
HILLINGDON'S LOCAL PLAN (2012)



Hillingdon's Local Plan (Part 1) 2012:

The Local Plan Part 1 - Strategic policies sets out the overall level and broad locations of growth up to 2026 and is part of Hillingdon Council's development plan. It comprises a spatial vision, strategic objectives, a spatial strategy, core policies and a monitoring and implementation framework with clear objectives for achieving delivery.

The UDP was Hillingdon's long term development strategy. Since its adoption, in 1998, the strategic policies have been replaced by the Local Plan Part 1 - strategic policies 2012. The remaining UDP policies have been saved and are being replaced by the emerging Local Plan Part 2 documents.



Hillingdon's Local Plan (Part 2) Development Management Policies (To be adopted)

The Local Plan Part 2 comprises Development Management Policies, Site Allocations and Designations and Policies Map. Once adopted it will deliver the detail of the strategic policies set out in the Local Plan Part 1: Strategic Policies (2012). Together they will form a comprehensive development strategy for the borough up to 2026.

3. CLIMATE CHANGE MITIGATION AND ADAPTATION STRATEGY

Climate Change is the rise in average global temperature due to increasing levels of greenhouse gases in the earth's atmosphere (primarily CO₂) that prevent the radiation of heat into space.

Buildings and spaces built today should respond to climate change issues and adapt to mitigation and adaptation measures. The London Plan through its policies addresses these issues and will require London Boroughs to consider how their developments will function in the future in the context of changing climate.

Hillingdon's Local plan aims to make provision to meet needs for housing, business, community services and infrastructure, in a sustainable way, protecting and improving both the built and the natural environments while mitigating climate change.

The climate change risks for the borough are summarised below

- Hotter, drier summers;
- Milder, wetter winters;
- More frequent extreme high temperatures;
- More frequent heavy downpours of rain;
- Significant decreases in soil moisture content in summer;
- Sea level rise and increases in storm surge height;
- Possible higher wind speeds.

3.1 CLIMATE CHANGE MITIGATION

As per the definition of United Nations Environment Programme (UNEP), Climate Change Mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behaviour.

The following policies from the London Plan and Hillingdon's Local Plan relate to Climate Change Mitigation, in the context of this proposed development.

LONDON PLAN 2016

- Policy 5.2 Minimising carbon dioxide emissions;
- Policy 5.3 Sustainable design and construction;
- Policy 5.6 Decentralised energy in development proposals;
- Policy 5.7 Renewable energy;

HILLINGDON'S LOCAL PLAN

Hillingdon's Local Plan (Part 1) 2012

- Policy EM1: Climate Change Adaptation and Mitigation

Hillingdon's Local Plan (Part 2) Development Management Policies (To be adopted)

- Policy DMEI 2: Reducing Carbon Emissions
- Policy DMEI 3: Decentralised Energy

The policies above are explained and reviewed in detail below providing a response on measures implemented for this proposed development.

3.2 CLIMATE CHANGE MITIGATION- POLICY REVIEW AND MEASURES IMPLEMENTED

LONDON PLAN 2016 POLICIES

Policy 5.2 Minimising Carbon Dioxide Emissions

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- Be lean: use less energy;
- Be clean: supply energy efficiently;
- Be green: use renewable energy.

B. The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Non-domestic buildings:

Year	Improvement on 2010 Building Regulations
2013 – 2016	40 per cent (equivalent to 35% over Part L 2013 TER)
2016 – 2019	As per building regulations requirements ⁴
2019 – 2031	Zero carbon

C. Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

D. As a minimum, energy assessments should include the following details:

- calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy;
- proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services;

⁴ For the period 2016 to 2019, London Plan Policy 5.2B sets the carbon dioxide emissions target for non-residential development to be in line with Part L of the Building Regulations. This target was intended to align with the then expected improvement to Part L of the Building Regulations in 2016. However, given that the Government announced that it does not intend to proceed with the proposed 2016 increase in on-site energy efficiency standards, the GLA continues to require that non-domestic development seek to achieve a 35 per cent reduction against Part L 2013.

- proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP);
- proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

E. The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

Measures being considered in the project to meet the above policy requirements

In order to design an energy efficient, low carbon development, the design team has followed the London Plan Energy Hierarchy i.e.

- The development is designed to have a highly efficient envelope and passive strategies have been incorporated in the design where possible. Efficient building services and lighting are proposed to reduce energy consumption;
- The design team has carried out a feasibility study to assess the potential of connecting the scheme to a district heating network or provide a Combined Heat and Power to meet heating demand;
- Renewable energy technologies are explored, and the most feasible options are proposed for the development.

Section 4 of the report presents the energy assessment and outlines the energy strategy developed for the proposed scheme. This is prepared in line with GLA guidance on reporting energy assessments. The assessment also covers carbon emissions due to non-regulated energy use in the development and lists a number of measures to reduce these.

According to the energy results, a reduction of 35% and 48% over the London Plan Baseline Emission Rate can be achieved for the domestic and non-domestic elements respectively after applying the proposed strategy.

Policy 5.3 Sustainable Design and Construction

A. The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

B. Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

C. Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:

- a. minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems);
- b. avoiding internal overheating and contributing to the urban heat island effect;
- c. efficient use of natural resources (including water), including making the most of natural systems both within and around buildings;
- d. minimising pollution (including noise, air and urban runoff);
- e. minimising the generation of waste and maximising reuse or recycling;
- f. avoiding impacts from natural hazards (including flooding);
- g. ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions;
- h. securing sustainable procurement of materials, using local supplies where feasible; and,
- i. promoting and protecting biodiversity and green infrastructure.

Measures being considered in the project to meet the above policy requirements

With regards to the residential elements, the GLA and the local sustainability guidance is used to ensure the design complies with the sustainability requirements as explained in each section throughout. This is in line with the requirements of Hillingdon Local Plan.

The energy section of this report provide details on how significant carbon savings can be achieved across the site and which measures will be considered to tackle overheating.

Policy 5.6 Decentralised Energy in Development Proposals

A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

B. Major development proposals should select energy systems in accordance with the following hierarchy:

- Connection to existing heating or cooling networks;
- Site wide CHP network;
- Communal heating and cooling.

C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Measures being considered in the project to meet the above policy requirements

The design team has explored opportunities for installation of decentralised energy system including CHP system. This report includes a summary of the findings.

According to the London Heat Map, there is no district heating network currently available in close proximity that would allow for the building to be connected, and the closest proposed district heating networks are located on the other side of the rail further away from the site.

However, the energy centre of the building is designed such that once a district heating network becomes available close to the building location, the building could connect to the network easily, subject to viability of connection and subject to all financial agreements.

The site to the southeast of the proposal, has recently achieved planning permission for a major mixed used development with a substantial residential part. This site has a central energy centre, fed by gas CHP and Boilers. We are currently in discussions with Barratt London, to investigate the potential of connection to this site.

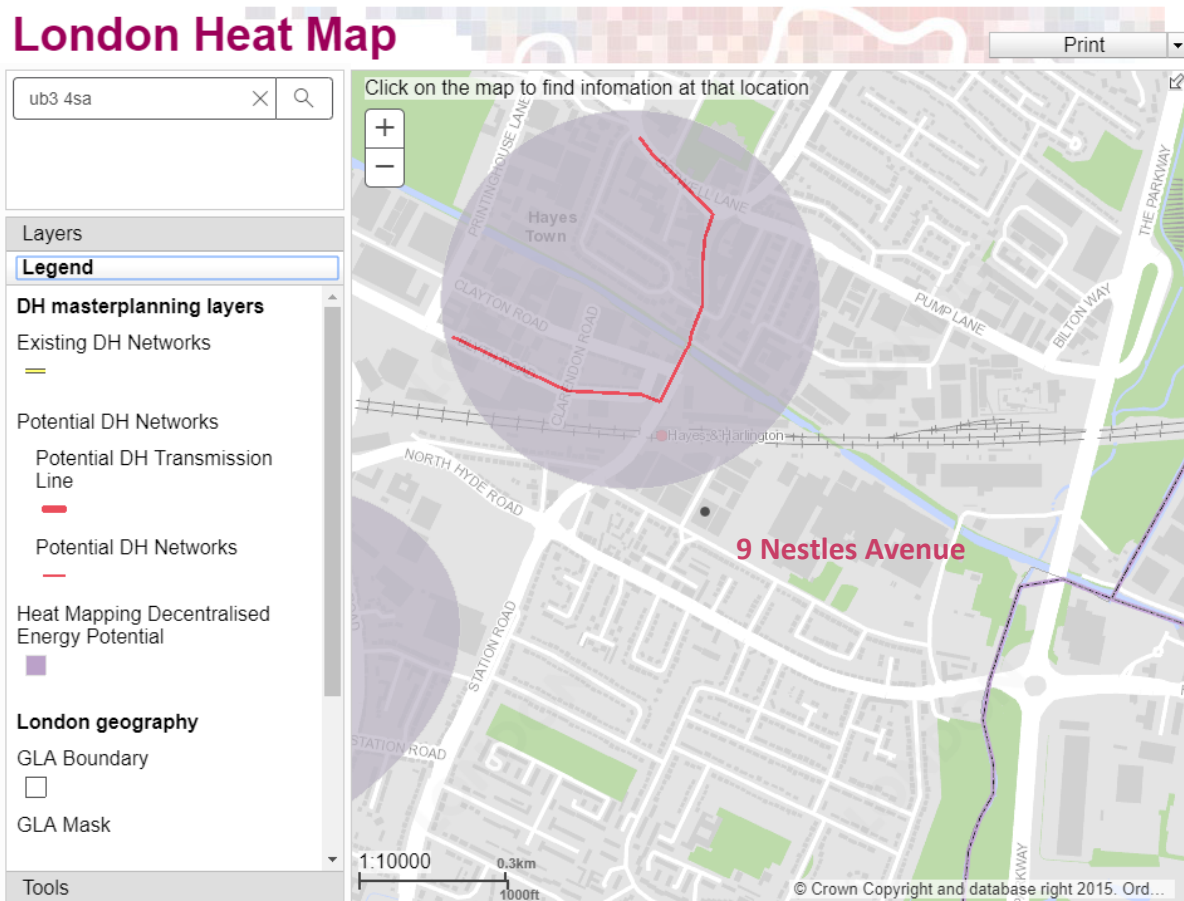


Figure 5 London Heat Map

Installation of a CHP unit for the building has been also considered. Given that the hot water demand for a building of this type is high and constant throughout the year, there is a good opportunity for utilising a CHP unit to provide both space heating and hot water while generating electricity on-site. The energy centre including CHP serves all parts of the site.

Policy 5.7 Renewable Energy

A. The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

D. All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

Measures being considered in the project to meet the above policy requirements

The design team has carried out a feasibility study, presented in the following section, to identify those renewable energy technologies that are appropriate for the proposed development.

The scheme will make use of the available roof space for installation of photovoltaic panels. The PV array will be carefully designed to avoid overshadowing of the panels from surrounding features such as lift shafts, the roof parapet etc.

Further, Air Source Heat Pumps are being proposed for the office areas as the most suitable renewable energy option.

Hillingdon's Local Plan (Part 1) 2012 Policies

Policy EM1: Climate Change Adaptation and Mitigation

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

1. Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.
2. Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.
3. Ensuring development meets the highest possible design standards whilst still

retaining competitiveness within the market.

4. Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.
5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.
6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.
7. Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation(39) as part of their proposals.
8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydro electricity and a greater use of waste as a resource.
9. Promoting new development to contribute to the upgrading of existing housing stock where appropriate.

The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:

10. Locating and designing development to minimise the probability and impacts of flooding.
11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.
12. Giving preference to development of previously developed land to avoid the loss of further green areas
13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks(40).
14. Promoting the inclusion of passive design(41) measures to reduce the impacts of urban heat effects.

Measures being considered in the project to meet the above policy requirements

Refer to the response to London Plan policy above on reducing carbon emissions, connection to district heating networks and provision of LZC energy. The measures also satisfy the requirements of the development management policies Policy DME1 2 : Reducing Carbon Emissions and Policy DMEI 3: Decentralised Energy. More details are provided in section 4 of the report.

3.3 CLIMATE CHANGE ADAPTATION

For a long time, the main focus of climate change has been on mitigation, making sure we minimise our impact on the environment. Adaptation strategies are those that take into account climate change and ensure that the building is capable of dealing with future change in climate. Given the time lag associated with climate change, even if we change the way we live, there is likely to be noticeable change in the climate during the life of the building.

To ensure that buildings maintain their relevance, it is essential that adaptation strategies are addressed during the design phase. Adoption of these strategies will mean that, even as we undergo climate change, the buildings can still function as required.

The following policies from the London Plan relate to Climate Change Adaptation, in the context of this proposed development.

LONDON PLAN 2016 ADAPTATION POLICIES

- Policy 5.3 Sustainable design and construction
- Policy 5.9 Overheating and cooling;
- Policy 5.10 Urban greening;
- Policy 5.12 Flood risk management;
- Policy 5.13 Sustainable drainage;
- Policy 5.15 Water use and supplies.
- Policy 5.11 Green roofs and development site environs
- Policy 5.16 Waste Net self-sufficiency
- Policy 7.14 Improving air quality
- Policy 6.3 Assessing effects of development on transport capacity

HILLINGDON'S LOCAL PLAN

Hillingdon's Local Plan (Part 1) 2012

- Policy EM1: Climate Change Adaptation and Mitigation
- Policy EM6: Flood Risk Management
- Policy EM7: Biodiversity and Geological Conservation
- Policy EM8: Land, Water, Air and Noise
- Policy EM11: Sustainable Waste Management

Hillingdon's Local Plan (Part 2) Development Management Policies (To be adopted)

- Policy DMEI 1 Living Walls and Roofs and Onsite Vegetation
- Policy DMEI 7 Biodiversity Protection and Enhancement
- Policy DMEI 9 Management of Flood Risk
- Policy DMEI 10 Water Management, Efficiency and Quality
- Policy DMEI 14 Air Quality
- Policy DMT 1 Managing Transport Impacts
- Policy DMT 5 Pedestrians and Cyclists

The policies above are explained and reviewed in detail in the next section providing a response on measures implemented for this proposed development.

3.4 CLIMATE CHANGE ADAPTATION- POLICY REVIEW AND MEASURES IMPLEMENTED

London Plan Policies (2016)

Policy 5.3 Sustainable Design and Construction

A. The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

B. Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

C. Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:

- a. minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems);
- b. avoiding internal overheating and contributing to the urban heat island effect;
- c. efficient use of natural resources (including water), including making the most of natural systems both within and around buildings;
- d. minimising pollution (including noise, air and urban runoff);
- e. minimising the generation of waste and maximising reuse or recycling;
- f. avoiding impacts from natural hazards (including flooding);
- g. ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions;
- h. securing sustainable procurement of materials, using local supplies where feasible; and,
- i. promoting and protecting biodiversity and green infrastructure.

Measures being considered in the project to meet the above policy requirements:

The proposed development will meet the guidance provided in the Supplementary Planning Guidance of the London Plan 2016, Sustainable Design and Construction to support the policies in the London Plan. High standards of performance will be met in reducing carbon emissions through passive and active design measures, energy efficiency, connection to district heating network, specification of LZC and renewable technology, mitigating overheating risk, flood risk and surface water runoff management, sustainable waste management, material resource efficiency, provision sustainable transport measures, protection and enhancing site biodiversity, water efficiency, reduction of pollution, improving health and wellbeing and adoption of sustainable management practices.

Policy 5.9 Overheating and Cooling

A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

- minimise internal heat generation through energy efficient design;
- reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
- manage the heat within the building through exposed internal thermal mass and high ceilings;
- passive ventilation;
- mechanical ventilation;
- active cooling systems (ensuring they are the lowest carbon options).

C. Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

D. Within LDFs boroughs should develop more detailed policies and proposals to support the avoidance of overheating and to support the cooling hierarchy.

Measures being considered in the project to meet the above policy requirements:

The project design has followed the overheating and cooling hierarchy as required by London Plan Policy 5.9 Overheating and Cooling. The cooling hierarchy has been addressed to reduce potential overheating risk and reduce demand for active cooling. Dynamic thermal modelling has been carried out to assess the overheating potential and ensure the risk of overheating is mitigated. Please see Appendix B for more details.

A detailed description of the overheating strategy can be found in Section 4.6.

Policy 5.10 Urban Greening

A. The Mayor will promote and support urban greening, such as new planting in the public realm (including streets, squares and plazas) and multifunctional green infrastructure, to contribute to the adaptation to, and reduction of, the effects of climate change.

B. The Mayor seeks to increase the amount of surface area greened in the Central Activities Zone by at least five per cent by 2030, and a further five per cent by 2050,

C. Development proposals should integrate green infrastructure from the beginning of the design process to contribute to urban greening, including the public realm. Elements that can contribute to this include tree planting, green roofs and walls, and soft landscaping. Major development proposals within the Central Activities Zone should demonstrate how green infrastructure has been incorporated.

Policy 5.11 Green Roofs and Development Site Environs

A. Major development proposals should be designed to include roof, wall and site planting, especially green roofs and walls where feasible, to deliver as many of the following objectives as possible:

- a) adaptation to climate change
- b) sustainable urban drainage;
- c) mitigation of climate change
- d) enhancement of biodiversity;
- e) accessible roof space;
- f) improvements to appearance and resilience of the building;
- g) growing food.

Policy DM16 Biodiversity

- a) When considering development proposals the council will seek the retention and enhancement, or the creation of biodiversity.
- b) Where development will affect a Site of Importance for Nature Conservation and/or species of importance the council will expect the proposal to meet the requirements of London Plan Policy 7.19E.
- c) Development adjacent to or within areas identified as part of the Green Grid Framework will be required to make a contribution to the enhancement of the Green Grid.

Measures being considered in the project to meet the above policy requirements:

The existing site is of low ecological value. The site ecology will be enhanced by the provision of green roof and ground floor planting which will contribute to biodiversity and help tackle climate change.

Policy 5.12 Flood Risk Management

B. Development proposals must comply with the flood risk assessment and management requirements set out in the NPPF and the associated technical Guidance on flood risk over the lifetime of the development and have regard to measures proposed in Thames Estuary 2100 (TE2100 – see paragraph 5.55) and Catchment Flood Management Plans.

C. Developments which are required to pass the Exceptions Test set out in the NPPF and the Technical Guidance will need to address flood resilient design and emergency planning by demonstrating that:

- the development will remain safe and operational under flood conditions;
- strategy of either safe evacuation and/or safely remaining in the building is followed under flood conditions;
- key services including electricity, water etc. will continue to be provided under flood conditions;
- buildings are designed for quick recovery following a flood.

D. Development adjacent to flood defences will be required to protect the integrity of existing flood defences and wherever possible should aim to be set back from the banks of watercourses and those defences to allow their management, maintenance and upgrading to be undertaken in a sustainable and cost effective way.

Policy 5.13 Sustainable Drainage

A. Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. store rainwater for later use;
2. use infiltration techniques, such as porous surfaces in non-clay areas;
3. attenuate rainwater in ponds or open water features for gradual release;
4. attenuate rainwater;
5. discharge rainwater direct to a watercourse;
6. discharge rainwater to a surface water sewer/drain;

7. discharge rainwater to the combined sewer.

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

B. Within LDFs boroughs should, in line with the Flood and Water Management Act 2010, utilise Surface Water Management Plans to identify areas where there are particular surface water management issues and develop actions and policy approaches aimed at reducing these risks.

Measures being considered in the project to meet the above policy requirements:

According to the Environment Agency's (EA) indicative flood map for planning and surface water flood map the proposed development site is located within a low risk Flood Zone 1. A detailed Flood Risk Assessment and Drainage Strategy Report has been prepared in support of the planning application by HTS Structural engineers.

Below is a summary of the findings from the report

- Risk of flooding from surface water, sewers, reservoirs or groundwater is low
- The SUDs strategy follow the abovementioned hierarchy and include any item that is technically feasible. Rainwater Harvesting has been considered for the scheme, however, its technical feasibility and viability will be further assessed at the detailed design strategy.
- Geo cellular attenuation tank, permeable paving and blue roof are proposed as the SUDs strategy to achieve a total discharge of 3.8 litres per second for all storm durations up to and including 1 in 100-years + 40% Climate Change event, which equates to a betterment of up to 96% over the existing scenario.
- The development will provide green roofs which will contribute to biodiversity and help tackle climate change.

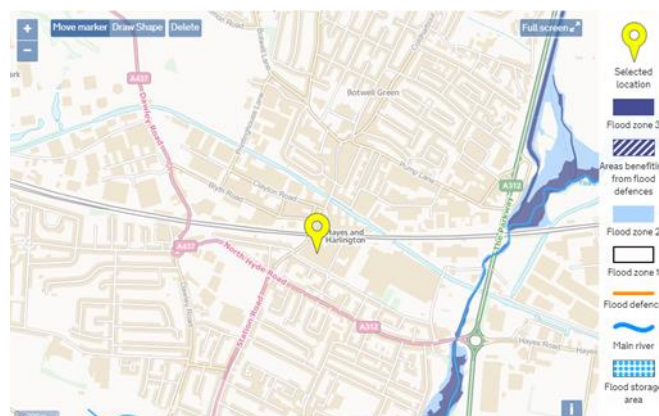


Fig 4 Environmental Agency flood map showing site is located in Flood Zone 1

Policy 5.15 Water Use and Supplies

- B. Development should minimise the use of mains water by:
- Incorporating water saving measures and equipment
 - designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day
- C. New development for sustainable water supply infrastructure, which has been selected within water companies' Water resource management plans, will be supported.

Measures being considered in the project to meet the above policy requirements:

Low water use fittings will be installed throughout the scheme to help reduce water consumption on site. This will reduce the water consumption per apartment to 105 l/p/day or less.

Policy 5.16 Waste net self-sufficiency

Strategic

A. The Mayor will work with London boroughs and waste authorities, the London Waste and Recycling Board (LW&RB), the Environment Agency, the private sector, voluntary and community sector groups, and neighbouring regions and authorities to:

- manage as much of London's waste within London as practicable, working towards managing the equivalent of 100% of London's waste within London by 2026
- create positive environmental and economic impacts from waste processing
- work towards zero biodegradable or recyclable waste to landfill by 2026.

B. This will be achieved by:

- minimising waste
- encouraging the reuse of and reduction in the use of materials
- exceeding recycling/composting levels in local authority collected waste (LACW) of 45 per cent by 2015, 50 per cent by 2020 and aspiring to achieve 60 per cent by 2031
- exceeding recycling/composting levels in commercial and industrial waste of 70 per cent by 2020
- exceeding recycling and reuse levels in construction, excavation and demolition (CE&D) waste of 95 per cent by 2020
- improving London's net self-sufficiency through reducing the proportion of waste exported from the capital over time
- working with neighbouring regional and district authorities to coordinate strategic waste management across the greater south east of England.

Measures being considered in the project to meet the above policy requirements:

Construction waste will be reduced by encouraging measures to optimise material efficiency in the design process in order to minimise environmental impact of material use and waste. The contractor will be required to have a construction resource management plan and also reduce construction waste on site and off site and divert non-hazardous construction (on-site and dedicated off-site manufacture/fabrication), demolition and excavation waste (where applicable) generated by the project from landfill.

Dedicated space will be provided for the segregation and storage of operational recyclable waste volumes generated by the building and will include the segregation of recyclable waste and general waste.

Policy 7.14 Improving air quality

Strategic

A The Mayor recognises the importance of tackling air pollution and improving air quality to London's development and the health and wellbeing of its people. He will work with strategic partners to ensure that the spatial, climate change, transport and design policies of this plan support implementation of his Air Quality and Transport strategies to achieve reductions in pollutant emissions and minimize public exposure to pollution.

Planning decisions

B Development proposals should:

- a. minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3)
- b. promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' 'The control of dust and emissions from construction and demolition'
- c. be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs)).
- d. ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having

clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure

Measures being considered in the project to meet the above policy requirements:

A detailed Air quality assessment has been completed by Mayer Brown Limited in support of the planning application covering assessment of the implications of Construction Dust, Construction Traffic and Plant, Operational traffic/Development traffic and building emissions. Mitigation measures have been proposed for construction dust management and Construction Traffic and Plant. As there is no implication on air quality from operational traffic and building emissions and hence mitigation measures will not be required. CHP system with NO_x emissions well below the London Plan SPG requirements (<250mgNO_x/Nm³) is proposed. Therefore, it is not anticipated that mitigation measures will be required for air quality affected from building emissions. For more information on the mitigation measures please refer to the air quality report.

Policy 6.3 Assessing effects of development on transport capacity

Planning decisions

A Development proposals should ensure that impacts on transport capacity and the transport network, at both a corridor and local level, are fully assessed. Development should not adversely affect safety on the transport network.

B Where existing transport capacity is insufficient to allow for the travel generated by proposed developments, and no firm plans exist for an increase in capacity to cater for this, boroughs should ensure that development proposals are phased until it is known these requirements can be met, otherwise they may be refused. The cumulative impacts of development on transport requirements must be taken into account.

C Transport assessments will be required in accordance with TfL's Transport Assessment Best Practice Guidance for major planning applications. Workplace and/or residential travel plans should be provided for planning applications exceeding the thresholds in, and produced in accordance with, the relevant TfL guidance. Construction logistics plans and delivery and servicing plans should be secured in line with the London Freight Plan¹ and should be co-ordinated with travel plans.

LDF preparation

D Boroughs should take the lead in exploiting opportunities for development in areas where appropriate transport accessibility and capacity exist or is being introduced. Boroughs should facilitate opportunities to integrate major transport proposals with development in a way that supports London Plan priorities.

E LDFs should include policies requiring transport assessments, travel plans, construction logistics and delivery/servicing plans as set out in C above.

Measures being considered in the project to meet the above policy requirements:

A detailed transport assessment and framework travel plan has been completed by i-Transport in support of the planning application.

The site is located in a PTAL 4 (rising to PTAL 5 with introduction of the Elizabeth Line) area with good access to public transport, including rail and a number of local bus services (with the closest bus stop under 400m from the site). The new PTAL 5 classification will bring the area in line with the zone within which development should be 'car-free' according to both the adopted London Plan and emerging London Plan.

In addition, and in support of car-free development, there is very good accessibility to local facilities and services, with the vast majority of key destinations within a distance most people will walk to (1,600m) and the remaining still within a realistic distance where some people will walk (3,200m), indicating that future occupiers of the site will have significant opportunities to utilise sustainable travel modes.

Below is a summary of the sustainable transport measures

- Cycle parking for the development will be provided in the form of double stacked cycle racks which will be capable of accommodating 144 bicycles, including 136 cycle parking spaces for the residential units and eight cycle parking spaces for the commercial unit. In addition, there will be seven external short-stay/visitor cycle parking spaces (two for employment and five for residential).
- The development is car free development aside from provision of four disabled parking spaces. All four spaces will be equipped with electric vehicle charging points.
- Zipcar will be secured as the car club membership provider for the proposed development.
- The Travel Plan will be adopted and is anticipated to influence behaviour change of the residents towards sustainable modes of travel and active travel.

The above travel measures also satisfy the development management policies (to be adopted) of Hillingdon's for sustainable transport measures Policy DMT 1 Managing Transport Impacts and Policy DMT 5 Pedestrians and Cyclists.

Hillingdon's Local Plan (Part 1) 2012 Policies

Policy EM1: Climate Change Adaptation and Mitigation

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

1. Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.
2. Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.
3. Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.
4. Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.
5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.
6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.
7. Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation as part of their proposals.
8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydroelectricity and a greater use of waste as a resource.
9. Promoting new development to contribute to the upgrading of existing housing stock where appropriate.

The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:

10. Locating and designing development to minimise the probability and impacts of flooding.
11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.
12. Giving preference to development of previously developed land to avoid the loss of further green areas
13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks⁽⁴⁰⁾.
14. Promoting the inclusion of passive design⁽⁴¹⁾ measures to reduce the impacts of urban heat effects.

Measures being considered in the project to meet the above policy requirements:

The development will be designed in line with London Plan Policy 5.3 Sustainable design and construction which address all the above issues listed in Policy EM1 such as reducing carbon emissions through passive and active design measures, energy efficiency, connection to district

hating network, specification of LZC and renewable technology, flood risk and surface water runoff management, sustainable waste management, protection and enhancing site biodiversity, pollution prevention, material resource efficiency, water efficiency etc as described in the London polices above.

Policy EM6: Flood Risk Management

The Council will require new development to be directed away from Flood Zones 2 and 3 in accordance with the principles of the National Planning Policy Framework (NPPF).

The subsequent Hillingdon Local Plan: Part 2 -Site Specific Allocations LDD will be subjected to the Sequential Test in accordance with the NPPF. Sites will only be allocated within Flood Zones 2 or 3 where there are overriding issues that outweigh flood risk. In these instances, policy criteria will be set requiring future applicants of these sites to demonstrate that flood risk can be suitably mitigated.

The Council will require all development across the borough to use sustainable urban drainage systems (SUDS) unless demonstrated that it is not viable. The Council will encourage SUDS to be linked to water efficiency methods. The Council may require developer contributions to guarantee the long term maintenance and performance of SUDS is to an appropriate standard.

Measures being considered in the project to meet the above policy requirements:

Refer to response to London Plan Policy 5.12 Flood Risk Management and Policy 5.13 sustainable Drainage above. The measures also comply with the requirements of Hillingdon's development management policies, Policy DMEI 9 Management of Flood Risk.

Policy EM7: Biodiversity and Geological Conservation

The Council will review all the Borough grade Sites of Importance for Nature Conservation (SINCs). Deletions, amendments and new designations will be made where appropriate within the Hillingdon Local Plan: Part 2- Site Specific Allocations Local Development Document. These designations will be based on previous recommendations made in discussions with the Greater London Authority.

Hillingdon's biodiversity and geological conservation will be preserved and enhanced with particular attention given to:

1. The conservation and enhancement of the natural state of:

- Harefield Gravel Pits
- Colne Valley Regional Park
- Fray's Farm Meadows
- Harefield Pit

2. The protection and enhancement of all Sites of Importance for Nature Conservation.

Sites with Metropolitan and Borough Grade 1 importance will be protected from any adverse impacts and loss. Borough Grade 2 and Sites of Local Importance will be protected from loss with harmful impacts mitigated through appropriate compensation.

3. The protection and enhancement of populations of protected species as well as priority species and habitats identified within the UK, London and the Hillingdon Biodiversity Action Plans.

4. Appropriate contributions from developers to help enhance Sites of Importance for Nature Conservation in close proximity to development and to deliver/ assist in the delivery of actions within the Biodiversity Action Plan.

5. The provision of biodiversity improvements from all development, where feasible.

6. The provision of green roofs and living walls which contribute to biodiversity and help tackle climate change.

7. The use of sustainable drainage systems that promote ecological connectivity and natural habitats.

Measures being considered in the project to meet the above policy requirements:

Refer to response to London Plan Policy 5.10 Urban Greening and Policy 5.11 Green Roofs and Development Site environs above. The measures also comply with the requirements of Hillingdon's development management policies Policy DMEI 1 Living Walls and Roofs and Onsite Vegetation and Policy DMEI 7 Biodiversity Protection and Enhancement.

Policy EM8: Land, Water, Air and Noise

Water Quality

The Council will seek to safeguard and improve all water quality, both ground and surface. Principal Aquifers, and Source Protection Zones will be given priority along with the:

River Colne

Grand Union Canal

River Pinn

Yeading Brook

Porter Land Brook

River Crane

Ruislip Lido

Air Quality

All development should not cause deterioration in the local air quality levels and should ensure the protection of both existing and new sensitive receptors.

All major development within the Air Quality Management Area (AQMA) should demonstrate air quality neutrality (no worsening of impacts) where appropriate; actively contribute to the promotion of sustainable transport measures such as vehicle charging points and the increased provision for vehicles with cleaner transport fuels; deliver increased planting through soft

landscaping and living walls and roofs; and provide a management plan for ensuring air quality impacts can be kept to a minimum.

The Council seeks to reduce the levels of pollutants referred to in the Government's National Air Quality Strategy and will have regard to the Mayor's Air Quality Strategy.

London Boroughs should also take account of the findings of the Air Quality Review and Assessments and Actions plans, in particular where Air Quality Management Areas have been designated.

The Council has a network of Air Quality Monitoring stations but recognises that this can be widened to improve understanding of air quality impacts. The Council may therefore require new major development in an AQMA to fund additional air quality monitoring stations to assist in managing air quality improvements.

Noise

The Council will investigate Hillingdon's target areas identified in the Defra Noise Action Plans, promote the maximum possible reduction in noise levels and will minimise the number of people potentially affected.

The Council will seek to identify and protect Quiet Areas in accordance with Government Policy on sustainable development and other Local Plan policies.

The Council will seek to ensure that noise sensitive development and noise generating development are only permitted if noise impacts can be adequately controlled and mitigated.

Land Contamination

The Council will expect proposals for development on contaminated land to provide mitigation strategies that reduce the impacts on surrounding land uses. Major development proposals will be expected to demonstrate a sustainable approach to remediation that includes techniques to reduce the need to landfill.

Water Resources

The Council will require that all new development demonstrates the incorporation of water efficiency measures within new development to reduce the rising demand on potable water. All new development must incorporate water recycling and collection facilities unless it can be demonstrated it is not appropriate. For residential developments, the Council will require applicants to demonstrate that water consumption will not surpass 105 litres per person per day.

Measures being considered in the project to meet the above policy requirements:

Refer to response above on London Plan Policy 7.14 Improving Air Quality on measures to reduce air pollution.

Refer to response above on London Plan Policy 5.15 Water Use Supplies for measures on water efficiency.

The above measures also satisfy the requirements of the development management policies (to be adopted) Policy DMEI 10 Water Management, Efficiency and Quality and Policy DMEI 14 Air Quality.

Policy EM11: Sustainable Waste Management

The Council will aim to reduce the amount of waste produced in the Borough and work in conjunction with its partners in West London, to identify and allocate suitable new sites for waste management facilities within the West London Waste Plan to provide sufficient capacity to meet the apportionment requirements of the London Plan which is 382 thousand tonnes per annum for Hillingdon by 2026.

The Council will require all new development to address waste management at all stages of a development's life from design and construction through to the end use and activity on site, ensuring that all waste is managed towards the upper end of the waste hierarchy.

The Council will follow the waste hierarchy by promoting the reduction of waste generation through measures such as bioremediation of soils and best practice in building construction. The Council will promote using waste as a resource and encouraging the re-use of materials and recycling. The Council will also support opportunities for energy recovery from waste and composting where appropriate. The Council will safeguard existing waste sites unless compensatory provision can be made.

The Council will seek to maximise the use of existing waste management sites through intensification or co-location of facilities.

Measures being considered in the project to meet the above policy requirements:

Refer to response above on London Plan Policy 5.16 Waste net self sufficiency

4. ENERGY ASSESSMENT

The energy assessment of the proposed scheme has been assessed following the Standard Assessment Procedure (SAP) and the National Calculation Methodology (NCM) for the domestic and non-domestic elements of the scheme respectively. This section, prepared in line with GLA Guidance on preparing energy assessments (October 2018), outlines the energy strategy developed for the scheme and shows how significant carbon savings can be achieved by integrating energy efficiency measures and using LZC technologies on site.

4.1 BUILDING REGULATION COMPLIANCE

Part L (Conservation of Fuel and Power) of the Building Regulations applies to all components of the development. This was updated in 2013 and came into effect in April 2014.

All components of the development will be designed to exceed the requirements of the Building Regulations Part L. Compliance with Part L 2013 will be demonstrated by completing carbon emission calculations in line with the SAP 2012 and NCM methodologies. The energy assessment details a number of energy efficiency improvements and includes a renewable energy analysis which leads to a reduced carbon emission rate for the development.

Meeting the requirements of Part L will be achieved through:

- Efficient Thermal Elements and Controlled fittings: the building fabric will be designed to improve on minimum Part L 2013 requirements;
- Building Services and Lighting: The new building services will be designed and specified to perform better than the minimum standards detailed in both Domestic & Non-Domestic Building Services Compliance Guide (2013 edition).

4.2 ENERGY MODELLING

The Standard Assessment Procedure (SAP 2012) was used to model the residential elements of the building. The non-domestic elements of the building have been modelled in IES-VE software (version 2018.0.2.0, Compliance 7.0.10.0). The energy assessment has been completed by Mecserve's energy modelling team who are accredited Energy Assessors⁵.

⁵ Panos Dalapas; Low Carbon Energy Assessor accredited to work on Level 3, 4 and 5 Non-domestic Buildings (Accreditation No. LCEA159416) and On-Construction Domestic Energy Assessor to work on new-built dwellings (Accreditation No. STRO030082)

4.3 BASELINE CARBON EMISSION RATE

According to GLA's Energy Assessment Guidance (October 2018), the Building Regulations Part L1A and Part L2A Target Emission Rate (TER) should be used to determine the baseline CO₂ emissions for the domestic and non-domestic elements of the scheme respectively. Table 6 below presents the baseline CO₂ emissions for the scheme.

Table 6 Baseline Carbon Dioxide emissions

Regulated Carbon dioxide emissions (Tonnes CO ₂ per annum)	Domestic	Non-Domestic
Total Floor Area (sqm)	4988	1440
GLA Baseline: Part L 2013 of the Building Regulations Compliant Development	79	17

From 6 April 2014, Approved Document L1A has introduced a fabric energy efficiency target (FEE). This is the maximum space heating and cooling energy demand for a new home. It is measured as the amount of energy which would normally be needed to maintain comfortable internal temperatures in a home and is measured in kWh per m² per annum. The table below presents the Target Fabric Energy Efficiency (TFEE) calculated by FSAP 2012 software.

Table 7 Dwellings Fabric Energy Efficiency

Fabric Energy Efficiency (kWh/sqm per annum)	Dwellings
Part L1A Target Fabric Energy Efficiency (TFEE) Rate	35.7

4.4 LONDON PLAN ENERGY HIERARCHY

To meet the requirements of Policy 5.2 Minimising Carbon Dioxide Emissions development proposals should minimise carbon dioxide emissions in accordance with the following energy hierarchy:

- Be lean: use less energy;
- Be clean: supply energy efficiently;
- Be green: use renewable energy.

The hierarchy provides the mechanism through which the carbon dioxide (CO₂) emission reduction targets in Policy 5.2 of the London Plan are achieved. It also contributes to the implementation of strategic energy policies relating to decentralised networks and ensures opportunities for building occupants to receive efficient, secure and affordable energy.

GLA Energy Assessment Guidance (October 2018) states that the energy assessment must clearly identify the carbon footprint of the development after each stage of the energy hierarchy. Regulated emissions must be provided and, separately, those emissions associated with uses not covered by Building Regulations i.e. unregulated energy uses.

The following sections demonstrates the performance of the development in relation to the London Plan carbon reduction targets for major developments. The target is 35% below the Baseline carbon emission rate for the non-domestic elements and zero carbon i.e. minimum 35% savings achieved on-site with a cash-in-lieu contribution for the remaining carbon to 100% for the domestic elements.

4.5 BE LEAN – DEMAND REDUCTION

Be Lean measures is the first stage of the Energy Hierarchy where energy demand of the building is reduced through architectural and building fabric measures (passive design) and energy efficient services (active design). Be Lean measures should demonstrate the extent to which the energy demand meets or exceeds Building Regulations. The following sections demonstrates how the proposed development will achieve energy and CO₂ emissions reduction over the baseline emissions.

PASSIVE DESIGN

Passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading have been integrated in the design.

Energy demand reduction will be achieved through:

- **Building Orientation Optimisation:** The building's orientation is largely dictated by the shape of the site. The majority of the units have a SE/NW orientation.
- **Passive Solar Design and Daylight:** All rooms have good access to daylight and sunlight, thus enhancing visual comfort and providing passive heating during winter. Windows will feature high performance glass of low g-value to reduce solar energy been transmitted through the pane in summer thus reducing the risk of overheating. Internal curtains will be provided to control solar gains and glare;
- **Thermal performance of the fabric:** the proposed building fabric exceeds the requirements set in Part L of Building Regulations;
- **Thermal bridging:** Accredited Construction Details will be used to minimise the impact of thermal bridging thus reducing heat losses through the building fabric;
- **Air-tightness:** Using enhanced construction skills and rigorous detailing to reduce the air permeability of the building and therefore eliminate heat losses through infiltration.

Table 8 below shows initial assumptions on building fabric specifications including air permeability. These will be thoroughly reviewed by the design team at detailed design stage.

Table 8 Proposed building fabric specifications

Building Fabric	U-value [W/m ² K]	Wall	0.16 – Domestic elements 0.18 – Non-domestic elements
		Floor	0.15 – Ground floor 0.15 – Party floor (between dwellings and commercial areas)
		Roof	0.15
		Windows	1.20 (g-value: 0.50)
		Solid Doors	1.00
	Air permeability		3 m ³ /m ² hr @50Pa – Domestic elements 5 m ³ /m ² hr @50Pa – Non-domestic elements
	Thermal Bridging		Approved Accredited Construction Details (in line with Table K1-SAP 2012) Lintels of high thermal performance (psi ≤ 0.05W/mK) will be also installed to reduce heat losses further

Achieving the above values will reduce the energy demand of the development in advance of adding any active energy efficiency measures or renewable energy systems to the development.

ACTIVE DESIGN

After reducing the energy demand of the development, the next stage would be to use energy efficient building services, lighting and controls throughout the scheme to reduce fuel consumption. Our proposed energy strategy includes the following:

- **Space Heating and Hot Water:** A communal heating system utilising gas-fired condensing boilers of high efficiency will provide heating and hot water throughout the scheme. A Variable Refrigerant flow (VRF) system using reverse cycle Air Source Heat Pumps will provide heating and comfort cooling in the commercial areas;
- **Ventilation:** Fresh air will be provided to the dwellings and the office areas via Mechanical Ventilation with Heat Recovery. All windows can be fully openable and the MVHR unit can be set on summer bypass mode during the warmer months;
- **Building services insulation:** The hot water tanks, pipes and ducts will be insulated to a high standard;
- **Lighting:** Low energy light fittings of LED types will be used throughout the scheme. Daylight harvesting controls will be installed in the office areas while PIR sensors will be provided in secondary areas such as stores and circulation areas.

Table 9 Proposed building services systems

Space Heating	Communal Heating system	LTHW system utilising gas-fired condensing boilers of 95% efficiency with underfloor heating		
	Controls	Charging system with programmer and TRVs		
	Retail unit	VRF system providing space heating and comfort cooling SCOP: 3.50		
Domestic Hot Water	Dwellings	Heat Interface Units (HIUs) installed in each flat will be fed by the communal heating system		
	Retail unit	Electric water heater (100% efficiency)		
Water consumption	Residential units	Dwellings designed to achieve a water use target less than 105 litres/person/day		
Comfort Cooling	Retail unit	Variable Refrigerant Volume (VRV) system providing cooling in the retail areas SEER: 5.5		
Ventilation	Dwellings	Whole house balanced mechanical ventilation with heat recovery (Approved installation scheme) with summer bypass		
		No. of wet fans (excl. kitchen)	SFP (W/l/s)	Efficiency (%)
		1	0.39	93%
		3	0.46	92%
		2	0.55	91%
	Retail unit	Central Mechanical Ventilation system with Heat Recovery serving the retail areas, the office and the toilets/shower facilities		
	AHU Specific Fan Power	1.80 W/l/s		
	Heat Recovery Efficiency	80% (Thermal wheel)		

	AHU Leakage	Class L2	
	Ductwork Leakage	Class B	
Lighting	Dwellings	All light fittings will be dedicated low energy types i.e. LED fittings	
	Luminaire efficacy (lm/W)	All non-domestic areas	90 lm/W
	Daylight sensors	Office areas - Control type: Switching - Sensor type: Addressable	
	Occupancy (PIR) sensors	Office areas: Manual on/Auto off Landlord areas: Auto on/off	
All Systems & Lighting	Metering Provision	All systems and lighting systems have provision for metering that warns "out of range" values	
	Power Factor	> 0.95	

CARBON SAVINGS FROM 'BE LEAN' MEASURES

After implementing all the passive and active energy efficiency measures listed above, the carbon dioxide emissions of the proposed scheme are reduced by 9tnCO₂ and 3tnCO₂ for the domestic and non-domestic elements respectively. Therefore, the reduction in carbon emissions of the domestic elements at this stage is more than 12% and 17% respectively, as required by GLA Energy Assessment Guidance.

Figure 6 below shows the breakdown of the regulated energy consumption and regulated carbon emission of a typical dwelling after applying the efficiency measures listed in this section.

The most significant carbon contributions are mainly from Domestic Hot Water followed by Lighting. Please note that the graphs do not include equipment loads. The non-regulated energy consumption and carbon emission is covered in Section 4.7.

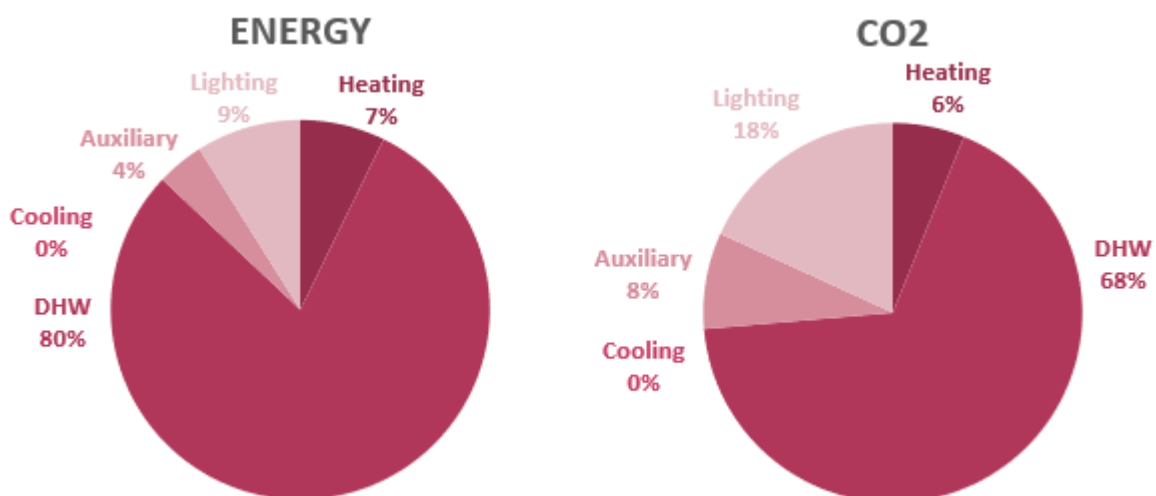


Figure 6 Breakdown of the energy consumption and carbon emissions at Lean stage (typical dwelling)

Table 10 Carbon Dioxide emissions reduction – Lean Stage

Regulated Carbon dioxide emissions (Tonnes CO ₂ per annum)	Domestic	Non-Domestic
GLA Baseline Emissions	79	17
Be Lean: After energy demand reduction	70	14
Carbon Savings over Baseline	10	3
Carbon Reduction over Baseline	12%	17%

Subsequently, the reduction in Fabric Energy Efficiency of the domestic elements is 18%, as the following table demonstrates.

Table 11 Dwellings Fabric Energy Efficiency

Fabric Energy Efficiency (kWh/sqm per annum)	Dwellings
Part L1A Target Fabric Energy Efficiency (TFEE) Rate	35.7
Area-weighted average Dwelling Fabric Energy Efficiency (DFEE) Rate	29.3
Reduction over Part L1A 2013 TFEE	18%

4.6 OVERHEATING AND COOLING POLICY

The project design has followed the overheating and cooling hierarchy as required by the London Plan Policy 5.9 Overheating and Cooling. The cooling hierarchy has been addressed to reduce potential overheating risk and reduce demand for active cooling.

The orientation of the dwellings varies throughout the scheme, the majority though have been given a SE/NW orientation. All dwellings will feature a Mechanical Ventilation unit with Heat recovery to provide background ventilation throughout the year. This will run in a summer bypass mode during the warmer months. Windows can be fully openable to allow for single-sided or cross ventilation in single-aspect and dual-aspect units respectively. A natural ventilation strategy will allow for additional flow rates to remove excessive heat gains when required. Windows can be also left open during the night in hot summer periods to allow for night-time cooling for cooling down the structure by taking advantage of the lower external temperatures.

Building fabric of high performance and excellent airtightness is specified to prevent heat transfer from the ambient environment in the living areas. Windows will be of low g-value to reduce solar energy being transmitted through the openings. All rooms will feature internal shading devices i.e. curtains or blinds of low shading coefficient for occupants to control both solar gains and glare. Low energy LED light fittings and energy efficiency appliances will be used throughout the scheme to reduce internal heat production. Light fittings of LED energy efficient types will be installed throughout the scheme and tenants will be advised to use energy efficiency appliances so that to reduce internal heat gains thus avoiding heat building up on warm summer days.

Finally, landscape design includes planting in the courtyard, which will reduce the urban island heat effect and contribute to passive cooling.

An Overheating study has been completed for the proposed scheme in line with the GLA guidance. Dynamic thermal modelling has been carried out for the development in line with the CIBSE TM59 methodology; results are presented in Appendix B.

4.7 NON-REGULATED ENERGY USE

London Plan (2016) requires that the energy demand and carbon dioxide emissions of the non-regulated end uses should also be calculated and reported in the energy assessments.

The total carbon emissions of the non-regulated end uses for the scheme have been calculated for both the dwellings and the non-domestic elements using the Standard Assessment Procedure (SAP) and National Calculation Methodology (NCM) respectively.

The following strategies are proposed to reduce the non-regulated energy demand of the development:

- The dwellings will be fitted out with highly efficient A-rated appliances. A Building User Guide issued to future residents will provide more information on energy efficiency use of appliances;
- Energy meters with display monitors will be provided within each flat. This will encourage the occupants to become more interested and involved in how energy is being used in their house;
- Information will be provided to occupants which will explain the operations of the installed systems and PV panels and how energy efficient behaviour can reduce the cost/carbon emissions of the development.

It is estimated that the proposed measures described above may reduce the non-regulated carbon emissions by at least 10%. However, at this stage, this can only be an assumption as small power consumption depends mainly on occupant's behaviour.

Table 12 Unregulated energy use and associated carbon emissions

Unregulated Carbon dioxide emissions (Tonnes CO ₂ per annum)	Domestic	Non-Domestic
GLA Baseline Emissions (based on SAP & NCM)	97	47
Be Lean: Assuming above measures will be considered	87	43
Carbon Savings over Baseline	10	5
Carbon Reduction over Baseline	10%	10%

4.8 BE CLEAN – HEATING INFRASTRUCTURE

In accordance with the Decentralised Energy Hierarchy of London Plan 2016, connection to existing district heat networks, site wide Combined Heat and Power (CHP) and incorporation of CHP in the buildings have been considered for the scheme.

DISTRICT ENERGY NETWORK

According to the London Heat Map, there is no district heating network currently available in close proximity that would allow for the building to be connected and the site is not within an opportunity area for a potential future connection shall one becomes available. However, the energy centre of the building is designed such that once a district heating network becomes available close to the building location, the building could connect to the network easily, subject to viability of connection and subject to all financial agreements.

The site on the west side of the proposed, has recently achieved planning permission for a major mixed used development with a substantial residential part, being developed by Barratt London. This site has an energy centre, served by gas CHP and boilers. We are currently in discussions with Barratt London team, to investigate the possibility of connection to their energy centre.

If due to different development programmes and completion date or for other reasons, connection was not initially feasible, the building will be future proofed to allow connection into a future district heating network when the opportunity arises. The design team has considered the following options to allow for a potential future connection to a district heating network:

- Provision of a single plant-boiler room to provide space heating;
- Identify and allow space for heat exchangers; and,
- Identify and safeguard external pipework routes.

COMBINED HEAT AND POWER

The design team has looked into the possibility of installing a CHP system within the proposed development. As CHP usually has higher capital cost compared to conventional gas fired boilers, to maximise its efficiency it is important that the CHP plant operates for as many hours as possible and matches closely the base heat and power loads so that neither the generated heat nor electricity is wasted.

Given that the hot water demand in residential buildings is high and constant throughout the year, there is a good opportunity for utilising a CHP unit to provide both space heating and hot water while generating electricity on-site. Thermal modelling has been carried out to identify the annual heating demand and the base heating load of the scheme to size the proposed CHP unit.

Table 13 Proposed CHP unit specifications

Combined Heat & Power	Make / Model	1 No. SAV XRGI 20	
	Part / Full Load	50% (min)	100% (max)
	Electricity power output	10 kW	20 kW
	Heat output	26.1 kW	38.7 kW
	Electricity production efficiency	24.5% (GCV)	29.8% (GCV)
	Heat production efficiency	64.0% (GCV)	57.6% (GCV)
	Overall efficiency	88.5% (GCV)	87.3% (GCV)

Currently the calculations and design are on the basis of XRGI 20 which has a NOx emission of 18 mg/Nm³, which is well below the emission standards for CHP plants in this range of size.

Table 14 shows that significant carbon savings can be achieved by utilising a CHP unit to operate as the lead boiler/heating system i.e. being prioritised to the gas-fired condensing boilers in providing the base heat load throughout the year.

Table 14 Carbon Dioxide emissions reduction – Clean Stage

Regulated Carbon dioxide emissions (Tonnes CO ₂ per annum)	Domestic	Non-Domestic
GLA Baseline Emissions	79	17
Be Lean: After energy demand reduction	70	14
Be Clean: After heat network / CHP	46	0
Carbon Savings over Lean stage	24	0
Carbon Reduction over Lean stage	30%	0%

Please refer to Appendix E showing the energy centre layout schematic and the site wide heat network schematic showing that all uses could be connected to this if required.

Appendix 3 of the GLA Energy Assessment Guidance (Oct 2018) is acknowledged. The guidance mentions:

“Small-medium residential developments: At this scale it is generally not economic to install CHP in residential led, mixed use developments (and where CHP is installed it tends to have lower electrical efficiencies and therefore higher carbon emissions). There are also growing concerns about the air quality impacts of gas-engine CHP at this scale. In addition, due to the small landlord electricity demand, CHP installed to meet the base heat load would require the export of electricity to the grid. However, the administrative burden of managing CHP electricity sales at this small scale where energy service companies (ESCOs) are generally not active, and the low unit price available for small volumes of exported CHP electricity, means it is generally uneconomic for developers to pursue. This can lead to CHP being installed but not operated”

However, it should be noted that the specified CHP unit, i.e. SAV 20KWe, has a total high efficiency (see above). The unit also tracks the electricity demand of the building and only operates when

there is electricity demand, therefore the above concern on exporting to grid is not applicable. Since the development includes office space on ground floor, the electricity demand will be high in a substantial part of the year, therefore the CHP will work effectively to meet this demand while meeting the heat/hot water demand of the residential development at the same time.

Finally, the air quality concern has already been addressed in this report and in the air quality report separately. As mentioned before, the SAV 20KWe unit has very low NOx emissions (as described above) which is substantially lower than the limit set by GLA for gas fired CHPs.

4.9 BE GREEN – RENEWABLE ENERGY TECHNOLOGIES

In order to further reduce emissions from the development in accordance with Local Authority Policies and London Plan Energy Hierarchy, it is necessary to consider the introduction of renewable energy systems on site.

A high-level assessment of the following renewable technologies was carried out as part of the feasibility study:

- Photovoltaic panels;
- Biomass Heating;
- Heat pumps (Ground/Water/Air);
- Wind turbines;
- Solar Hot Water System.

Photovoltaic panels (PVs) were identified as the most appropriate technology for this site. Appendix A of this report provides brief commentary on the technologies not considered appropriate for the scheme.

PHOTOVOLTAIC PANELS

Installation of Photovoltaic panels on the roof areas of the development has been considered and a full shading analysis has been completed for the site to assess overshadowing from surrounding buildings and other features on the roof e.g. lift shafts and the roof parapet (Figure 7). Figure 8 shows the indicative position of the PV panels at various roof levels. The proposed configuration of the PV array should allow enough space between the panels to avoid overshadowing during winter when the sun is at its lowest altitude. A distance of at least 1.5m should be kept from the roof edge and circa 1m from nearby features to provide access and address health and safety issues during installation and maintenance.

The details of the proposed PV panels will be confirmed at the detailed design stage by a Microgeneration Certification Scheme (MCS)⁶ accredited body responsible for design and installation of the PV array. The current layout is based on the specifications described in Table 15.

Table 15 Proposed Renewable Energy Technology (PV panels)

Photovoltaic (PV) Panels	No. of panels	67
	Power output	17.4kWp (assuming 260Wp each)
	Module Efficiency	16.1%
	Area of each panel	1.61 sqm (1639 mm x 983mm)
	Orientation	Facing due SE/SW
	Inclination	30 degrees (to achieve optimum efficiency)

⁶ MCS is an eligibility requirement for the Government's financial incentives, which include the Feed-in Tariff and the Renewable Heat Incentive.

The diagram is a detailed architectural floor plan of a building, likely a residential or institutional structure, showing multiple interconnected rooms and corridors. The plan is oriented with a north arrow in the top right corner, pointing towards the upper right. Key features are highlighted with labels and leader lines:

- PV panels:** A long, narrow strip of rectangular panels is located along the left edge of the building's footprint.
- Amenity areas:** These are represented by light pink shaded regions, primarily located in the central and right portions of the plan, surrounding the plant units.
- Plant units & lift shafts:** These are shown as grey-shaded rectangular areas, typically situated adjacent to the amenity spaces and along the building's perimeter.
- Roof parapet height: 1.2m:** This label is positioned at the bottom center of the plan, indicating the height of the parapet walls.

The building's layout includes various room types, including what appear to be large open spaces, smaller utility rooms, and corridors. The overall design suggests a modern, functional building with integrated renewable energy and dedicated service areas.

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The energy output of the PV panels, circa 15.9 MWh, will either be used to meet the demand of the development or will be exported to the grid. Feed in Tariffs will be applicable to the installation according to current legislation and the PV panels will generate revenue each year.

AIR SOURCE HEAT PUMP

A VRV system utilising Air Source Heat Pumps of high seasonal efficiency (SCOP > 3.50) will provide heating and comfort cooling in the office areas located on the ground floor.

Air-source or aerothermal heat-pumps extract heat from the ambient air and transfer it through refrigerants acting as a medium to the hot water storage. Even though the system consumes electricity, which is a carbon intensive fuel, significant savings can be achieved mainly due to its high seasonal efficiency.

The following table presents the carbon savings achieved after proposing renewable energy technologies on site.

Table 16 Carbon Dioxide emissions reduction for the development

Regulated Carbon dioxide emissions (Tonnes CO ₂ per annum)	Domestic	Non-Domestic
GLA Baseline Emissions	79	17
Be Lean: After energy demand reduction	70	14
Be Clean: After heat network / CHP	46	14
Be Green: After renewable energy technologies	41	11
Carbon Savings over Clean stage	5	3
Carbon Reduction over Clean stage	6%	18%

5. CONCLUSIONS

This Energy Statement outlines the key features and strategies adopted by the development team to reduce energy use and carbon emissions for the scheme and demonstrate compliance with the London Plan and Hillingdon Council's Climate Change Mitigation and Adaptation Policies.

The strategy for reducing energy use and associated carbon emissions through the design of the scheme follows a three-step approach in line with the London Plan energy hierarchy.

- Reducing the energy demand through passive design strategies and provision of high-quality building envelope;
- Reducing the energy consumption through best practice design of building services, lighting and control; and,
- Installation of on-site Low and Zero carbon technologies.

Passive and active energy efficiency features include:

- Building fabric of high thermal performance in terms of U-values and air tightness;
- Building services systems of high efficiency; and,
- Low energy LED Light fitting installed throughout the scheme.

Non-regulated energy demand will be reduced by using energy efficiency appliances that consume less energy than standard equipment. Small power will also be metered separately to track down energy consumption patterns throughout the day. Finally, a building user guide will be distributed to future tenants to advise on how to reduce energy consumption.

Following the proposed energy strategy, the building achieves significant carbon savings that exceed both the Building Regulations' Target Emission Rate and the London Plan Target Reduction in terms of CO₂ emissions.

The following tables demonstrate the overall reduction in the regulated and unregulated carbon emission of the development after each stage of the London Plan Energy Hierarchy. Results are presented separately for the domestic and non-domestic elements of the development.

Table 17 Regulated carbon dioxide emissions after each stage of the energy hierarchy for domestic buildings

	Regulated domestic carbon dioxide emissions (Tonnes CO ₂ per annum)
Baseline CO ₂ emissions (Part L 2013 of the Building Regulations Compliant Development)	79
CO ₂ emissions after energy demand reduction (be lean)	70
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean)	46
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	41

Table 18 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	10	12%
Be clean: Savings from heat network	24	30%
Be green: Savings from renewable energy	5	6%
Cumulative on site savings	38	48%
Carbon shortfall	41	
	(Tonnes CO ₂ per annum)	
Cumulative savings for off-set payment	1234	

Table 19 Regulated carbon dioxide emissions after each stage of the energy hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide emissions (Tonnes CO ₂ per annum)
Baseline CO ₂ emissions (Part L 2013 of the Building Regulations Compliant Development)	17
CO ₂ emissions after energy demand reduction (be lean)	14
CO ₂ emissions after heat network (be clean)	14
CO ₂ emissions after renewable energy (be green)	11

Table 20 Regulated carbon dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	3	17%
Be clean: Savings from heat network	0	0%
Be green: Savings from renewable energy	3	18%
Total cumulative savings	6	35%

Table 21 Site wide regulated carbon dioxide emissions and savings

	Total regulated emissions	CO ₂ savings	Percentage saving
	(Tonnes CO ₂ /year)	(Tonnes CO ₂ /year)	(%)
Part L 2013 baseline	96		
Be lean	84	12	13%
Be clean	60	24	25%
Be green	52	8	8%
	CO ₂ savings offset (Tonnes CO ₂)		
Offset	1234		

Results show demonstrate the total regulated CO₂ savings from each stage of the Energy Hierarchy for the domestic and non-domestic elements of the development separately. A reduction of 35% and 48% over the London Plan Baseline Emission Rate can be achieved for the domestic and non-domestic elements respectively after applying the proposed strategy.

The figures below show the total carbon savings achieved for the domestic and non-domestic elements of the 9 Nestle Avenue scheme over the London Plan's Baseline Emission Rate at each stage of the proposed London Plan Energy Hierarchy as a result of the energy strategy proposed for the scheme.

The Sustainability policies and requirements of both Great London Authority and the local council are addressed in this report and are considered during the design of this development. These requirements and policies and the development response to each policy are detailed in the first few sections of this report, referring also to other relevant consultants' reports where relevant.



Figure 9 Domestic carbon savings at each stage of the London Plan Hierarchy



Figure 10 Non-domestic carbon savings at each stage of the London Plan Hierarchy

APPENDIX A RENEWABLE ENERGY SYSTEMS NOT FEASIBLE FOR THE SITE

A.1 BIOMASS HEATING

Mainly due to the high hot water demand of the proposed scheme throughout the year and the fact that this is located in a London borough, there are concerns regarding the supply chain and the reliability of supply throughout the life of project. The impact of frequent fuel deliveries on local traffic and noise should also be considered. There are also concerns within the local authority over air-quality issues associated with biomass boilers. The issues outlined above, together with the fact that biomass boilers need very large fuel storages to reduce the frequency of deliveries, especially for this scale of development, means that we would not consider this option either appropriate or practical for the development.

A.2 GROUND SOURCE HEAT PUMPS

The possibility of utilising a ground source heat pump has been considered for the scheme. With a closed loop borehole system, it would be possible to drop loops beneath the basement of the building and extract heat from the ground, which has a constant temperature throughout the year. However, a ground source system is considered to be more complex, technically risky and costly when compared to the proposed CHP unit.

A.3 WIND TURBINES

The urban setting of the development means that the wind speed may not be consistent and reliable to generate the expected energy. Previous studies on wind turbine performance in urban climate have shown that air turbulence in the urban area will usually result in lower energy production than expected. Additionally, installation of wind turbines might not be acceptable in a dense residential urban environment due to noise issues and aesthetic impacts. We would therefore consider wind turbines inappropriate for the site.

A.4 SOLAR HOT WATER SYSTEM

Due to the type of the building, the development has high hot water demand throughout the year. However, installing solar thermal panels would reduce significantly the efficiency of the proposed CHP unit, as the two systems would compete against each other in providing renewable heat. Given that the CHP can provide heating by offering significantly higher carbon savings it is proposed that the available roof space is used for installing photovoltaic panels thus generating more electricity on site. In addition, PV panels are easy to install and require minimum maintenance in comparison to the thermal panels.

APPENDIX B OVERHEATING ASSESSMENT



Overheating Assessment

for

Healey Development Solutions (Hayes) Ltd

9 Nestles Avenue

London Borough of Hillingdon
Hayes UB3 4SA

Issue No:	02
Issue Date:	November 2018
Reference:	P18-117

ISSUE

Issue No.	Date of issue	Purpose of issue	Prepared by	Checked by	Changes
01	29.11.2018	Draft report for comments	P Dalapas	N Dabidian	
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EXECUTIVE SUMMARY

Mecserve have been appointed by Healey Development Solutions (Hayes) Ltd to carry out an overheating assessment of the proposed residential scheme at 9 Nestles Avenue in the London Borough of Hillingdon.

The assessment has identified a sample of dwellings to represent all the residential units within the development in this overheating study. Some of these units have a larger glazing area or are units with S/SW-facing windows or top-floor units that receive less overshadowing from neighbour buildings as well as single aspect units where cross ventilation is not possible.

These dwellings have been assessed against the CIBSE TM59 overheating criteria for homes on the basis of the methodology provided in the guide and assumptions regarding the building fabric and the occupants' behaviour, summarised in the following sections.

TM59 requires the development to comply with the relevant criteria using the DSY1 weather data file (describing a moderately warm summer) for the 2020s. The analysis results show that all assessed units comply with the TM59 overheating criteria against the DSY1 weather data i.e. during a moderately warm summer (as described by DSY1) these are expected to cope with moderately warm weather conditions.

As required by both TM59 and GLA guidance on preparing energy assessments, the more extreme DSY2 and DSY3 weather data files for 2020s, featuring a short intense warm spell and a long, less intense warm spell respectively, have been also used. Even though compliance with DSY2 and DSY3 is not mandatory, these have been used in our study and results are presented in Appendices B.

Finally, guidelines on how to operate the building in the most efficient way to avoid overheating during the warmer months are provided in Section 8. These should be included in the Home User Guide provided to the future occupants.

1. INTRODUCTION

This report presents the Overheating Assessment carried out for a sample of dwellings in the proposed 9 Nestles Avenue scheme in the London Borough of Hillingdon. The study aims to assess the risk of overheating in the main occupied areas of the assessed units i.e. open plan kitchen/living rooms and bedrooms against the CIBSE TM59 overheating criteria and in line with the methodology described in the GLA Energy Assessment Guidance (October 2018).

Section 3 reviews all the relevant planning policies with regards to Overheating and Cooling and sets out the strategy for the new scheme to address the cooling hierarchy set by London Plan's Policy 5.9.

1.1 PROPOSED DEVELOPMENT

The development proposal planning application seeks the demolition of the existing building and redevelopment to provide a building up to 10 storeys, with 868 sqm of Class B floorspace at ground and first floor level and 81 residential units to the upper floors, with associated landscaping, access, car parking and cycle parking. The site forms part of the wider masterplan for mixed use residential led redevelopment (Figure 1).

More information can be found on the Design and Access Statement prepared by Brimelow McSweeney Architects.



Figure 1 Proposed 9 Nestles Avenue scheme – SE elevation (Brimelow McSweeney Architects)

2. THERMAL MODELLING

Thermal modelling has been carried out using IES Virtual Environment (Version 2018.0.2.0). IES software is approved by CIBSE AM11 'Building Energy and Environmental Modelling' (2015) to provide full dynamic thermal analysis.

The model geometry was based on the planning layouts and elevations drawings (Information Issue: October 2018) received by Brimelow McSweeney Architects. Figure 2 below shows the results of the solar insolation analysis carried out at early design stage to estimate the solar energy received on each element of the building.

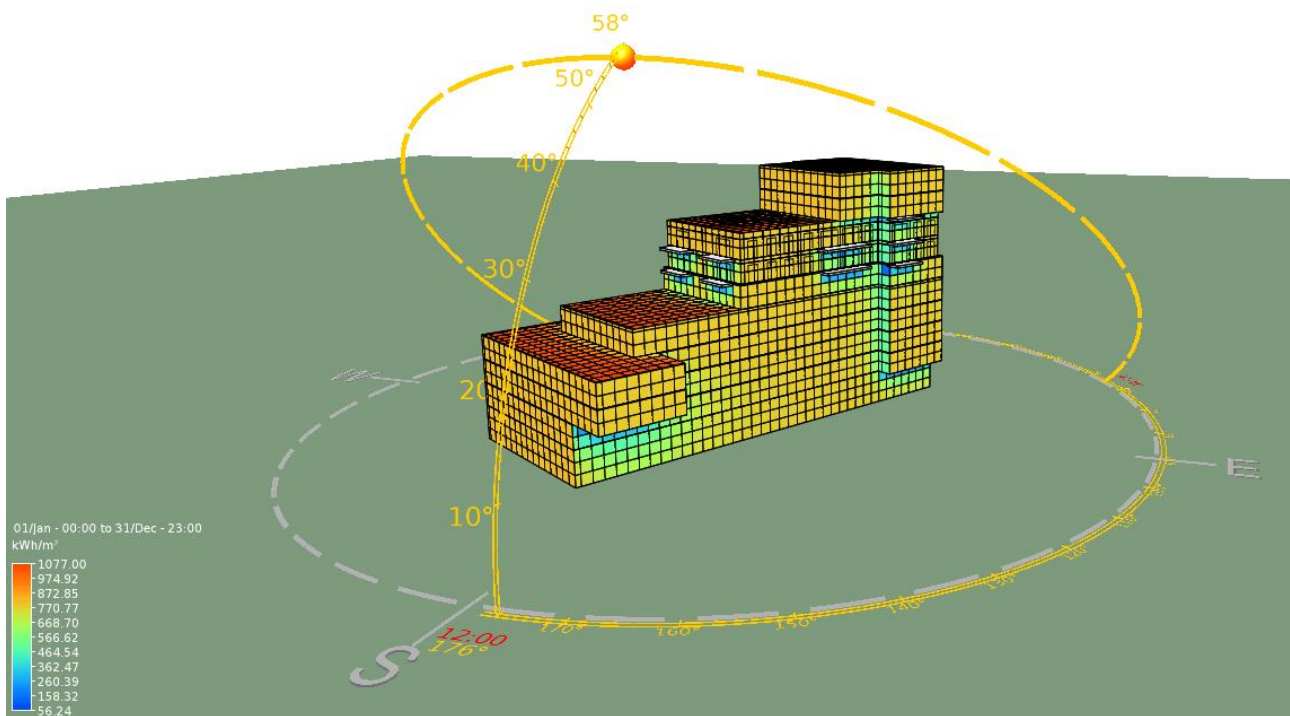


Figure 2 Proposed 9 Nestles Avenue scheme – IES thermal model

3. LONDON PLAN POLICY 5.9

Given the higher temperatures London is likely to experience in the near future, as a result of the climate change that would intensify the urban heat island effect in many areas within Greater London, London Plan, through the cooling hierarchy in Policy 5.9, seeks to reduce any potential of overheating and need of active cooling.

London Plan – Policy 5.9 Overheating and Cooling

A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

- minimise internal heat generation through energy efficient design;
- reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
- manage the heat within the building through exposed internal thermal mass and high ceilings;
- passive ventilation;
- mechanical ventilation;
- active cooling systems (ensuring they are the lowest carbon options).

C. Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

D. Within LDFs boroughs should develop more detailed policies and proposals to support the avoidance of overheating and to support the cooling hierarchy.

Measures being considered in the project to meet the above policy requirements:

Measures to eliminate the risk of overheating have been considered and integrated in the design of the new dwellings. The following will be applied to ensure thermal comfort during summer within the main living areas of each unit:

- Windows can be fully opened to allow for natural ventilation thus providing sufficient air flow rates to remove excessive heat gains;

- Glazing of low g-value, i.e. 0.40 for all windows and glazed doors will be specified to avoid heat transmittance during summer but allow for passive heating in the winter;
- Internal shading devices i.e. curtains of low shading coefficient will be used to control solar gains;
- Occupants will be advised to use A-rated appliances of low energy consumption to reduce internal heat gains and avoid prolonged use of any appliances during hot summer days;
- Energy efficiency light fittings that emit less heat than standard types will be also specified to reduce overheating potential.

3.1 GLA GUIDANCE ON OVERHEATING

The GLA guidance on preparing energy assessments includes a section on Overheating modelling as below:

The SPG (Paragraph 3.2.3) encourages developers to undertake dynamic modelling to assess the risk of overheating in their development. It is expected that dynamic thermal modelling of the overheating risk will be undertaken to support the energy assessment, unless the applicant can demonstrate exceptional circumstances where opportunities for reducing cooling demands via passive measures are constrained

The dynamic thermal modelling should be in addition to any assessment of overheating risk obtained from the Part L Building Regulation compliance tools SAP and SBEM. Evidence of how the development performs against the overheating criteria should be presented along with an outline of the assumptions made (e.g. around internal gains).

In 2014 the CIBSE, working in conjunction with the GLA, published: Design Summer Years for London (TM49: 2014). This guide aims to provide a risk-based approach to help developers and their advisers simultaneously address the challenges of developing in an urban heat island and managing an uncertain future climate. It provides guidance to help ensure that new development is better designed for the climate it will experience over its design life.

Where dynamic modelling is carried out, it should be undertaken in accordance with the guidance and data sets in TM49, which are summarised below.

As it is impossible to prejudge the impact of warm weather conditions on a building in a general sense, overheating modelling should be conducted using three design weather years:

- 1976: a year with a prolonged period of sustained warmth;
- 1989: a moderately warm summer (current design year for London);
- 2003: a year with a very intense single warm spell.

To enable the urban heat island effect in the locality of the development to be taken into account, weather year data for three different locations are provided in the guide - this data has been

adjusted to take account of future climate effects. The most representative weather data set for the project location should be used. For development within:

- the Greater London Authority Central Activity Zone (CAZ) and other high-density urban areas (e.g. Canary Wharf): London Weather Centre data.
- lower density urban and suburban areas: London Heathrow airport data.
- rural and peri-urban areas around the edge of London: Gatwick Airport data.

CIBSE guide TM52 contains additional guidance on the limits of thermal comfort. Entitled 'The Limits of Thermal Comfort: Avoiding Overheating in European Buildings', the TM provides guidance on predicting overheating in buildings. It is intended to inform designers, developers and others responsible for defining the indoor environment in buildings and it is recommended that this is considered when carrying out modelling.

This report follows GLA guidance closely. It uses the CIBSE TM59 guidance to assess the risk of overheating in the dwellings. CIBSE TM59 (2017) uses the adaptive method described in CIBSE TM52 (2013), however, sets specific criteria for assessing the risk of overheating in residential buildings.

The more extreme weather data files DSY 2 and DSY3, listed in TM49, for 2020s have been also used in this study. TM59 does not require a pass for these two additional weather datafiles, it recommends, however, reporting against these. The analysis results against the DSY2 and DSY3 weather data are presented in Appendix B.

4. OVERHEATING CRITERIA

4.1 CIBSE TM59 OVERHEATING CRITERIA FOR DWELLINGS

CIBSE has published TM59 'Design methodology for the assessment of overheating risk in homes' in May 2017. The guidance replaces TM52 (referred in the GLA guidance note of 2016) to be used in residential buildings. TM59 provides designers with a standardised approach to predicting overheating risk for residential building designs using dynamic thermal analysis.

The methodology provides a baseline for all domestic overheating risk assessments. Studies for buildings of multi-residential character, including student accommodation, care homes etc., can also employ this methodology as a starting point, provided that any deviation is clearly stated and justified. Compliance is based on passing both of the following two criteria.

Table 1 CIBSE TM59 Overheating criteria

Hours of exceedance (H_e) criteria for homes predominantly naturally ventilated	
Criterion 1	For living rooms, bedrooms and kitchens: the number of hours (H_e) during which ΔT , the difference between the actual operative temperature in the room at any time (T_{op}) and T_{max} the limiting maximum acceptable temperature, is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.
Criterion 2	For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

- Criterion 1 provides an understanding of how often a room is likely to exceed its comfort range during the summer months.
- Criterion 2 applies only to bedrooms and assess thermal comfort during night time.

4.2 TM52 OVERHEATING CRITERIA FOR NON-DOMESTIC AREAS

CIBSE TM52 'The limits of thermal comfort: avoiding overheating in European buildings' (2013) has a set of criteria to assess the risk of overheating in non-domestic spaces that have either natural or mechanical ventilation as described below. Those rooms that fail any two of the three criteria are classed as overheating.

Table 2 CIBSE TM52 Overheating criteria

Criterion 1	Hours of exceedance (H_e)
	The number of hours (H_e) during which ΔT , the difference between the actual operative temperature in the room at any time (T_{op}) and T_{max} the limiting maximum acceptable temperature, is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.
Criterion 2	Daily weighted exceedance (W_e)
	To allow for the severity of overheating the weighted exceedance (W_e) shall be less than or equal to 6 in any one day where: $W_e = (\sum h_e) \times WF = (h_{e0} \times 0) + (h_{e1} \times 1) + (h_{e2} \times 2) + (h_{e3} \times 3)$, where the weighting factor $WF = 0$ if $\Delta T \leq 0$, otherwise $WF = \Delta T$, and h_{ey} is the time (h) when $WF = y$.
Criterion 3	Upper limit temperature (T_{upp})
	To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4 K.

The proposed development comprises office/workshop areas that extend on the ground and first floor. Given the fact that, in general, offices have high internal gains from occupants, lighting and equipment, it is not feasible to rely on a natural ventilation strategy to eliminate the risk of overheating. Also, due to the deep layout of the floor, a natural ventilation strategy would not provide adequate air to remove the excessive heat that builds up on warmer days. Therefore, a mixed mode ventilation system utilising mechanical ventilation to provide free cooling when the external temperature is low along with an energy efficiency comfort cooling system to provide cooling only on very warm days is proposed to maintain thermal comfort throughout the year.

As shown in the following table passive measures, e.g. solar control glass and low glazing to wall ratio, have been applied and the actual cooling demand is lower than that of the notional, based on the BRUKL output document results.

Table 3 Reporting template for cooling demand

	Area weighted average non-domestic cooling demand (MJ/sqm)	Total area weighted non-domestic cooling demand (MJ/year)
Notional	114.3	164615
Actual	57.1	82235
Achieved reduction		50%

5. PASSIVE DESIGN MEASURES

According to London Plan's Policy 5.9, measures at the highest priority level of the GLA's Cooling Hierarchy should include passive design solutions to reduce excessive heat gains and therefore eliminate the risk of overheating. The following passive design measures have been incorporated in the design of the proposed residential development at 9 Nestles Avenue:

Table 4 Passive Design Measures

Passive Design Solutions	Description
Orientation	The dwellings' orientation varies throughout the proposed development, the majority though have East/West facing windows.
High performance building fabric & Fenestration	Windows of high performance will be provided to all the units. These will have a low U-value to reduce heat losses during winter and prevent heat transfer from outside during summer. Solar control glass of a low g-value (0.40) will be specified to reduce solar gains being transmitted through the windows. Thermal mass is a property that enables building materials to absorb, store, and later release significant amounts of heat. Therefore, the dwellings can benefit from the proposed external walls' inherent thermal mass that when combined with a night-time cooling strategy can store excess heat during the day and remove it during the night.
Shading	The apartments' balconies act as canopies thus providing overshadowing to the rooms below. The dwellings located on the lower floors also take advantage of the overshadowing from the neighboring buildings. Internal shading devices i.e. curtains or blinds of low shading coefficient will be also used in all dwellings. Manual control will be allowed for future occupants to adjust the light levels thus eliminating any risk of overheating and glare.
Mechanical Ventilation	In addition to the natural ventilation strategy proposed using fully openable windows, a Mechanical Ventilation unit with Heat Recovery will be installed in each unit. During summer, this will operate using a summer bypass to provide increase supply flow rates in the living areas.

Energy efficient lighting & appliances	Internal heat generation is minimised through the selection of LED, energy efficient lighting. A-rated appliances that emit low heat gains will also be used throughout the scheme to reduce internal gains.
Heat distribution infrastructure	Well insulated pipework will be specified to reduce heat losses from the hot water pipes running across the communal corridors and inside the dwellings. In addition, any party walls between main the dwellings and plant areas as well as risers will be well insulated to prevent any heat transfer.
Green areas	Provision of green roof areas and planting at ground floor level will contribute in improving the site's microclimate and reducing the impact of the heat island effect.

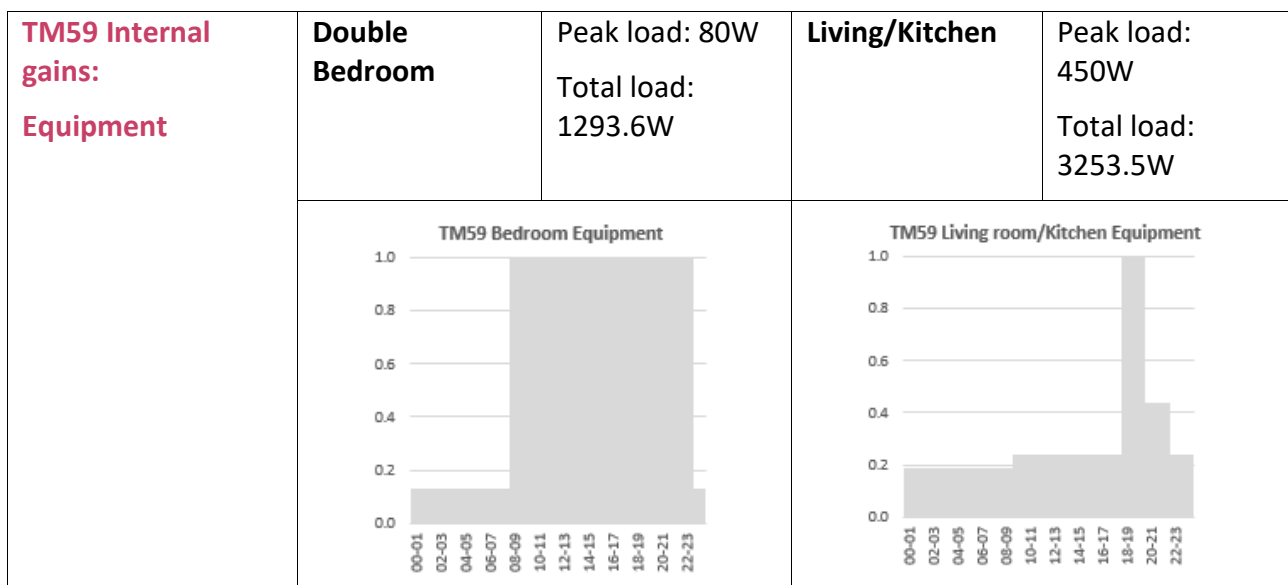
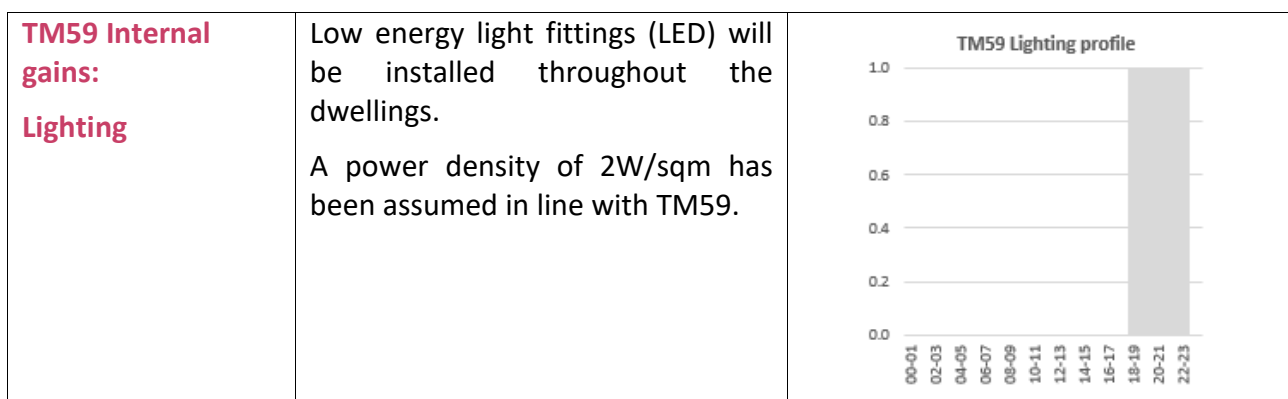
6. MODELLING INPUT DATA

Building category	Category II: Normal expectation (for new buildings and renovations)
Sample size	The below units have been included in the analysis and assessed against TM59 criteria. • 6th floor: All units • 7th floor: All units Appendix C of the report shows the assessed units on the floor layout drawings. The assessed dwellings have been selected in line with the guidance provided in Section 3.1 of TM59. These have rooms with large glazed areas or rooms with windows facing due south/southwest. Also, units located on the upper floors, thus receiving higher solar gains, and single aspect flats where a cross ventilation strategy is not possible have also been included in the study.
Weather file	As required by TM59, the study has been carried out using the latest CIBSE Design Summer Year (DSY1, representing a moderately warm summer) weather file for 2020s, high emissions, 50% percentile scenario. The London Heathrow airport data, representing lower density urban and suburban areas, was used. In line with the GLA methodology, the following more extreme weather files have been also used and results are presented separately in Appendix B of the report: • DSY2 (2020s): featuring short intense warm spell • DSY3 (2020s): featuring long, less intense warm spell
Ventilation strategy	All dwellings will feature a Mechanical Ventilation unit with Heat recovery to provide background ventilation throughout the year. This will run in a summer bypass mode during the warmer months. Windows can be fully openable to allow for single-sided or cross ventilation in single-aspect and dual-aspect units respectively. A natural ventilation strategy will allow for additional flow rates to remove excessive heat gains when required.

	Windows can be also left open during the night in hot summer periods to allow for night-time cooling for cooling down the structure by taking advantage of the lower external temperatures.
Windows and door openings	Windows in each room have been modelled to open when the internal dry bulb temperature exceeds both 22°C and the external dry bulb Temperature. In all the dwellings, internal doors in living/kitchens and bedrooms have been assumed to be left open when needed to take advantage of cross ventilation to increase air movement inside the house.
Shading devices	It has been assumed that light curtains will be installed internally for solar control (Shading coefficient: 0.49). When closed, the curtains are assumed to block 50% of the openable area thus reducing air flow. According to the GLA Energy Assessment Guidance, where blinds are required to enable a pass then the applicant should confirm that they will be included in the base build. The impact of using internal shading devices on reducing the risk of overheating has been assessed. Results are presented for both scenarios i.e. with and without curtains for reference, as required by TM59.
Air speed	The modelled air speed inside the rooms have been set at 0.1 m/s in line with the TM59 methodology
Exposure type	Given the site location, all walls have been assumed to be semi-exposed.
Air infiltration	0.25 ACH

TM59 assumptions on internal heat gains from occupants, equipment and lighting, presented in the below tables, have been used in the assessment.

TM59 Internal gains: Occupancy	No. of people	Living room/Kitchen	Same as No. of bedrooms
		Double Bedrooms	2
	Peak load	Sensible	75 W/person
		Latent	55 W/person



7. ANALYSIS RESULTS

Dynamic thermal modelling has been carried out on the basis of the assumptions presented in the previous section. The risk of overheating in all the main areas have been assessed against the CIBSE DSY1 weather file.

The table below provides a summary of the No. of rooms complying with Criteria 1 and 2 of the CIBSE TM59 Guide. The impact of having internal shading devices has been assessed and results are presented separately.

Table 5 No. of rooms passing TM59 Overheating criteria (CIBSE DSY1 2020s weather file)

Room	Total No.	Without internal shading devices		With internal shading devices	
		Criterion 1 ≤ 3%	Criterion 2 ≤ 32hrs	Criterion 1 ≤ 3%	Criterion 2 ≤ 32hrs
Open plan Living room/Kitchen	16	14	N/A	16	N/A
Double Bedrooms	24	24	24	24	24
CIBSE TM59 Compliance	40	38		40	
		95%		100%	

Results show that using internal shading devices of low shading coefficient will have a positive impact on reducing the risk of overheating in the dwellings. Without the use of internal shading devices, 2 kitchen/living rooms fail to comply with the first TM59 criterion. The risk of overheating inside the flats is reduced further when using internal curtains or blinds. Detailed results are presented in Appendix A in terms of percentage of occupied hours when the internal dry resultant temperature is in within the comfort range given by both TM59 criteria.

All rooms have also been assessed against the more extreme weather conditions, described by weather files DSY2 and DSY3. Results are presented in Appendix B for the 2020s data files.

8. GUIDELINES ON MANAGING THE RISK OF OVERHEATING

The following mitigation measures should be considered during the event of a heatwave to minimise the risk of overheating in the new dwellings and ensure thermal comfort for the future occupants. These should be included in the Home User Guide distributed to the occupants.

- Comprehensive instructions on how to operate the windows and the curtains should be given to the future occupants to control thermal comfort in their rooms.
- Occupants should leave the windows open whenever the internal room temperature rises over 22°C. However, if the external temperature is higher than the internal temperature (in hot summer days) windows need to remain closed for that period. As long as the external temperature cools down, these should be left open again to provide fresh air in the dwellings.
- Occupants should be advised to leave their windows open during the night on warm summer days to take advantage of the low external temperatures during the night for cooling down their rooms and remove the excessive heat that builds up throughout the day.
- Occupants should be advised to use the internal shading devices throughout the sunny days to prevent direct solar gains been transmitted into their rooms. These should be left closed when the rooms are not occupied.
- Internal shading devices e.g. curtains or blinds with low solar transmittance will be specified in all units (shading coefficient < 0.49).
- Occupants should be advised that, when using the curtains/blinds, they should make sure that these do not cover the openable area of the windows completely so that the air movement is not blocked. Curtains should be designed and installed such that the main openable area of the window is not fully covered but allow for as much air flow as possible.
- All fixed building elements such as ceiling lights and fridges will be very energy efficient. It is essential that the occupants also use energy efficient equipment, for example, energy efficient light fittings of LED types and A+ rated electrical appliances such as TVs that consume less energy should be specified and promoted to reduce internal heat gains. Occupants should be also advised against prolonged use of any appliances during hot summer days.

9. CONCLUSIONS

Mecserve have been appointed by Healey Development Solutions (Hayes) Ltd to carry out an overheating assessment of the proposed residential scheme at 9 Nestles Avenue in the London Borough of Hillingdon.

The assessment has identified a sample of dwellings that have a higher risk of overheating. These are mainly units that have a larger glazing area, units with S/SW-facing windows, top-floor units that receive less overshadowing from neighbour buildings as well as single aspect units where cross ventilation is not possible.

These dwellings have been assessed against the CIBSE TM59 overheating criteria for homes on the basis of the methodology provided in the guide and assumptions regarding the building fabric and the occupants' behaviour, summarised in Section 6 of this report.

TM59 requires the development to comply with the relevant criteria using the DSY1 weather data file (describing a moderately warm summer) for the 2020s. The analysis results show that all assessed units comply with the TM59 overheating criteria against the DSY1 weather data i.e. during a moderately warm summer (as described by DSY1) these are expected to cope with moderately warm weather conditions. The impact of using internal shading devices to control solar gains have been assessed separately and results are reported in line with the TM59 methodology.

As required by both TM59 and GLA guidance on preparing energy assessments, the more extreme DSY2 and DSY3 weather data files for 2020s, featuring a short intense warm spell and a long, less intense warm spell respectively, have been also used. Even though compliance with DSY2 and DSY3 is not mandatory, these have been used in our study and results are presented in Appendices B.

To ensure minimum disruption during the event of a hot spell, it is important that occupants are aware of how to operate the building following the guidelines provided in Section 8. Opening the windows to allow for natural ventilation and closing the internal shading devices to control solar gains without blocking the windows' openable area is essential to tackle the risk of overheating and ensure thermal comfort. These should be included in the Home User Guide distributed to the occupants.

This report and the supporting thermal modelling are based on guidance provided by CIBSE TM59. It is also using predicted weather conditions as described in TM59 and assumes future occupants will follow the recommendations of this report. The output of our simulation correlates to this input data and is only correct when the input data is valid. All results provided by an overheating analysis are indication of risk of overheating rather than an accurate prediction of absolute internal temperatures under operational conditions. Occupant perception of thermal comfort is a complex area and the most recent CIBCE guides TM59 have tried to consider this to some extent, however they do not claim to predict risk of discomfort for every occupant.

APPENDIX A RESULTS: CIBSE 2020S DSY1 WEATHER FILE

The following table presents results in detail for each of the assessed room. Compliance for bedrooms is based on passing both of the following two criteria.

Room	Windows without curtains		Overall Compliance	Windows with curtains		Overall Compliance
	Criterion 1	Criterion 2		Criterion 1	Criterion 2	
	≤ 3%	≤ 32hrs		≤ 3%	≤ 32hrs	
L06.01.2B.DB 1	0.5	N/A	Pass	0.2	N/A	Pass
L06.01.2B.DB 2	0.0	25	Pass	0.0	25	Pass
L06.01.2B.LK	0.1	25	Pass	0.0	23	Pass
L06.02.1B.DB	0.5	N/A	Pass	0.4	N/A	Pass
L06.02.1B.LK	0.1	25	Pass	0.0	23	Pass
L06.03.1B.DB	0.2	N/A	Pass	0.1	N/A	Pass
L06.03.1B.LK	0.0	25	Pass	0.0	21	Pass
L06.04.2B.DB 1	0.3	N/A	Pass	0.1	N/A	Pass
L06.04.2B.DB 2	0.0	25	Pass	0.0	20	Pass
L06.04.2B.LK	0.5	21	Pass	0.0	18	Pass
L06.05.2B.DB 1	1.5	N/A	Pass	0.9	N/A	Pass
L06.05.2B.DB 2	0.4	21	Pass	0.1	16	Pass
L06.05.2B.LK	0.1	23	Pass	0.0	18	Pass
L06.06.1B.DB	3.5	N/A	Fail	2.1	N/A	Pass
L06.06.1B.LK	0.1	22	Pass	0.0	18	Pass
L06.07.1B.DB	1.3	N/A	Pass	0.5	N/A	Pass
L06.07.1B.LK	0.1	23	Pass	0.0	20	Pass
L06.08.2B.DB 1	1.7	N/A	Pass	1.0	N/A	Pass
L06.08.2B.DB 2	0.2	27	Pass	0.0	26	Pass
L06.08.2B.LK	0.2	23	Pass	0.1	21	Pass
L07.01.2B.DB 1	0.4	N/A	Pass	0.1	N/A	Pass
L07.01.2B.DB 2	0.0	25	Pass	0.0	23	Pass
L07.01.2B.LK	0.0	24	Pass	0.0	20	Pass
L07.02.1B.DB	0.4	N/A	Pass	0.4	N/A	Pass
L07.02.1B.LK	0.0	25	Pass	0.0	23	Pass
L07.03.1B.DB	0.4	N/A	Pass	0.3	N/A	Pass
L07.03.1B.LK	0.0	22	Pass	0.0	19	Pass
L07.04.2B.DB 1	0.4	N/A	Pass	0.1	N/A	Pass
L07.04.2B.DB 2	0.0	22	Pass	0.0	17	Pass
L07.04.2B.LK	0.1	19	Pass	0.0	16	Pass
L07.05.2B.DB 1	3.3	N/A	Fail	1.8	N/A	Pass
L07.05.2B.DB 2	0.5	N/A	Pass	0.2	N/A	Pass
L07.05.2B.LK	0.0	25	Pass	0.0	25	Pass
L07.06.1B.DB	0.1	25	Pass	0.0	23	Pass
L07.06.1B.LK	0.5	N/A	Pass	0.4	N/A	Pass
L07.07.1B.DB	0.1	25	Pass	0.0	23	Pass
L07.07.1B.LK	0.2	N/A	Pass	0.1	N/A	Pass
L07.08.2B.DB 1	0.0	25	Pass	0.0	21	Pass
L07.08.2B.DB 2	0.3	N/A	Pass	0.1	N/A	Pass

Room		Windows without curtains		Overall Compliance	Windows with curtains		Overall Compliance
		Criterion 1	Criterion 2		Criterion 1	Criterion 2	
		≤ 3%	≤ 32hrs		≤ 3%	≤ 32hrs	
L07.08.2B.LK		0.0	25	Pass	0.0	20	Pass
Total No. Pass	Living room /Kitchens	14 / 16	N/A	14 / 16	16 / 16	N/A	16 / 16
	Double Bedrooms	24 / 24	24 / 24	24 / 24	24 / 24	24 / 24	24 / 24
Overall compliance % Pass				38 / 40 95%			40 / 40 100%

APPENDIX B RESULTS: CIBSE 2020S DSY2 & DSY3 WEATHER FILES

In line with the CIBSE TM59 methodology, the proposed development is required to be assessed against and pass using the CIBSE 2020s DSY1 weather file. Section 7 of the report demonstrates that all assessed units comply with both TM59 criteria.

Both TM59 and GLA guidance recommend that in addition to DSY1 the following two additional TM49 design weather years for 2020s:

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

should be used to further test the design, even though, a pass against these is not mandatory.

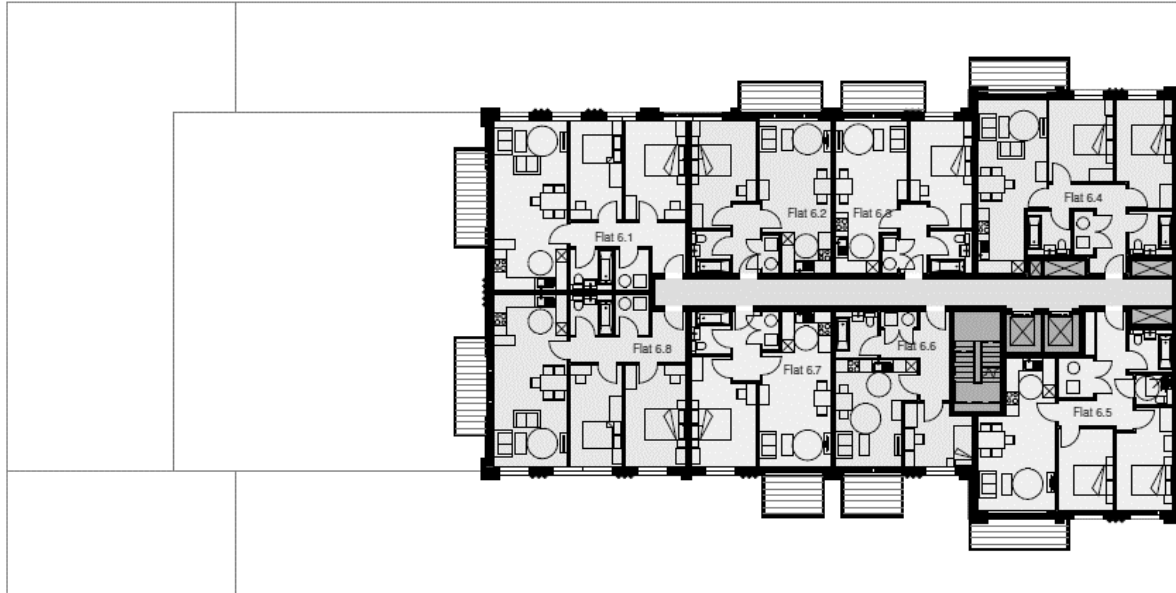
All sample units have been assessed against the more extreme DSY2 and DSY3 weather files for 2020s and results are presented below.

Room	CIBSE 2020s DSY2		Compliance	CIBSE 2020s DSY3		Compliance
	Criterion 1	Criterion 2		Criterion 1	Criterion 2	
	≤ 3%	≤ 32hrs		≤ 3%	≤ 32hrs	
L06.01.2B.DB 1	0.5	30	Pass	1.0	50	Fail
L06.01.2B.DB 2	0.2	35	Fail	0.7	54	Fail
L06.01.2B.LK	2.4	N/A	Pass	3.0	N/A	Pass
L06.02.1B.DB	0.2	35	Fail	0.7	53	Fail
L06.02.1B.LK	1.0	N/A	Pass	1.7	N/A	Pass
L06.03.1B.DB	0.1	33	Fail	0.5	53	Fail
L06.03.1B.LK	1.1	N/A	Pass	1.7	N/A	Pass
L06.04.2B.DB 1	0.4	39	Fail	0.8	60	Fail
L06.04.2B.DB 2	0.4	36	Fail	0.8	54	Fail
L06.04.2B.LK	0.5	N/A	Pass	1.0	N/A	Pass
L06.05.2B.DB 1	0.3	39	Fail	0.7	56	Fail
L06.05.2B.DB 2	0.3	37	Fail	0.7	55	Fail
L06.05.2B.LK	1.1	N/A	Pass	1.5	N/A	Pass
L06.06.1B.DB	0.4	38	Fail	0.8	55	Fail
L06.06.1B.LK	0.7	N/A	Pass	0.9	N/A	Pass
L06.07.1B.DB	0.2	35	Fail	0.6	55	Fail
L06.07.1B.LK	0.8	N/A	Pass	0.9	N/A	Pass
L06.08.2B.DB 1	0.2	35	Fail	0.6	55	Fail
L06.08.2B.DB 2	0.6	30	Pass	1.0	49	Fail
L06.08.2B.LK	2.3	N/A	Pass	2.8	N/A	Pass
L07.01.2B.DB 1	0.2	26	Pass	0.8	45	Fail
L07.01.2B.DB 2	0.1	33	Fail	0.5	52	Fail
L07.01.2B.LK	3.3	N/A	Fail	4.8	N/A	Fail
L07.02.1B.DB	0.1	32	Pass	0.5	52	Fail
L07.02.1B.LK	1.0	N/A	Pass	1.9	N/A	Pass
L07.03.1B.DB	0.1	33	Fail	0.5	53	Fail
L07.03.1B.LK	1.5	N/A	Pass	2.2	N/A	Pass

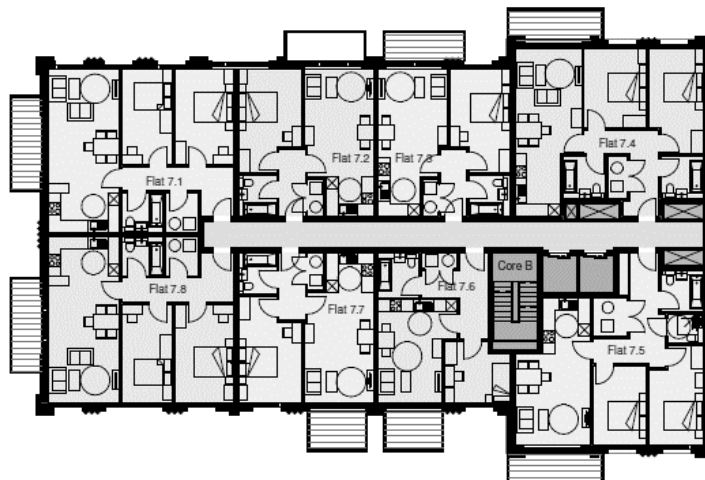
Room		CIBSE 2020s DSY2		Compliance	CIBSE 2020s DSY3		Compliance
		Criterion 1	Criterion 2		Criterion 1	Criterion 2	
		≤ 3%	≤ 32hrs		≤ 3%	≤ 32hrs	
L07.04.2B.DB 1		0.2	38	Fail	0.8	59	Fail
L07.04.2B.DB 2		0.3	35	Fail	0.8	54	Fail
L07.04.2B.LK		0.4	N/A	Pass	0.9	N/A	Pass
L07.05.2B.DB 1		0.2	36	Fail	0.6	55	Fail
L07.05.2B.DB 2		0.3	35	Fail	0.7	54	Fail
L07.05.2B.LK		1.1	N/A	Pass	1.3	N/A	Pass
L07.06.1B.DB		0.4	38	Fail	0.7	54	Fail
L07.06.1B.LK		1.2	N/A	Pass	1.4	N/A	Pass
L07.07.1B.DB		0.1	33	Fail	0.5	53	Fail
L07.07.1B.LK		1.1	N/A	Pass	1.1	N/A	Pass
L07.08.2B.DB 1		0.1	33	Fail	0.4	53	Fail
L07.08.2B.DB 2		0.4	28	Pass	0.8	45	Fail
L07.08.2B.LK		3.4	N/A	Fail	4.1	N/A	Fail
Total No. Pass	Living room /Kitchens	14 / 16	N/A	14 / 16	14 / 16	N/A	14 / 16
	Double Bedrooms	24 / 24	5 / 24	5 / 24	24 / 24	0 / 24	0 / 24
Overall compliance % Pass				19 / 40 48%			14 / 40 35%

APPENDIX C FLOOR LAYOUTS – ASSESSED UNITS

6th Floor



7th Floor



APPENDIX D GLA-DOMESTIC OVERHEATING CHECKLIST

Section 1 - Site features affecting vulnerability to overheating		Yes or No
Site location	Urban – within central London or in a high-density conurbation	
	Peri-urban – on the suburban fringes of London	Yes
Air quality and/or Noise sensitivity – are any of the following in the vicinity of buildings?	Busy roads / A roads	
	Railways / Overground / DLR	Yes
	Airport / Flight path	Yes
	Industrial uses / waste facility	Yes
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Yes
	Are residents likely to be at home during the day (e.g. students)?	Yes
Dwelling aspect	Are there any single aspect units?	Yes
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	No
	If yes, is this to allow acceptable levels of daylighting?	
Security - Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	No
	Vulnerable areas identified by the Police Architectural Liaison Officer	No
	Other	

Section 2 - Design features implemented to mitigate overheating risk		Response
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Yes
	Will green roofs be provided?	Yes
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	Yes
Materials	Have high albedo (light colour) materials been specified?	Yes
Dwelling aspect	% of total units that are single aspect	
	% single aspect with N / NE / NW orientation	
	% single aspect with E orientation	
	% single aspect with S / SE / SW orientation	
	% single aspect with W orientation	
Glazing ratio - What is the glazing ratio (glazing: internal floor area) on each facade?	N / NE / NW	0
	E	0.25
	S / SE / SW	0.25
	W	0.25
Daylighting	What is the average daylight factor range?	
Window opening	Are windows openable?	Yes
Window opening	What is the average percentage of openable area for the windows?	50%
Window opening - What is the extent of the opening?	Fully openable	Yes
	Limited (e.g. for security, safety, wind loading reasons)	
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	No

Shading	Is there any external shading?	Balconies
	Is there any internal shading?	
Glazing specification	Is there any solar control glazing?	Yes
Ventilation – What is the ventilation strategy?	Natural – background	All dwellings will be provided with MVHR units that can run on bypass mode during summer.
	Natural – purge	
	Mechanical – background (e.g. MVHR)	Fully openable windows will allow for natural ventilation to remove excessive heat gains on warm days.
	Mechanical – purge	
	What is the average design air change rate	
Heating system	Is communal heating present?	Yes
	What is the flow/return temperature?	TBC
	Have horizontal pipe runs been minimised?	Where possible the extend of the pipework will be minimised to reduce heat losses
	Do the specifications include insulation levels in line with the London Heat Network Manual?	All hot water pipes will be well insulated to reduce heat losses thus tackling the risk of overheating.

APPENDIX C NON-DOMESTIC ELEMENTS: BRUKL REPORTS

Project name

9 Nestles Avenue (Be Lean)**As designed**

Date: Wed Nov 28 11:29:00 2018

Administrative information

Building Details

Address: 9 Nestles Avenue, Hayes, UB3 4SA

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.10

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Panagiotis Konstantinos Dalapas

Telephone number: 02031415800

Address: Mecserve Ltd 83 Blackfriars Road, London, SE1 8HA

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	11.7
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	11.7
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	9.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	L00000DB:Surf[3]
Floor	0.25	0.15	0.15	L00000DB:Surf[0]
Roof	0.25	0.15	0.15	L00000E3:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	L00000DD:Surf[0]
Personnel doors	2.2	1	1	L00000DB:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	5.5	0	0	0.8
Standard value	0.91*	3.2	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
L00.Office		-	1.8	0	-	-	-	-	-	-	-	N/A
L01.Office		-	1.8	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
L00.Bike store	90	-	-	50
L00.Bike store	90	-	-	94
L00.Comms	90	-	-	18
L00.Gas	90	-	-	7
L00.Lobby	-	90	-	73
L00.Lobby	-	90	-	98
L00.Parking	90	-	-	419
L00.Refuse	90	-	-	25
L00.Refuse	90	-	-	41
L00.Resi plant	90	-	-	409
L00.Substation	90	-	-	108
L00.Switch room	90	-	-	73

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
L00.Office		90	-	-
L01.Office		90	-	-
				General lighting [W]
				4685
				1336

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00.Comms	N/A	N/A
L00.Office	NO (-86.2%)	YES
L01.Office	NO (-82.9%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1440.2	1440.2
External area [m ²]	2410.5	2410.5
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	580.42	974.39
Average U-value [W/m ² K]	0.24	0.4
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4	6.47
Cooling	2.42	5.25
Auxiliary	4.21	1.3
Lighting	9.03	12.62
Hot water	1.81	1.99
Equipment*	65.12	65.12
TOTAL**	21.46	27.63

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	48.64	91.75
Primary energy* [kWh/m ²]	57.14	67.48
Total emissions [kg/m ²]	9.7	11.7

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	20.5	57.1	6.4	3.9	6.7	0.89	4.11	0.91	5.5
	Notional	0	0	0	0	0	0	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	32	114.3	10.3	8.4	2.1	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	L00000DB:Surf[3]
Floor	0.2	0.15	L00000DB:Surf[0]
Roof	0.15	0.15	L00000E3:Surf[1]
Windows, roof windows, and rooflights	1.5	1.4	L00000DD:Surf[0]
Personnel doors	1.5	1	L00000DB:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Project name

9 Nestles Avenue (Be Green)**As designed**

Date: Wed Nov 28 15:08:09 2018

Administrative information

Building Details

Address: 9 Nestles Avenue, Hayes, UB3 4SA

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.10

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Panagiotis Konstantinos Dalapas

Telephone number: 02031415800

Address: Mecserve Ltd 83 Blackfriars Road, London, SE1 8HA

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	11.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	11.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	7.6
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	L00000DB:Surf[3]
Floor	0.25	0.15	0.15	L00000DB:Surf[0]
Roof	0.25	0.15	0.15	L00000E3:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	L00000DD:Surf[0]
Personnel doors	2.2	1	1	L00000DB:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	5.5	0	0	0.8
Standard value	2.5*	3.2	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L00.Office		-	1.8	0	-	-	-	-	-	-	-	N/A
L01.Office		-	1.8	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
L00.Bike store	90	-	-	50
L00.Bike store	90	-	-	94
L00.Comms	90	-	-	18
L00.Gas	90	-	-	7
L00.Lobby	-	90	-	73
L00.Lobby	-	90	-	98
L00.Parking	90	-	-	419
L00.Refuse	90	-	-	25
L00.Refuse	90	-	-	41
L00.Resi plant	90	-	-	409
L00.Substation	90	-	-	108
L00.Switch room	90	-	-	73

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
L00.Office		90	-	-
L01.Office		90	-	-
				General lighting [W]
				4685
				1336

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00.Comms	N/A	N/A
L00.Office	NO (-86.2%)	YES
L01.Office	NO (-82.9%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1440.2	1440.2
External area [m ²]	2410.5	2410.5
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	580.42	974.39
Average U-value [W/m ² K]	0.24	0.4
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.04	2.18
Cooling	2.42	5.25
Auxiliary	4.21	1.3
Lighting	9.03	12.62
Hot water	1.81	1.99
Equipment*	65.12	65.12
TOTAL**	18.5	23.34

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	3.43	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	48.64	91.75
Primary energy* [kWh/m ²]	58.49	72.64
Total emissions [kg/m ²]	7.6	11.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	20.5	57.1	1.7	3.9	6.7	3.43	4.11	3.5	5.5
	Notional	0	0	0	0	0	0	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	32	114.3	3.5	8.4	2.1	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	L00000DB:Surf[3]
Floor	0.2	0.15	L00000DB:Surf[0]
Roof	0.15	0.15	L00000E3:Surf[1]
Windows, roof windows, and rooflights	1.5	1.4	L00000DD:Surf[0]
Personnel doors	1.5	1	L00000DB:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

APPENDIX D DOMESTIC ELEMENTS: SAP WORKSHEETS (TYPICAL UNIT)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.16

Property Address: 6-02 (Be Lean)

Address : 9 Nestles Avenue, Hayes, UB3 4SA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.45	(1a) x	2.5	(2a) =	128.63 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.45	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			128.63 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = ÷ (5) = (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			3.26	x1/[1/(1.4)+0.04] =	4.32		
Windows Type 2			6.53	x1/[1/(1.4)+0.04] =	8.66		
Walls	21.09	9.79	11.3	x 0.18 =	2.03		
Total area of elements, m²			21.09				

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 15.01 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 678 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 17.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	24.63	24.5	24.37	23.76	23.65	23.11	23.11	23.02	23.32	23.65	23.88	24.12

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 41.64 41.51 41.38 40.77 40.66 40.12 40.12 40.03 40.33 40.66 40.89 41.13

Average = Sum(39)_{1...12} /12= 40.77 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m= 0.81 0.81 0.8 0.79 0.79 0.78 0.78 0.78 0.78 0.79 0.79 0.8

Average = Sum(40)_{1...12} /12= 0.79 (40)

[illegible]

TER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	169.52	149.6	157.54	141.81	139.4	125.18	120.81	131.75	131.27	147.02	154.72	165.64	(62)
--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	169.52	149.6	157.54	141.81	139.4	125.18	120.81	131.75	131.27	147.02	154.72	165.64	
Output from water heater (annual) _{1...12}												1734.25	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	78.15	69.42	74.16	68.23	68.13	62.7	61.95	65.59	64.73	70.67	72.52	76.86	(65)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	(66)

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

(67)m=	13.64	12.11	9.85	7.46	5.57	4.71	5.09	6.61	8.87	11.27	13.15	14.02	(67)
--------	-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

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

(68)m=	151	152.57	148.62	140.21	129.6	119.63	112.97	111.4	115.35	123.75	134.36	144.34	(68)
--------	-----	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	105.04	103.3	99.68	94.77	91.58	87.09	83.27	88.16	89.9	94.98	100.73	103.3	(72)
--------	--------	-------	-------	-------	-------	-------	-------	-------	------	-------	--------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	321.67	319.97	310.14	294.43	278.75	263.41	253.31	258.16	266.11	281.99	300.23	313.65	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	3.26	x	19.64	x	0.63	x	0.7	=	19.57	(80)	
West	0.9x	0.77	x	6.53	x	19.64	x	0.63	x	0.7	=	39.2	(80)	
West	0.9x	0.77	x	3.26	x	38.42	x	0.63	x	0.7	=	38.28	(80)	
West	0.9x	0.77	x	6.53	x	38.42	x	0.63	x	0.7	=	76.67	(80)	
West	0.9x	0.77	x	3.26	x	63.27	x	0.63	x	0.7	=	63.04	(80)	
West	0.9x	0.77	x	6.53	x	63.27	x	0.63	x	0.7	=	126.27	(80)	
West	0.9x	0.77	x	3.26	x	92.28	x	0.63	x	0.7	=	91.94	(80)	
West	0.9x	0.77	x	6.53	x	92.28	x	0.63	x	0.7	=	184.16	(80)	

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West	0.9x	0.77	x	3.26	x	113.09	x	0.63	x	0.7	=	112.67	(80)
West	0.9x	0.77	x	6.53	x	113.09	x	0.63	x	0.7	=	225.69	(80)
West	0.9x	0.77	x	3.26	x	115.77	x	0.63	x	0.7	=	115.34	(80)
West	0.9x	0.77	x	6.53	x	115.77	x	0.63	x	0.7	=	231.04	(80)
West	0.9x	0.77	x	3.26	x	110.22	x	0.63	x	0.7	=	109.81	(80)
West	0.9x	0.77	x	6.53	x	110.22	x	0.63	x	0.7	=	219.96	(80)
West	0.9x	0.77	x	3.26	x	94.68	x	0.63	x	0.7	=	94.33	(80)
West	0.9x	0.77	x	6.53	x	94.68	x	0.63	x	0.7	=	188.94	(80)
West	0.9x	0.77	x	3.26	x	73.59	x	0.63	x	0.7	=	73.32	(80)
West	0.9x	0.77	x	6.53	x	73.59	x	0.63	x	0.7	=	146.86	(80)
West	0.9x	0.77	x	3.26	x	45.59	x	0.63	x	0.7	=	45.42	(80)
West	0.9x	0.77	x	6.53	x	45.59	x	0.63	x	0.7	=	90.98	(80)
West	0.9x	0.77	x	3.26	x	24.49	x	0.63	x	0.7	=	24.4	(80)
West	0.9x	0.77	x	6.53	x	24.49	x	0.63	x	0.7	=	48.87	(80)
West	0.9x	0.77	x	3.26	x	16.15	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	6.53	x	16.15	x	0.63	x	0.7	=	32.23	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	58.76	114.95	189.31	276.1	338.37	346.38	329.77	283.27	220.18	136.4	73.27	48.32	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.43	434.92	499.45	570.53	617.11	609.79	583.08	541.43	486.28	418.4	373.5	361.97	(84)
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7. Mean internal temperature (heating season)

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

21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.8	0.6	0.42	0.3	0.34	0.57	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.38	20.53	20.74	20.93	20.99	21	21	21	21	20.89	20.6	20.35	(87)
--------	-------	-------	-------	-------	-------	----	----	----	----	-------	------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.26	20.26	20.27	20.27	20.27	20.27	20.26	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.77	0.56	0.37	0.25	0.29	0.51	0.84	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.43	19.64	19.94	20.19	20.25	20.27	20.27	20.27	20.26	20.15	19.76	19.39	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46	(91)
------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.05	20.31	20.53	20.59	20.61	20.61	20.61	20.6	20.49	20.15	19.84	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.05	20.31	20.53	20.59	20.61	20.61	20.61	20.6	20.49	20.15	19.84	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.78	0.58	0.39	0.28	0.31	0.54	0.85	0.97	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	375.98	423.06	460.37	444.66	357.72	240.84	160.83	168.46	260.54	357.66	363.04	358.75	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m]

(97)m=	648.28	628.91	571.45	474.15	361.61	241.07	160.85	168.49	262.25	402.17	533.6	643.19	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	202.59	138.33	82.65	21.23	2.89	0	0	0	0	33.11	122.8	211.62	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

815.23 (98)

Space heating requirement in kWh/m²/year

15.85 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.5 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

202.59	138.33	82.65	21.23	2.89	0	0	0	0	33.11	122.8	211.62	
--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------	--

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

216.67	147.94	88.39	22.71	3.09	0	0	0	0	35.42	131.34	226.33	
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------	--

Total (kWh/year) = Sum(211)_{1...5,10...12} =

871.9 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	
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Total (kWh/year) = Sum(215)_{1...5,10...12} =

0 (215)

Water heating

Output from water heater (calculated above)

169.52	149.6	157.54	141.81	139.4	125.18	120.81	131.75	131.27	147.02	154.72	165.64	
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Efficiency of water heater

79.8 (216)

(217)m=	85.29	84.61	83.18	81.05	79.99	79.8	79.8	79.8	79.8	81.57	84.21	85.47	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	198.76	176.82	189.38	174.97	174.27	156.86	151.38	165.1	164.49	180.23	183.74	193.8	
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Total = Sum(219a)_{1...12} =

2109.82 (219)

Annual totals

Space heating fuel used, main system 1

871.9

Water heating fuel used

2109.82

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling design stage

central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75	(231)
Electricity for lighting		240.84	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	188.33 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	455.72 (264)
Space and water heating	(261) + (262) + (263) + (264) =		644.05 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	125 (268)
Total CO2, kg/year		sum of (265)...(271) =	807.97 (272)

TER = 15.7 (273)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.16

Property Address: 6-02 (Be Lean)

Address : 9 Nestles Avenue, Hayes, UB3 4SA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.45	(1a) x	2.5	(2a) =	128.63 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.45	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			128.63 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	+	0	0 (6a)
Number of open flues	0	+	0	+	0	0 (6b)
Number of intermittent fans				0	x 10 =	0 (7a)
Number of passive vents				0	x 10 =	0 (7b)
Number of flueless gas fires				0	x 40 =	0 (7c)
Air changes per hour						
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>						
Number of storeys in the dwelling (ns)						0 (9)
Additional infiltration					[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction						0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>						
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0						0 (12)
If no draught lobby, enter 0.05, else enter 0						0 (13)
Percentage of windows and doors draught stripped						0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area						3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)						0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>						
Number of sides sheltered						3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =		0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

78.2 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.26 0.25 0.25 0.24 0.23 0.22 0.22 0.22 0.23 0.23 0.24 0.25 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.26 0.25 0.25 0.24 0.23 0.22 0.22 0.22 0.23 0.23 0.24 0.25 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			3.26	x1/[1/(1.2)+0.04] =	3.73		(27)
Windows Type 2			6.53	x1/[1/(1.2)+0.04] =	7.48		(27)
Walls	21.09	9.79	11.3	x 0.16 =	1.81		(29)
Total area of elements, m²			21.09				(31)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 13.02 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 678 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	10.92	10.79	10.67	10.05	9.93	9.31	9.31	9.19	9.56	9.93	10.18	10.42

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 25.93 25.81 25.69 25.07 24.95 24.33 24.33 24.21 24.58 24.95 25.19 25.44
Average = Sum(39)_{1..12} /12= 25.04 (39)

Heat loss parameter (HLP), W/m²K

(40)m= 0.5 0.5 0.5 0.49 0.48 0.47 0.47 0.47 0.48 0.48 0.49 0.49
Average = Sum(40)_{1..12} /12= 0.49 (40)

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Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	178.2	157.44	166.22	150.21	148.08	133.58	129.49	140.43	139.67	155.7	163.12	174.32	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	178.2	157.44	166.22	150.21	148.08	133.58	129.49	140.43	139.67	155.7	163.12	174.32	
Output from water heater (annual) _{1...12}												1836.47	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	85.09	75.69	81.11	74.95	75.08	69.42	68.9	72.54	71.45	77.61	79.25	83.8	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	(66)

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

(67)m=	14.09	12.51	10.17	7.7	5.76	4.86	5.25	6.83	9.16	11.64	13.58	14.48	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	151	152.57	148.62	140.21	129.6	119.63	112.97	111.4	115.35	123.75	134.36	144.34	(68)
--------	-----	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.37	112.63	109.02	104.1	100.91	96.42	92.6	97.49	99.23	104.32	110.06	112.64	(72)
--------	--------	--------	--------	-------	--------	-------	------	-------	-------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	328.45	326.7	316.8	301.01	285.26	269.9	259.81	264.71	272.74	288.7	307	320.45	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	3.26	x	19.64	x	0.38	x	0.58	=	9.78	(80)
West	0.9x	0.77	x	6.53	x	19.64	x	0.5	x	0.58	=	25.77	(80)
West	0.9x	0.77	x	3.26	x	38.42	x	0.38	x	0.58	=	19.13	(80)
West	0.9x	0.77	x	6.53	x	38.42	x	0.5	x	0.58	=	50.42	(80)
West	0.9x	0.77	x	3.26	x	63.27	x	0.38	x	0.58	=	31.51	(80)
West	0.9x	0.77	x	6.53	x	63.27	x	0.5	x	0.58	=	83.04	(80)
West	0.9x	0.77	x	3.26	x	92.28	x	0.38	x	0.58	=	45.95	(80)
West	0.9x	0.77	x	6.53	x	92.28	x	0.5	x	0.58	=	121.1	(80)

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West	0.9x	0.77	x	3.26	x	113.09	x	0.38	x	0.58	=	56.31	(80)
West	0.9x	0.77	x	6.53	x	113.09	x	0.5	x	0.58	=	148.42	(80)
West	0.9x	0.77	x	3.26	x	115.77	x	0.38	x	0.58	=	57.64	(80)
West	0.9x	0.77	x	6.53	x	115.77	x	0.5	x	0.58	=	151.93	(80)
West	0.9x	0.77	x	3.26	x	110.22	x	0.38	x	0.58	=	54.88	(80)
West	0.9x	0.77	x	6.53	x	110.22	x	0.5	x	0.58	=	144.64	(80)
West	0.9x	0.77	x	3.26	x	94.68	x	0.38	x	0.58	=	47.14	(80)
West	0.9x	0.77	x	6.53	x	94.68	x	0.5	x	0.58	=	124.25	(80)
West	0.9x	0.77	x	3.26	x	73.59	x	0.38	x	0.58	=	36.64	(80)
West	0.9x	0.77	x	6.53	x	73.59	x	0.5	x	0.58	=	96.57	(80)
West	0.9x	0.77	x	3.26	x	45.59	x	0.38	x	0.58	=	22.7	(80)
West	0.9x	0.77	x	6.53	x	45.59	x	0.5	x	0.58	=	59.83	(80)
West	0.9x	0.77	x	3.26	x	24.49	x	0.38	x	0.58	=	12.19	(80)
West	0.9x	0.77	x	6.53	x	24.49	x	0.5	x	0.58	=	32.14	(80)
West	0.9x	0.77	x	3.26	x	16.15	x	0.38	x	0.58	=	8.04	(80)
West	0.9x	0.77	x	6.53	x	16.15	x	0.5	x	0.58	=	21.2	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	35.55	69.55	114.54	167.05	204.73	209.57	199.52	171.39	133.22	82.53	44.33	29.24	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364	396.25	431.34	468.06	489.99	479.48	459.34	436.1	405.95	371.23	351.33	349.68	(84)
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7. Mean internal temperature (heating season)

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

21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.93	0.83	0.65	0.47	0.32	0.23	0.26	0.42	0.69	0.91	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.83	20.9	20.97	21	21	21	21	21	21	21	20.94	20.82	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.52	20.52	20.52	20.53	20.53	20.55	20.55	20.55	20.54	20.53	20.53	20.53	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.92	0.81	0.62	0.45	0.3	0.21	0.23	0.39	0.66	0.89	0.97	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.3	20.4	20.49	20.53	20.53	20.55	20.55	20.55	20.54	20.53	20.46	20.29	(90)
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fLA = Living area ÷ (4) =

0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.55	20.63	20.71	20.75	20.75	20.76	20.76	20.76	20.75	20.75	20.68	20.54	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.55	20.63	20.71	20.75	20.75	20.76	20.76	20.76	20.75	20.75	20.68	20.54	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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Utilisation factor for gains, hm:

(94)m=	0.96	0.92	0.82	0.63	0.46	0.31	0.22	0.24	0.4	0.68	0.9	0.97	(94)
--------	------	------	------	------	------	------	------	------	-----	------	-----	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	350.15	365.22	353.14	296.07	225.73	149.78	101.12	105.47	163.52	251.68	316.22	338.91	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	421.38	406.08	365.06	296.99	225.77	149.78	101.12	105.47	163.52	253.12	342.11	415.63	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	53	27.46	8.87	0.66	0.03	0	0	0	0	1.07	18.64	57.08	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

166.8 (98)

Space heating requirement in kWh/m²/year

3.24 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.1 (306)

Space heating

kWh/year

Annual space heating requirement

166.8

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

183.48 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1836.47

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2020.12 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

22.04 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

90.23 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

90.23 (331)

DER WorkSheet: New dwelling design stage

Energy for lighting (calculated in Appendix L)

248.75 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		91 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 523.05 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 11.44 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 534.49 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		534.49 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 46.83 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 129.1 (379)
Total CO2, kg/year	sum of (376)...(382) =		710.42 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.81 (384)
El rating (section 14)			90.13 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Panagiotis Dalapas **Stroma Number:** STRO030082
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.16

Property Address: 6-02 (Be Clean)

Address : 9 Nestles Avenue, Hayes, UB3 4SA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.45 (1a) ×	2.5 (2a) =	128.63 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	128.63 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				0 × 10 =	0 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

78.2 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.26 0.25 0.25 0.24 0.23 0.22 0.22 0.22 0.23 0.23 0.24 0.25 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.26 0.25 0.25 0.24 0.23 0.22 0.22 0.22 0.23 0.23 0.24 0.25 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			3.26	x1/[1/(1.2)+ 0.04] =	3.73		(27)
Windows Type 2			6.53	x1/[1/(1.2)+ 0.04] =	7.48		(27)
Walls	21.09	9.79	11.3	x 0.16 =	1.81		(29)
Total area of elements, m²			21.09				(31)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 13.02 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 678 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	10.92	10.79	10.67	10.05	9.93	9.31	9.31	9.19	9.56	9.93	10.18	10.42

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 25.93 25.81 25.69 25.07 24.95 24.33 24.33 24.21 24.58 24.95 25.19 25.44

Average = Sum(39)_{1..12} /12= 25.04 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m= 0.5 0.5 0.5 0.49 0.48 0.47 0.47 0.47 0.48 0.48 0.49 0.49

Average = Sum(40)_{1..12} /12= 0.49 (40)

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Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	178.2	157.44	166.22	150.21	148.08	133.58	129.49	140.43	139.67	155.7	163.12	174.32	(62)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	178.2	157.44	166.22	150.21	148.08	133.58	129.49	140.43	139.67	155.7	163.12	174.32	
Output from water heater (annual) _{1...12}												1836.47	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	85.09	75.69	81.11	74.95	75.08	69.42	68.9	72.54	71.45	77.61	79.25	83.8	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	(66)

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

(67)m=	14.09	12.51	10.17	7.7	5.76	4.86	5.25	6.83	9.16	11.64	13.58	14.48	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	151	152.57	148.62	140.21	129.6	119.63	112.97	111.4	115.35	123.75	134.36	144.34	(68)
--------	-----	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.37	112.63	109.02	104.1	100.91	96.42	92.6	97.49	99.23	104.32	110.06	112.64	(72)
--------	--------	--------	--------	-------	--------	-------	------	-------	-------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	328.45	326.7	316.8	301.01	285.26	269.9	259.81	264.71	272.74	288.7	307	320.45	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	3.26	x	19.64	x	0.38	x	0.58	=	9.78	(80)
West	0.9x	0.77	x	6.53	x	19.64	x	0.5	x	0.58	=	25.77	(80)
West	0.9x	0.77	x	3.26	x	38.42	x	0.38	x	0.58	=	19.13	(80)
West	0.9x	0.77	x	6.53	x	38.42	x	0.5	x	0.58	=	50.42	(80)
West	0.9x	0.77	x	3.26	x	63.27	x	0.38	x	0.58	=	31.51	(80)
West	0.9x	0.77	x	6.53	x	63.27	x	0.5	x	0.58	=	83.04	(80)
West	0.9x	0.77	x	3.26	x	92.28	x	0.38	x	0.58	=	45.95	(80)
West	0.9x	0.77	x	6.53	x	92.28	x	0.5	x	0.58	=	121.1	(80)

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West	0.9x	0.77	x	3.26	x	113.09	x	0.38	x	0.58	=	56.31	(80)
West	0.9x	0.77	x	6.53	x	113.09	x	0.5	x	0.58	=	148.42	(80)
West	0.9x	0.77	x	3.26	x	115.77	x	0.38	x	0.58	=	57.64	(80)
West	0.9x	0.77	x	6.53	x	115.77	x	0.5	x	0.58	=	151.93	(80)
West	0.9x	0.77	x	3.26	x	110.22	x	0.38	x	0.58	=	54.88	(80)
West	0.9x	0.77	x	6.53	x	110.22	x	0.5	x	0.58	=	144.64	(80)
West	0.9x	0.77	x	3.26	x	94.68	x	0.38	x	0.58	=	47.14	(80)
West	0.9x	0.77	x	6.53	x	94.68	x	0.5	x	0.58	=	124.25	(80)
West	0.9x	0.77	x	3.26	x	73.59	x	0.38	x	0.58	=	36.64	(80)
West	0.9x	0.77	x	6.53	x	73.59	x	0.5	x	0.58	=	96.57	(80)
West	0.9x	0.77	x	3.26	x	45.59	x	0.38	x	0.58	=	22.7	(80)
West	0.9x	0.77	x	6.53	x	45.59	x	0.5	x	0.58	=	59.83	(80)
West	0.9x	0.77	x	3.26	x	24.49	x	0.38	x	0.58	=	12.19	(80)
West	0.9x	0.77	x	6.53	x	24.49	x	0.5	x	0.58	=	32.14	(80)
West	0.9x	0.77	x	3.26	x	16.15	x	0.38	x	0.58	=	8.04	(80)
West	0.9x	0.77	x	6.53	x	16.15	x	0.5	x	0.58	=	21.2	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	35.55	69.55	114.54	167.05	204.73	209.57	199.52	171.39	133.22	82.53	44.33	29.24	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364	396.25	431.34	468.06	489.99	479.48	459.34	436.1	405.95	371.23	351.33	349.68	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.93	0.83	0.65	0.47	0.32	0.23	0.26	0.42	0.69	0.91	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.83	20.9	20.97	21	21	21	21	21	21	21	20.94	20.82	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.52	20.52	20.52	20.53	20.53	20.55	20.55	20.55	20.54	20.53	20.53	20.53	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.92	0.81	0.62	0.45	0.3	0.21	0.23	0.39	0.66	0.89	0.97	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.3	20.4	20.49	20.53	20.53	20.55	20.55	20.55	20.54	20.53	20.46	20.29	(90)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.55	20.63	20.71	20.75	20.75	20.76	20.76	20.76	20.75	20.75	20.68	20.54	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.55	20.63	20.71	20.75	20.75	20.76	20.76	20.76	20.75	20.75	20.68	20.54	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.96	0.92	0.82	0.63	0.46	0.31	0.22	0.24	0.4	0.68	0.9	0.97	(94)
--------	------	------	------	------	------	------	------	------	-----	------	-----	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	350.15	365.22	353.14	296.07	225.73	149.78	101.12	105.47	163.52	251.68	316.22	338.91	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	421.38	406.08	365.06	296.99	225.77	149.78	101.12	105.47	163.52	253.12	342.11	415.63	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	53	27.46	8.87	0.66	0.03	0	0	0	0	1.07	18.64	57.08	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												166.8	(98)

Space heating requirement in kWh/m²/year

3.24	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
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Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP

0.82	(303a)
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Fraction of community heat from heat source 2

0.18	(303b)
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Fraction of total space heat from Community CHP (302) x (303a) =

0.82	(304a)
------	--------

Fraction of total space heat from community heat source 2 (302) x (303b) =

0.18	(304b)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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Distribution loss factor (Table 12c) for community heating system

1.1	(306)
-----	-------

Space heating

Annual space heating requirement

166.8	
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Space heat from Community CHP (98) x (304a) x (305) x (306) =

150.45	(307a)
--------	--------

Space heat from heat source 2 (98) x (304b) x (305) x (306) =

33.03	(307b)
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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)
---	-------

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) =

0	(309)
---	-------

Water heating

Annual water heating requirement

1836.47	
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If DHW from community scheme:

Water heat from Community CHP (64) x (303a) x (305) x (306) =

1656.49	(310a)
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Water heat from heat source 2 (64) x (303b) x (305) x (306) =

363.62	(310b)
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Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] =

22.04	(313)
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Cooling System Energy Efficiency Ratio

0	(314)
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Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) =

0	(315)
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Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

90.23	(330a)
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DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	90.23	(331)
Energy for lighting (calculated in Appendix L)		248.75	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		29.8	(361)
Heat efficiency of CHP unit		57.6	(362)
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating from CHP) $(307a) \times 100 \div (362) =$	261.2	x 0.22	56.42 (363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	77.84	x 0.52	-40.4 (364)
Water heated by CHP $(310a) \times 100 \div (362) =$	2875.86	x 0.22	621.19 (365)
less credit emissions for electricity $-(310a) \times (361) \div (362) =$	857.01	x 0.52	-444.79 (366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		95 (367b)
CO2 associated with heat source 2 $[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	=	90.18 (368)
Electrical energy for heat distribution $[(313) \times$	0.52	=	11.44 (372)
Total CO2 associated with community systems $(363)...(366) + (368)...(372)$		=	294.04 (373)
CO2 associated with space heating (secondary) $(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater $(312) \times$	0.22	=	0 (375)
Total CO2 associated with space and water heating $(373) + (374) + (375) =$			294.04 (376)
CO2 associated with electricity for pumps and fans within dwelling $(331)) \times$	0.52	=	46.83 (378)
CO2 associated with electricity for lighting $(332))) \times$	0.52	=	129.1 (379)
Total CO2, kg/year $\text{sum of (376)...(382) =}$			469.98 (383)
Dwelling CO2 Emission Rate $(383) \div (4) =$			9.13 (384)
EI rating (section 14)			93.47 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Panagiotis Dalapas **Stroma Number:** STRO030082
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.16

Property Address: 6-02 (Be Green)

Address : 9 Nestles Avenue, Hayes, UB3 4SA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.45	(1a) x	2.5	(2a) =	128.63 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.45	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			128.63 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	+	0 x 40 = 0 (6a)
Number of open flues	0	+	0	+	0 x 20 = 0 (6b)
Number of intermittent fans				0	x 10 = 0 (7a)
Number of passive vents				0	x 10 = 0 (7b)
Number of flueless gas fires				0	x 40 = 0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = ÷ (5) = (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

78.2 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.26 0.25 0.25 0.24 0.23 0.22 0.22 0.22 0.23 0.23 0.24 0.25 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.26 0.25 0.25 0.24 0.23 0.22 0.22 0.22 0.23 0.23 0.24 0.25 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			3.26	x1/[1/(1.2)+ 0.04] =	3.73		(27)
Windows Type 2			6.53	x1/[1/(1.2)+ 0.04] =	7.48		(27)
Walls	21.09	9.79	11.3	x 0.16 =	1.81		(29)
Total area of elements, m²			21.09				(31)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 13.02 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 678 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	10.92	10.79	10.67	10.05	9.93	9.31	9.31	9.19	9.56	9.93	10.18	10.42

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 25.93 25.81 25.69 25.07 24.95 24.33 24.33 24.21 24.58 24.95 25.19 25.44
Average = Sum(39)_{1..12} /12= 25.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m= 0.5 0.5 0.5 0.49 0.48 0.47 0.47 0.47 0.48 0.48 0.49 0.49
Average = Sum(40)_{1..12} /12= 0.49 (40)

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Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	178.2	157.44	166.22	150.21	148.08	133.58	129.49	140.43	139.67	155.7	163.12	174.32	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	178.2	157.44	166.22	150.21	148.08	133.58	129.49	140.43	139.67	155.7	163.12	174.32	
Output from water heater (annual) _{1...12}												1836.47	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	85.09	75.69	81.11	74.95	75.08	69.42	68.9	72.54	71.45	77.61	79.25	83.8	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	(66)

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

(67)m=	14.09	12.51	10.17	7.7	5.76	4.86	5.25	6.83	9.16	11.64	13.58	14.48	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	151	152.57	148.62	140.21	129.6	119.63	112.97	111.4	115.35	123.75	134.36	144.34	(68)
--------	-----	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.37	112.63	109.02	104.1	100.91	96.42	92.6	97.49	99.23	104.32	110.06	112.64	(72)
--------	--------	--------	--------	-------	--------	-------	------	-------	-------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	328.45	326.7	316.8	301.01	285.26	269.9	259.81	264.71	272.74	288.7	307	320.45	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	3.26	x	19.64	x	0.38	x	0.58	=	9.78	(80)
West	0.9x	0.77	x	6.53	x	19.64	x	0.5	x	0.58	=	25.77	(80)
West	0.9x	0.77	x	3.26	x	38.42	x	0.38	x	0.58	=	19.13	(80)
West	0.9x	0.77	x	6.53	x	38.42	x	0.5	x	0.58	=	50.42	(80)
West	0.9x	0.77	x	3.26	x	63.27	x	0.38	x	0.58	=	31.51	(80)
West	0.9x	0.77	x	6.53	x	63.27	x	0.5	x	0.58	=	83.04	(80)
West	0.9x	0.77	x	3.26	x	92.28	x	0.38	x	0.58	=	45.95	(80)
West	0.9x	0.77	x	6.53	x	92.28	x	0.5	x	0.58	=	121.1	(80)

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West	0.9x	0.77	x	3.26	x	113.09	x	0.38	x	0.58	=	56.31	(80)
West	0.9x	0.77	x	6.53	x	113.09	x	0.5	x	0.58	=	148.42	(80)
West	0.9x	0.77	x	3.26	x	115.77	x	0.38	x	0.58	=	57.64	(80)
West	0.9x	0.77	x	6.53	x	115.77	x	0.5	x	0.58	=	151.93	(80)
West	0.9x	0.77	x	3.26	x	110.22	x	0.38	x	0.58	=	54.88	(80)
West	0.9x	0.77	x	6.53	x	110.22	x	0.5	x	0.58	=	144.64	(80)
West	0.9x	0.77	x	3.26	x	94.68	x	0.38	x	0.58	=	47.14	(80)
West	0.9x	0.77	x	6.53	x	94.68	x	0.5	x	0.58	=	124.25	(80)
West	0.9x	0.77	x	3.26	x	73.59	x	0.38	x	0.58	=	36.64	(80)
West	0.9x	0.77	x	6.53	x	73.59	x	0.5	x	0.58	=	96.57	(80)
West	0.9x	0.77	x	3.26	x	45.59	x	0.38	x	0.58	=	22.7	(80)
West	0.9x	0.77	x	6.53	x	45.59	x	0.5	x	0.58	=	59.83	(80)
West	0.9x	0.77	x	3.26	x	24.49	x	0.38	x	0.58	=	12.19	(80)
West	0.9x	0.77	x	6.53	x	24.49	x	0.5	x	0.58	=	32.14	(80)
West	0.9x	0.77	x	3.26	x	16.15	x	0.38	x	0.58	=	8.04	(80)
West	0.9x	0.77	x	6.53	x	16.15	x	0.5	x	0.58	=	21.2	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	35.55	69.55	114.54	167.05	204.73	209.57	199.52	171.39	133.22	82.53	44.33	29.24	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364	396.25	431.34	468.06	489.99	479.48	459.34	436.1	405.95	371.23	351.33	349.68	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.93	0.83	0.65	0.47	0.32	0.23	0.26	0.42	0.69	0.91	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.83	20.9	20.97	21	21	21	21	21	21	21	20.94	20.82	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.52	20.52	20.52	20.53	20.53	20.55	20.55	20.55	20.54	20.53	20.53	20.53	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.92	0.81	0.62	0.45	0.3	0.21	0.23	0.39	0.66	0.89	0.97	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.3	20.4	20.49	20.53	20.53	20.55	20.55	20.55	20.54	20.53	20.46	20.29	(90)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.55	20.63	20.71	20.75	20.75	20.76	20.76	20.76	20.75	20.75	20.68	20.54	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.55	20.63	20.71	20.75	20.75	20.76	20.76	20.76	20.75	20.75	20.68	20.54	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.96	0.92	0.82	0.63	0.46	0.31	0.22	0.24	0.4	0.68	0.9	0.97	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	350.15	365.22	353.14	296.07	225.73	149.78	101.12	105.47	163.52	251.68	316.22	338.91	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	421.38	406.08	365.06	296.99	225.77	149.78	101.12	105.47	163.52	253.12	342.11	415.63	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	53	27.46	8.87	0.66	0.03	0	0	0	0	1.07	18.64	57.08	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 166.8 (98)

Space heating requirement in kWh/m²/year

3.24 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP 0.82 (303a)

Fraction of community heat from heat source 2 0.18 (303b)

Fraction of total space heat from Community CHP (302) x (303a) = 0.82 (304a)

Fraction of total space heat from community heat source 2 (302) x (303b) = 0.18 (304b)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.1 (306)

Space heating

Annual space heating requirement kWh/year 166.8

Space heat from Community CHP (98) x (304a) x (305) x (306) = 150.45 (307a)

Space heat from heat source 2 (98) x (304b) x (305) x (306) = 33.03 (307b)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1836.47

If DHW from community scheme:

Water heat from Community CHP (64) x (303a) x (305) x (306) = 1656.49 (310a)

Water heat from heat source 2 (64) x (303b) x (305) x (306) = 363.62 (310b)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] = 22.04 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 90.23 (330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	90.23	(331)
Energy for lighting (calculated in Appendix L)		248.75	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-94.69	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		29.8	(361)
Heat efficiency of CHP unit		57.6	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP	$(307a) \times 100 \div (362) =$	261.2	x	0.22		56.42	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	77.84	x	0.52		-40.4	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2875.86	x	0.22		621.19	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	857.01	x	0.52		-444.79	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					95	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	=	90.18	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	11.44	(372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				=	294.04	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					294.04	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$			0.52	=	46.83	(378)
CO2 associated with electricity for lighting	$(332))) \times$			0.52	=	129.1	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1				0.52	x 0.01 =	-49.14	(380)
Total CO2, kg/year	sum of (376) ... (382) =					420.83	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$					8.18	(384)
EI rating (section 14)						94.15	(385)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.16

Property Address: 6-02 (Be Lean)

Address : 9 Nestles Avenue, Hayes, UB3 4SA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.45 (1a) ×	2.5 (2a) =	128.63 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	128.63 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				2 × 10 =	20 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.16 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]×0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.41 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 × (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) × (20) = 0.31 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			3.26	x1/[1/(1.4)+0.04] =	4.32		
Windows Type 2			6.53	x1/[1/(1.4)+0.04] =	8.66		
Walls	21.09	9.79	11.3	x 0.18 =	2.03		
Total area of elements, m²			21.09				

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 15.01 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 678 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 17.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	24.63	24.5	24.37	23.76	23.65	23.11	23.11	23.02	23.32	23.65	23.88	24.12

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 41.64 41.51 41.38 40.77 40.66 40.12 40.12 40.03 40.33 40.66 40.89 41.13

Average = Sum(39)_{1...12} /12= 40.77 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m= 0.81 0.81 0.8 0.79 0.79 0.78 0.78 0.78 0.78 0.79 0.79 0.8

Average = Sum(40)_{1...12} /12= 0.79 (40)

Number of days in month (Table 1a)

(41)m=

kWh/year:

1.73

(42)

75 36

(43)

Hot water usage in litres per day for each month $Vd.m = \text{factor from Table 1c} \times (43)$

(44)m=

Total = Sum(44)_{1 12} =

904 26

(44)

(45)m=

$$\text{Total} = \text{Sum}(45)_{1 \dots 12} =$$

1185.63

(45)

(46)m=

150

(47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

0

(48)

0

(49)

0

(50)

1

0

(51)

0

(52)

0

(53)

0

(54)

0

(55)

$$((56)_m = (55) \times (41)_m$$

(56)m=

(56)

(57)m=

0

(58)

(59)m=

(59)

(61)m=

(61)

TFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	104.49	91.38	94.3	82.21	78.89	68.07	63.08	72.38	73.25	85.36	93.18	101.19	(62)
--------	--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	104.49	91.38	94.3	82.21	78.89	68.07	63.08	72.38	73.25	85.36	93.18	101.19	
Output from water heater (annual) _{1...12}												1007.78	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.12	22.85	23.57	20.55	19.72	17.02	15.77	18.1	18.31	21.34	23.3	25.3	(65)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	(66)

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

(67)m=	13.64	12.11	9.85	7.46	5.57	4.71	5.09	6.61	8.87	11.27	13.15	14.02	(67)
--------	-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

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

(68)m=	151	152.57	148.62	140.21	129.6	119.63	112.97	111.4	115.35	123.75	134.36	144.34	(68)
--------	-----	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.11	34	31.69	28.55	26.51	23.64	21.2	24.32	25.43	28.68	32.35	34	(72)
--------	-------	----	-------	-------	-------	-------	------	-------	-------	-------	-------	----	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	248.74	247.67	239.15	225.21	210.67	196.96	188.24	191.32	198.64	212.69	228.86	241.35	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	3.26	x	19.64	x	0.63	x	0.7	=	19.57	(80)
West	0.9x	0.77	x	6.53	x	19.64	x	0.63	x	0.7	=	39.2	(80)
West	0.9x	0.77	x	3.26	x	38.42	x	0.63	x	0.7	=	38.28	(80)
West	0.9x	0.77	x	6.53	x	38.42	x	0.63	x	0.7	=	76.67	(80)
West	0.9x	0.77	x	3.26	x	63.27	x	0.63	x	0.7	=	63.04	(80)
West	0.9x	0.77	x	6.53	x	63.27	x	0.63	x	0.7	=	126.27	(80)
West	0.9x	0.77	x	3.26	x	92.28	x	0.63	x	0.7	=	91.94	(80)
West	0.9x	0.77	x	6.53	x	92.28	x	0.63	x	0.7	=	184.16	(80)

TFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.26	x	113.09	x	0.63	x	0.7	=	112.67	(80)
West	0.9x	0.77	x	6.53	x	113.09	x	0.63	x	0.7	=	225.69	(80)
West	0.9x	0.77	x	3.26	x	115.77	x	0.63	x	0.7	=	115.34	(80)
West	0.9x	0.77	x	6.53	x	115.77	x	0.63	x	0.7	=	231.04	(80)
West	0.9x	0.77	x	3.26	x	110.22	x	0.63	x	0.7	=	109.81	(80)
West	0.9x	0.77	x	6.53	x	110.22	x	0.63	x	0.7	=	219.96	(80)
West	0.9x	0.77	x	3.26	x	94.68	x	0.63	x	0.7	=	94.33	(80)
West	0.9x	0.77	x	6.53	x	94.68	x	0.63	x	0.7	=	188.94	(80)
West	0.9x	0.77	x	3.26	x	73.59	x	0.63	x	0.7	=	73.32	(80)
West	0.9x	0.77	x	6.53	x	73.59	x	0.63	x	0.7	=	146.86	(80)
West	0.9x	0.77	x	3.26	x	45.59	x	0.63	x	0.7	=	45.42	(80)
West	0.9x	0.77	x	6.53	x	45.59	x	0.63	x	0.7	=	90.98	(80)
West	0.9x	0.77	x	3.26	x	24.49	x	0.63	x	0.7	=	24.4	(80)
West	0.9x	0.77	x	6.53	x	24.49	x	0.63	x	0.7	=	48.87	(80)
West	0.9x	0.77	x	3.26	x	16.15	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	6.53	x	16.15	x	0.63	x	0.7	=	32.23	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	58.76	114.95	189.31	276.1	338.37	346.38	329.77	283.27	220.18	136.4	73.27	48.32	(83)
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	307.5	362.62	428.46	501.31	549.04	543.34	518.01	474.59	418.82	349.1	302.13	289.67	(84)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.67	0.47	0.34	0.39	0.65	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.24	20.4	20.64	20.88	20.98	21	21	21	20.99	20.81	20.48	20.22	(87)
--------	-------	------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.26	20.26	20.27	20.27	20.27	20.27	20.26	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.62	0.42	0.28	0.33	0.59	0.92	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.55	19.71	19.94	20.17	20.25	20.27	20.27	20.27	20.26	20.12	19.79	19.53	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.03	20.27	20.5	20.59	20.61	20.61	20.61	20.6	20.44	20.11	19.85	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.03	20.27	20.5	20.59	20.61	20.61	20.61	20.6	20.44	20.11	19.85	(93)
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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TFEE WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.85	0.64	0.44	0.31	0.35	0.62	0.92	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	306.42	358.78	411.04	424	354.1	240.58	160.81	168.41	258.14	322.55	299.35	288.97	(95)
--------	--------	--------	--------	-----	-------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	648.39	627.91	569.58	473.03	361.39	241.06	160.84	168.49	262.08	400.14	531.91	643.56	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.43	180.86	117.95	35.3	5.42	0	0	0	0	57.73	167.44	263.82	
--------	--------	--------	--------	------	------	---	---	---	---	-------	--------	--------	--

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1082.96 (98)

Space heating requirement in kWh/m²/year

21.05 (99)

8c. Space cooling requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	377.17	296.92	304.2	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	1	1	0	0	0	0	(101)
---------	---	---	---	---	---	------	---	---	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	374.78	296.34	303.1	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	700.6	669.74	619.99	0	0	0	0	(103)
---------	---	---	---	---	---	-------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m

set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	234.59	277.81	235.77	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 748.17 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	58.65	69.45	58.94	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 187.04 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 3.64 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 24.68 (109)

Target Fabric Energy Efficiency (TFEE) 28.39 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.16

Property Address: 6-02 (Be Lean)

Address : 9 Nestles Avenue, Hayes, UB3 4SA

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.45 (1a) ×	2.5 (2a) =	128.63 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	128.63 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				2 × 10 =	20 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.16 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]×0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 3 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.31 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 × (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) × (20) = 0.24 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.3	0.3	0.29	0.26	0.25	0.22	0.22	0.22	0.24	0.25	0.27	0.28
-----	-----	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.52 0.53 0.53 0.54 0.54 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.52 0.53 0.53 0.54 0.54 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			3.26	x1/[1/(1.2)+0.04] =	3.73		(27)
Windows Type 2			6.53	x1/[1/(1.2)+0.04] =	7.48		(27)
Walls	21.09	9.79	11.3	x 0.16 =	1.81		(29)
Total area of elements, m²			21.09				(31)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 13.02 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 678 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	23.16	23.08	23.01	22.66	22.6	22.3	22.3	22.24	22.41	22.6	22.73	22.87

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 38.17 38.1 38.02 37.68 37.61 37.31 37.31 37.26 37.43 37.61 37.74 37.88

Average = Sum(39)_{1..12} /12= 37.68 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m= 0.74 0.74 0.74 0.73 0.73 0.73 0.73 0.72 0.73 0.73 0.73 0.74

Average = Sum(40)_{1..12} /12= 0.73 (40)

DFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	104.49	91.38	94.3	82.21	78.89	68.07	63.08	72.38	73.25	85.36	93.18	101.19	(62)
--------	--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	104.49	91.38	94.3	82.21	78.89	68.07	63.08	72.38	73.25	85.36	93.18	101.19	
Output from water heater (annual) _{1...12}												1007.78	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.12	22.85	23.57	20.55	19.72	17.02	15.77	18.1	18.31	21.34	23.3	25.3	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	86.64	(66)

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

(67)m=	14.09	12.51	10.17	7.7	5.76	4.86	5.25	6.83	9.16	11.64	13.58	14.48	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	151	152.57	148.62	140.21	129.6	119.63	112.97	111.4	115.35	123.75	134.36	144.34	(68)
--------	-----	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	-69.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.11	34	31.69	28.55	26.51	23.64	21.2	24.32	25.43	28.68	32.35	34	(72)
--------	-------	----	-------	-------	-------	-------	------	-------	-------	-------	-------	----	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	249.19	248.07	239.47	225.45	210.86	197.12	188.41	191.54	198.94	213.06	229.29	241.81	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	3.26	x	19.64	x	0.38	x	0.58	=	9.78	(80)
West	0.9x	0.77	x	6.53	x	19.64	x	0.5	x	0.58	=	25.77	(80)
West	0.9x	0.77	x	3.26	x	38.42	x	0.38	x	0.58	=	19.13	(80)
West	0.9x	0.77	x	6.53	x	38.42	x	0.5	x	0.58	=	50.42	(80)
West	0.9x	0.77	x	3.26	x	63.27	x	0.38	x	0.58	=	31.51	(80)
West	0.9x	0.77	x	6.53	x	63.27	x	0.5	x	0.58	=	83.04	(80)
West	0.9x	0.77	x	3.26	x	92.28	x	0.38	x	0.58	=	45.95	(80)
West	0.9x	0.77	x	6.53	x	92.28	x	0.5	x	0.58	=	121.1	(80)

DFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.26	x	113.09	x	0.38	x	0.58	=	56.31	(80)
West	0.9x	0.77	x	6.53	x	113.09	x	0.5	x	0.58	=	148.42	(80)
West	0.9x	0.77	x	3.26	x	115.77	x	0.38	x	0.58	=	57.64	(80)
West	0.9x	0.77	x	6.53	x	115.77	x	0.5	x	0.58	=	151.93	(80)
West	0.9x	0.77	x	3.26	x	110.22	x	0.38	x	0.58	=	54.88	(80)
West	0.9x	0.77	x	6.53	x	110.22	x	0.5	x	0.58	=	144.64	(80)
West	0.9x	0.77	x	3.26	x	94.68	x	0.38	x	0.58	=	47.14	(80)
West	0.9x	0.77	x	6.53	x	94.68	x	0.5	x	0.58	=	124.25	(80)
West	0.9x	0.77	x	3.26	x	73.59	x	0.38	x	0.58	=	36.64	(80)
West	0.9x	0.77	x	6.53	x	73.59	x	0.5	x	0.58	=	96.57	(80)
West	0.9x	0.77	x	3.26	x	45.59	x	0.38	x	0.58	=	22.7	(80)
West	0.9x	0.77	x	6.53	x	45.59	x	0.5	x	0.58	=	59.83	(80)
West	0.9x	0.77	x	3.26	x	24.49	x	0.38	x	0.58	=	12.19	(80)
West	0.9x	0.77	x	6.53	x	24.49	x	0.5	x	0.58	=	32.14	(80)
West	0.9x	0.77	x	3.26	x	16.15	x	0.38	x	0.58	=	8.04	(80)
West	0.9x	0.77	x	6.53	x	16.15	x	0.5	x	0.58	=	21.2	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	35.55	69.55	114.54	167.05	204.73	209.57	199.52	171.39	133.22	82.53	44.33	29.24	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	284.74	317.62	354.01	392.5	415.58	406.69	387.93	362.93	332.15	295.59	273.62	271.05	(84)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.93	0.79	0.58	0.42	0.47	0.75	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.41	20.6	20.82	20.96	21	21	21	20.98	20.79	20.5	20.28	(87)
--------	------	-------	------	-------	-------	----	----	----	-------	-------	------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.31	20.31	20.31	20.31	20.32	20.32	20.32	20.32	20.31	20.31	20.31	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.52	0.36	0.4	0.68	0.95	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.66	19.77	19.96	20.17	20.29	20.32	20.32	20.32	20.31	20.15	19.86	19.64	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.96	20.07	20.25	20.47	20.6	20.63	20.63	20.63	20.62	20.45	20.16	19.93	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.96	20.07	20.25	20.47	20.6	20.63	20.63	20.63	20.62	20.45	20.16	19.93	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

DFEE WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.77	0.55	0.39	0.43	0.71	0.95	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	284.04	315.74	347.02	361.42	318.76	223.77	150.44	157.57	236.74	282.11	271.96	270.57	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	597.69	577.88	522.99	436.11	334.71	225.05	150.52	157.76	243.96	370.31	492.91	596.04	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	233.35	176.16	130.92	53.77	11.87	0	0	0	0	65.63	159.08	242.15	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1072.94

Space heating requirement in kWh/m²/year

20.85 (99)

8c. Space cooling requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	350.73	276.11	283.14	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	1	0.99	0	0	0	0	(101)
---------	---	---	---	---	---	------	---	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	345.57	274.86	281.04	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	541.08	517.93	489.77	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m

set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	140.77	180.84	155.29	0	0	0	0	(104)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Total = Sum(104) = 476.9 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	(106)
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Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	35.19	45.21	38.82	0	0	0	0	(107)
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Total = Sum(107) = 119.22 (107)

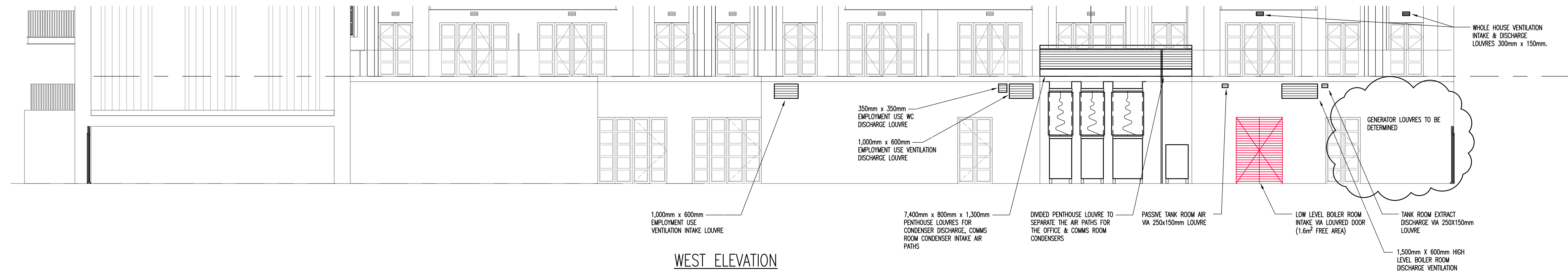
Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 2.32 (108)

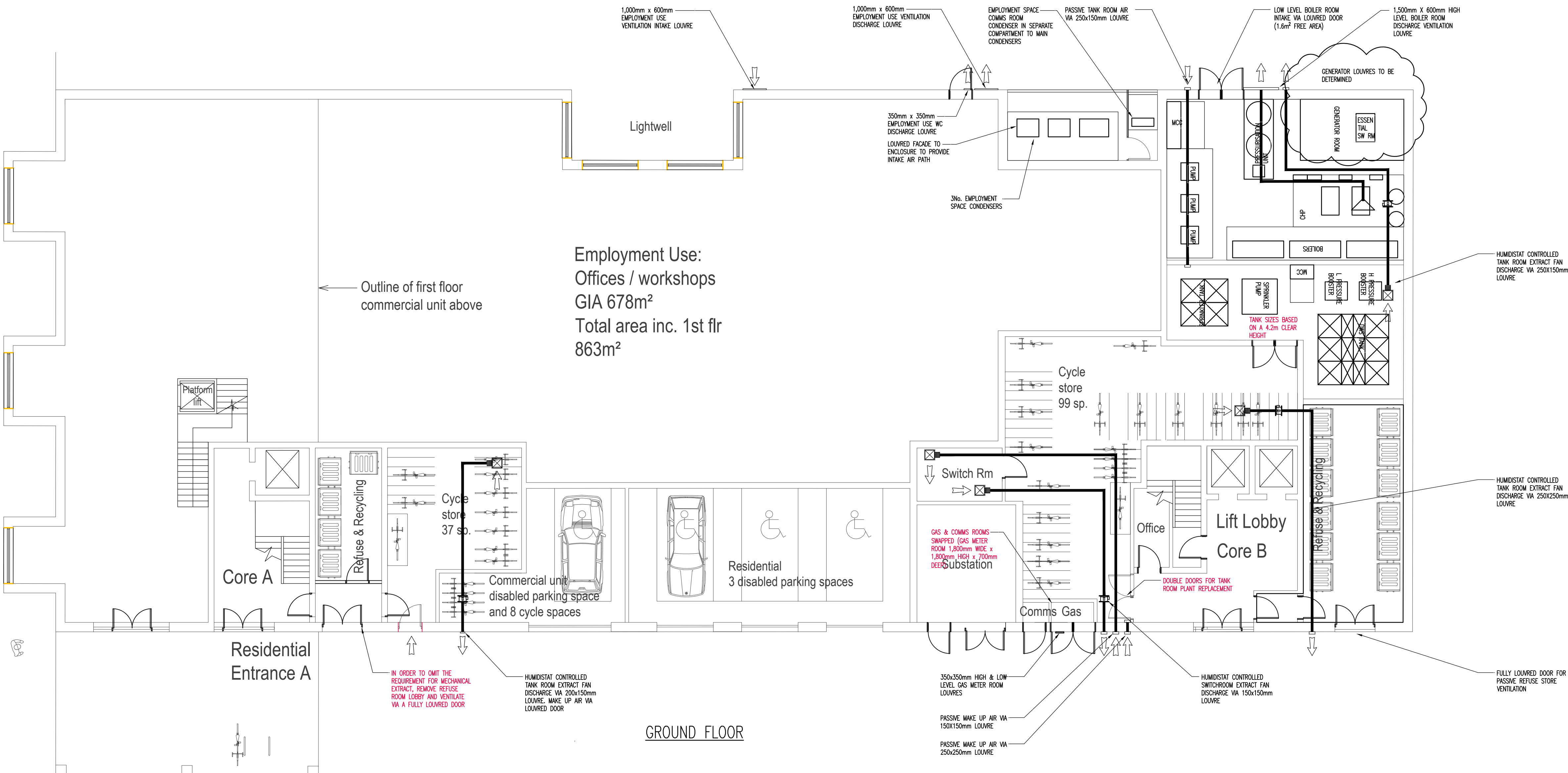
8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 23.17 (109)

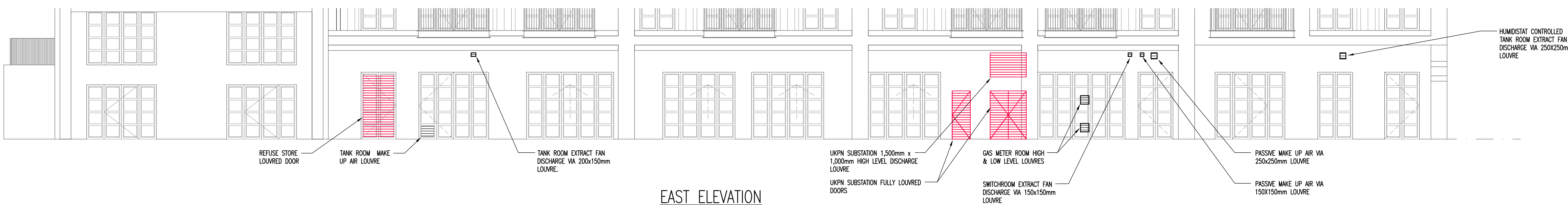
APPENDIX E ENERGY CENTRE



WEST ELEVATION



GROUND FLOOR



EAST ELEVATION

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPE OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

SIGNIFICANT RESIDUAL RISKS

THESE STATEMENTS RESULT FROM THE DESIGN RISK ASSESSMENTS CARRIED OUT BY THE DESIGNER. THE SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION IS INTENDED TO BE CONSISTENT WITH, BUT NOT REPLACE, THE HEALTH AND SAFETY INFORMATION ISSUED AS PART OF THE DOCUMENTATION PREPARED BY THE COM-C. RISKS SHOWN ARE SIGNIFICANT RISKS ONLY I.E. THOSE WHICH AN EXPERIENCED CONTRACTOR MAY NOT REASONABLY ANTICIPATE.

CONSTRUCTION

SPECIFICS E.G.

CONTRACTOR TO ENSURE ALL OPERATIVES ARE TRAINED AND COMPETENT FOR WORKING AT HEIGHT.

CONTRACTOR TO ENSURE THAT LIFTING EQUIPMENT IS OPERATED BY QUALIFIED PERSONNEL AND IS SUITABLE FOR USE IN SITE CONDITIONS.

MAINTENANCE

SPECIFICS E.G.

P1	28/11/18	FOR COMMENT	
Revision	Date	Description	
Drawing Status: PRELIMINARY			
Architect			
BRIMELOW MCSWEENEY			
Client			
MEADOW PARTNERS			
MCSERVE 83 Blackfriars Road London SE1 8HA 020 3141 5800 www.mcservice.com			
Project Title			
9 NESTLES AVENUE HAYES UB3 4SA			
Drawing Title			
GROUND FLOOR VENTILATION PROVISION			
Date	Scale	Drawn	Checked
28/11/18	1:100@A1	AJM	
Drawing No:		Revision	
P18-117/SK/3101 P1		P1	