Yonder
Engineering a better environment

Energy and Sustainability Statement

South Caldecotte

1943 Rev A

5 July 2019

Engineering a better environment

Revision Record

Revision	Revision Notes / Comments	Date	Prepared By	Checked By	Approved By
DRAFT	Draft revision for comment	05th April 2019	JG	CM	NBE
A	Aligned to planning application	4th July 2019	JG	CM	NBE

Disclaimer

This report has been prepared by Yonder Limited, with all reasonable skill, care and diligence within the terms of the contract with the client, and in line with our general terms and conditions of business.

We disclaim any responsibility to the client and others of any matters outside the scope above.

Whilst the simulations have been undertaken in good faith using reasonable skill and care, Yonder Limited can take no responsibility for differences between the computer simulations and the actual performance of the completed building due to the inherent complexity and variability of the physics in a building and its environment.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or part thereof, is made known. Any such party relies on the report at its own risk.

Executive Summary

This energy and sustainability statement has been prepared in relation to the South Caldecotte masterplan development, consisting of six large distribution centre type warehouse, three medium sized warehouses and a small office block, a total of 10 units.

This report details the design intent of the scheme to demonstrate compliance with Plan:MK policies SC1, SC2, and SC3 in the adopted plan to ensure sustainable development in the Milton Keynes area. The proposed scheme included several design features to improve energy efficiency and promote climate change robustness. The key features are warehouse and office fabrics with improved thermal efficiency and highly efficient servicing strategies across the site.

Due to the speculative nature of the masterplan exact calculations are not possible; as a modelling strategy four proposed units have been extensively modelled for this statement, with scaling operations used to predict the remaining units and sitewide energy and emissions performance characteristics.

The key results of this strategy are shown in the table below, summarising the potential reductions in regulated emissions as a result of the improvements detailed in this report. The residual emissions column is consistent with MKC SPD Sustainable Construction Guide, April 2007, and include an estimate of unregulated power.

If the site is built in a manner consistent with the assumptions detailed in this report an overall reduction in regulated emissions of 49% is expected, with a sitewide carbon offset contribution in the region of £1.05 million, equivalent to £4.83/m^2 across the site.

	GIA	Improvement over TER			Residual Emissions	Carbon offset contribution	
Unit	m^2	Lean/Clean	Green	Green/Lean	tonnes	£	£/m^2
Unit 1	47811	35.0%	48.4%	20.7%	1330	265,940	5.56
Unit 2	57173	34.4%	48.0%	20.8%	1599	319,838	5.59
Unit 3	34347	35.7%	49.0%	20.7%	942	188,423	5.49
Unit 4	23616	37.2%	50.1%	20.5%	633	126,641	5.36
Unit 5	5704	25.5%	41.4%	21.3%	107	21,339	3.74
Unit 6	967	21.0%	37.1%	20.5%	23	4,573	4.73
Unit 7	5358	25.8%	41.4%	21.1%	100	20,042	3.74
Unit 8	4627	25.5%	41.4%	21.3%	87	17,308	3.74
Unit 9	15383	40.5%	52.5%	20.2%	423	84,641	5.50
Unit 10	25873	36.8%	49.8%	20.6%	698	139,639	5.40
Site	220858	35.3%	48.7%	20.7%	5942	1,066,394	4.83

Contents

Introduction

This energy and sustainability statement has been prepared in relation to the proposed South Caldecotte masterplan development, this development proposes ten units across a large site, consisting of six large distribution centre warehouses, three medium size warehouses and a small office unit.

This report seeks to demonstrate the development will be able to comply with both local and national energy and sustainability policy.

Policy context

The local policy, Plan:MK 2016 – 2031 was adopted by Milton Keynes Council in March 2019, Plan:MK intentionally intends to pre-empt national policy to generate significant reductions in carbon emissions in Milton Keynes.

The key sustainable development requirements under Plan:MK are set out in section 17. Sustainable Construction and Renewable Energy of the plan, and detailed in Policies SC1, SC2, and SC3 of the plan.

Policy SC1 Sustainable construction

A. Development proposals will be required to demonstrate how they have implemented the principles and requirements set out below. With the exception of requirements K.2/3/5, non-residential development of 1000 sq.m or more that is demonstrated to achieve a BREEAM Outstanding rating will not be required to meet the requirements below.

Materials and waste

B. Reuse land and buildings wherever feasible and consistent with maintaining and enhancing local character and distinctiveness.
C. Reuse and recycle materials that arise through demolition and refurbishment, including the reuse of excavated soil and hardcore within the site.
D. Prioritise the use of materials and construction techniques that have smaller ecological and carbon footprints, help to sustain or create good air quality, and improve resilience to a changing climate where appropriate.
E. Incorporate green roofs and/or walls into the structure of buildings where technically feasible to improve water management in the built environment, provide space for biodiversity and aid resilience and adaptation to climate change.
F. Consider the lifecycle of the building and public spaces, including how they can be easily adapted and modified to meet changing social and economic needs and how materials can be recycled at the end of their lifetime.

G. Space is provided and appropriately designed to foster greater levels of recycling of domestic and commercial waste.

Energy and Climate

H. Implement the Energy Hierarchy within the design of new buildings by prioritising fabric first, passive design and landscaping measures to minimise energy demand for heating, lighting and cooling.
I. Review the opportunities to provide energy storage and demand management so as to tie in with local and national energy security priorities.
J. The design of buildings and the wider built environment is resilient to the ongoing and predicted impacts of climate change.
K. Development proposals for 11 or more dwellings and non-residential development with a floor space of 1000 sq.m or more will be required to submit an Energy and Climate Statement that demonstrates how the proposal will achieve the applicable requirements below:
    1. Achieve a 19% carbon reduction improvement upon the requirements within Building Regulations Approved Document Part L 2013, or achieve any higher standard than this that is required under new national planning policy or Building Regulations.
    2. Provide on-site renewable energy generation, or connection to a renewable or low carbon community energy scheme, that contributes to a further 20% reduction in the residual carbon emissions subsequent to a) above.
    3. Make financial contributions to the Council's carbon offset fund to enable the residual carbon emissions subsequent to the a) and b) above to be offset by other local initiatives.
    4. Calculate Indoor Air Quality and Overheating Risk performance for proposed new dwellings.
    5. Implement a recognised quality regime that ensures the 'as built' performance (energy use, carbon emissions, indoor air quality, and overheating risk) matches the calculated design performance of dwellings in d) above.
    6. Put in place a recognised monitoring regime to allow the assessment of energy use, indoor air quality, and overheating risk for 10% of the proposed dwellings for the first five years of their occupancy, and ensure that the information recovered is provided to the applicable occupiers and the planning authority.

Water

L. All newly constructed dwellings will be required to achieve an estimated water consumption of no more than 110 litres/person/day.
M. Water reuse and recycling and rainwater harvesting should also be incorporated wherever feasible to reduce demand on mains water supply, subject to viability. Proposals will be expected to maximise the use of the above measures subject to the outcome of the viability assessment.

Retrofitting

N. Proposals which would result in considerable improvements to the energy efficiency, carbon emissions and/or general suitability, condition and longevity of existing buildings will be supported, with significant weight attributed to those benefits.

Policy SC1 requires a comprehensive energy, sustainability, climate review for large developments. This report is intended to address this policy in full and represent the Energy and Climate Statement required under section

K of the policy. It is noted that policy statements K4, K5, K6, and L apply to new dwellings only and are not further considered here. Additionally policy statement N applies to retrofitted buildings and is also not applicable to this development.

As this document demonstrates, the proposed development is fully compliant with Policy SC1, providing carbon emission reductions in excess of the requirements of statement K1 and making considered, economical, and environmentally optimal design decisions in the provision of on-site renewables, fabric selection, and servicing strategy to ensure the development is both low carbon and robust to climate change.

Policy SC2 Community energy networks and large scale renewable energy schemes

A. Low carbon and renewable energy schemes will be attributed significant weight in their favour, and will be supported where it can be demonstrated that there will not be any significant negative social, economic, or environmental impacts associated with them.
B. Proposals for over 100 homes and non-residential developments of over 1,000 sq.m. will be expected to consider the integration of community energy networks in the development. This consideration should form part of development proposals and take into account the site's characteristics and the existing cooling, heat and power demands on adjacent sites.
C. All new developments in proximity of an existing or proposed combined heat and power (CHP), combined cooling, heat and power (CCHP) station or local energy network will be expected to connect to the network unless it can be demonstrated that:
    1. a better alternative for reducing carbon emissions from the development can be achieved; or
    2. heating and/or cooling loads of the scheme do not justify a CHP connection; or
    3. the cost of achieving this would make the proposed development unviable

Policy SC2 requires new developments to consider community heat schemes in their development where they are environmentally and economically appropriate. This report confirms that the proposed development complies with this policy.

Policy SC 3 Low carbon and renewable energy generation

A. The Council will encourage proposals for low carbon and renewable energy generation developments that are led by, or meet the needs of local communities.
B. Planning permission will be granted for proposals to develop low carbon and renewable energy sources (including community energy networks) unless there would be:
    1. 1. Significant harm to the amenity of residential area, due to noise, traffic, pollution or odour;
    2. Significant harm to wildlife species or habitat;
    3. Unacceptable landscape and visual impact on the landscape, including cumulative impacts;
    4. Unacceptable harm to the significance of heritage assets; and

5. Unacceptable impact on air safety.

C. In addition to the above criteria, wind turbines should avoid unacceptable shadow flicker and electro-magnetic interference and be sited an appropriate distance away from occupied properties, consistent with the size and type of the turbine. Proposals to develop solar PV farms should avoid unacceptable visual impact from the effect of glint and glare on the landscape, on neighbouring uses and aircraft safety. Proposals for large scale renewable energy in the open countryside should be informed by a satisfactory landscape and visual impact assessment.
D. In the case of energy generation through wind power, permission will only be granted for proposals where:
    1. The proposed site is identified in a Neighbourhood Development Plan or other Development Plan Document as a suitable site for wind energy generation; and
    2. Following consultation with local residents, it can be demonstrated that the planning impacts identified can be fully addressed, and therefore the proposal has the backing of the local community; and
    3. The proposal complies with national and local guidance, including the Council's Wind Turbines SPD and Landscape Sensitivity to Wind Turbine and Solar PV Development document.

Policy SC3 sets out the councils policy on standalone renewable energy developments, as this development proposes only building mounted renewable generation there is no requirement to comply with this policy, it is not further addressed in this report.

Proposed development

The proposed development application title and description provided by the developer are:

Development of up to 215,646 m^2 of Storage, Distribution buildings (B1/B8), with ancillary offices (B1 (a)), car and HGV parking areas, a new primary access off Brickhill Street, with earthworks, drainage and attenuation features and other associated infrastructure.

The application is for a series of not less than six logistics buildings with a maximum floor space of 56,629 m^2 (609k sq. Ft) with the required ancillary offices, parking and loading and truck parking with a height limit of 18 m to haunch. The development would be accessed from a single point on the existing highway network. The main entrance would be off Brickhill Street and incorporates highway improvements to enable this. This would provide an all-movement and all-vehicle and pedestrian access. A pedestrian access footpath would remain across the site and the existing pedestrian right of way is extended through a linear park/landscape buffer along the railway and A5 edge of the site (within the site demise). The existing pedestrian link, under the existing underpass, would connect the P.R.O.W. to further reaching pedestrian/lakeside walks. Also included through the centre of the site is a cycle 'Redway' route linking Bow Brickhill Station to the A5 / Kelly's Kitchen Roundabout.

The master plan of the site is presented in Figure 1.

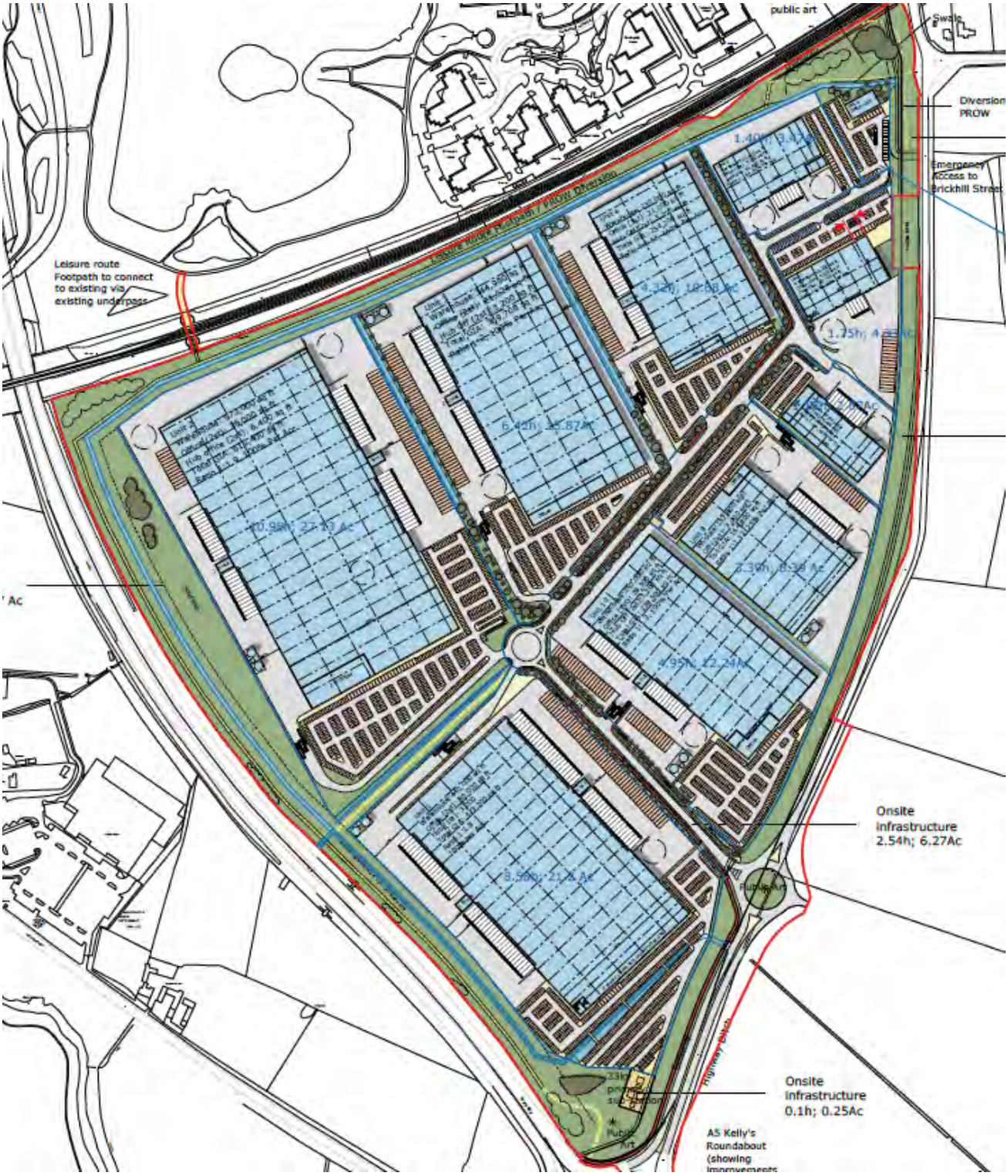


Figure 1: South Caldecotte master plan

SC1: Energy & Climate

To comply with Plan:MK Policy SC1 Energy and Climate section, an energy hierarchy strategy has been used in the design of the units to minimise the ongoing energy consumption and carbon emissions from the developments.

This energy strategy can be described as:

1. Be lean – use passive design techniques and energy efficient building services to reduce the demand for energy.
2. Be clean – where possible use district heat or local combined heat and power (CHP) systems to deliver energy to site efficiently.
3. Be green – Use local renewables generation to further offset emissions.

To assess the potential for energy savings at the site indicative energy models of four buildings of the development have been built using IES Virtual Environment software version 2018.2.0.0 to perform energy and emissions calculations in accordance with Part L2A of the Building Regulations 2013.

Plan:MK Policy SC1 introduces further emissions improvements over Part L2A for new developments in Milton Keynes, specifically requiring a 19% improvement of the building emissions rate over the requirements set by Approved Document Part L2A 2013 by the use of energy efficient passive design and building services provision; followed by a further 20% reduction in carbon emissions via on-site renewable energy generation or connection to a low carbon community energy scheme.

In terms of the energy hierarchy described above, the requirements of policy SC1 have been interpreted in this energy strategy as requiring a 19% improvement of the building emissions rate (BER) over the target emissions rate (TER) after the Be lean stage of the hierarchy, with a further 20% reduction in the BER being demonstrated as the cumulative improvements of the Be clean and Be green stages leading to a minimum overall improvement of 35.2% of the BER over the TER.

Methodology

The current development is speculative, with the design, layout, and final use characteristics of each unit unknown at this point. To facilitate the calculations for this energy statement four representative buildings have been modelled using the energy hierarchy described above to provide details of the potential energy savings available based on early design decisions and make indicative calculations of the expected extent of low and zero carbon technologies at the site.

The proposed development comprises six large distribution centre type units, 3 medium sized warehouse units and a small office unit. Two large units, Unit 1 and Unit 9, one medium unit, Unit 7, and the office, Unit 6, have been modelled for this energy statement. These blocks are chosen as representing large and small variations of each building type. The results for these units have then been used as a basis for estimating the energy results for the remaining buildings. Separate scaling calculations have been made for the large units and the medium units.

To provide a representative assessment for the buildings a number of assumptions have been made regarding the future use of the units and a representative fit out is used as detailed below. Given the difference in scale between the large units and smaller units, some variation has been made in assumed use.

Large unit fit-out and use assumptions

The large units are modelled on the basis that they function as warehouse distribution centres under planning category B8 and that the warehouse will operate on a 24-hour-a-day, 7-days-a-week basis, while the offices are in typical daytime use.

Given the mode of operation of the large units, allowance has been made for a staff welfare area consisting of a locker room with toilets and showers, and a staff canteen. Office areas have been given a reasonable allowance for core circulation, reception and toilet areas, with the balance for the floorplate on each floor fitted out as a single large open plan office.

Medium warehouse unit fit-out and use assumptions

The medium units are also considered as functioning as warehouses under planning category B8, with typical daytime operation of both the warehouse and offices.

The smaller units do not include allocations for canteen or locker space, although shower rooms have been included. Office areas have been given a smaller allowance for reception and toilet areas, with the balance of the office floor plate on each floor fitted out as a single open plan office area.

Office unit fit out and use assumptions

The office unit is assumed to function under planning category B1, with typical daytime operation.

The fitout is assumed to be a open plan office using the NCM speculative office usage templates, with allowanced made for a small core services are consisting of toilets and a stair core; a reception area has been included on each of the two floors of the building.

Mechanical services strategy

The fit-out basis assumes that the warehouses are unheated spaces and that the office areas are served by variable refrigerant flow (VRF) heat pumps supplying heating and cooling; ancillary areas are assumed to be heated by a low temperature hot water (LTHW) boiler serving radiators in these spaces. The hub offices are assumed to be served by a separate LTHW heating system. Mechanical heat recovery supply and extract ventilation is assumed to all office areas, hub offices and welfare areas with mechanical extract assumed to toilet and shower areas.

Be lean

A number of passive and low energy solutions are proposed for the development to reduce energy consumption, where these represent improvements over the Part L baseline they have been highlighted in green

Building fabric – warehouse units

Walls – Metal clad insulated build up to achieve a U-value of 0.35 W/m^2/K

Roof – Metal clad insulated build up to achieve a U-value of 0.23 W/m^2/K

Floor – Uninsulated 175mm concrete slab – area adjusted U-value in warehouse spaces, 0.25 W/m^2/K to hub.

Curtain walling/Glazing – overall system average of 1.5 W/m^2/K, g-value 0.4, LT 0.6

Rooflights – system U-value 1.30 W/m^2/K, g-value 0.55, LT 0.58. triple glazed rooflight system to 12% coverage.

Air permeability – 3 m^3/h/m^2 @ 50 Pa to Units 4, 5, 7, 8, 9, 10, 2 m^3/h/m^2 @ 50 Pa to Units 1, 2, 3;

Building fabric – office unit

Walls – Rainscreen build up to achieve a U-value of 0.20 W/m^2/K

Roof – Inverted roof build up on concrete deck to achieve a U value of 0.18 W/m^2/K.

Floor – Insulated floor to achieve a U-value of 0.20 W/m^2/K.

Curtain walling/Glazing – to match warehouse units

Air permeability - 5 m^3/h/m^2 @ 50 Pa

Building services

Power factor correction to >0.95, metering and out of range warnings to all lighting, HVAC, and DHW systems via BMS system.

LTHW heating – Efficiency 91%, variable speed pump with differential sensors.

Extract to toilets and showers – 10 air changes per hour, fans remote from zone with SFP of 0.4 W/l/s.

Supply and extract ventilation via ceiling mounted heat recovery units operating with SFP of 1.5 W/l/s and heat recovery efficiency of 70%

VRF system to offices and canteen with CoP 4, EER 3.5, SEER 5.0.

Hot water to the main office block and welfare area are supplied via the LTHW heating system with 900 l of storage with standing losses of 0.005 kWh/l/day and distributed via a secondary circulation system with circulation losses of 7 W/m, and a time switch controlled circulation pump, the pump powers are assumed to be 200W for the large units and 100W for the smaller blocks, secondary circulation length is adjusted to be appropriate to each representative model.

Lighting is assumed to be provided by high efficiency LED throughout with average initial efficacy of 100 lumens per circuit Watt in warehouse and main open plan offices, and an average initial efficacy of 80 lumens per circuit Watt across all other spaces. Display lighting in the reception areas is time switched and provides an average initial efficacy of 22 lumens per circuit Watt.

All areas excluding plant rooms are assumed to operate with presence detecting PIR sensors, and daylight dimming is included to the main warehouse, office spaces, canteens, and reception lobby areas.

Be clean

As discussed below there are no suitable opportunities for low carbon community heating schemes for this development. As a suitable alternative, an efficient VRF heat pump heating and cooling system is proposed for the office spaces, the benefits of this system have been included at the Be lean stage.

Be green

As there is no opportunity for low carbon community systems in the development, it is proposed that the developments obligations under policy SC1 are to be met using roof mounted photovoltaic panels with an array size determined based in the residual carbon emissions for the building following the lean and clean stages of the energy hierarchy.

Large unit indicative results

Representative Unit 1

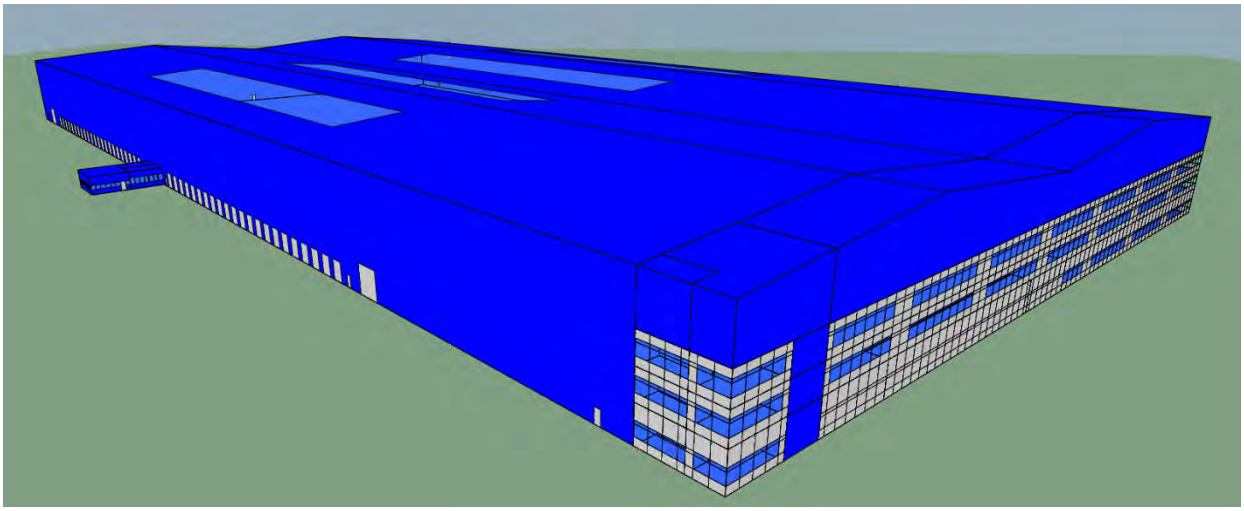


Figure 2: Unit 1 thermal model

Unit 1 is one of the largest proposed units on the site, the model includes 40,000m^2 of warehouse space, 3,150m^2 of office space, 1,575m^2 staff welfare space, and 3000m^2 hub space. A rendered view of the Unit 1 thermal model is show in Figure 2.

Due to the large size of the warehouse, and the associated large welfare area, occupying the undercroft area below the offices, the LTHW hot water system is assumed to have 900 l of storage and a secondary circulation loop length of 400 m. The hub office, WC, and showers are assumed to be served by electric point of use heaters.

Following the energy hierarchy detailed above for this building suggests that an overall reduction in in the BER over the TER of 48% is possible once the impacts of the Be lean and Be green elements have been included.

A summary of the results for this unit is given in Table 1, showing a target emissions rate of 22.3 kgCO_2/m^2 for this building. The Be lean improvements demonstrate a building emissions rate of 14.5 kgCO_2/m^2, a reduction of 35%. With the addition of a photovoltaic array with an annual yield of approximately 278MWh the Be green building offers a building emissions rate of 11.5 kgCO_2/m^2, an improvement of 48% over the TER and 21% over the Be lean BER.

Based on the methodology described in the Supplementary Planning Document Sustainable Construction Guide the residual carbon emissions from this building, including unregulated consumption, can be expected to be approximately 1330 tonnes per year, suggesting a carbon offset payment in the region of £290,000.

Table 1: Unit 1 summary results

	TER	BER		PV Yield		Residual Carbon (tonnes)				Carbon fund
	$kgCO_2/m^2$			kWh/m^2		Reg.	Unreg.	PV	Total	contribution
Lean	22.3	14.5	35%			573	876		1449	£289,841
Clean	22.3	14.5	35%			573	876		1449	£289,841
Green	22.3	11.5	48%	5.81	21%	573	876	-120	1330	£265,940

The calculations for this unit indicate an EPC rating of A13 is achievable with the inclusion of the Be lean and Be clean measures.

The reductions in emissions rates for this building at each stage of the energy hierarchy are shown graphically in Figure 3.

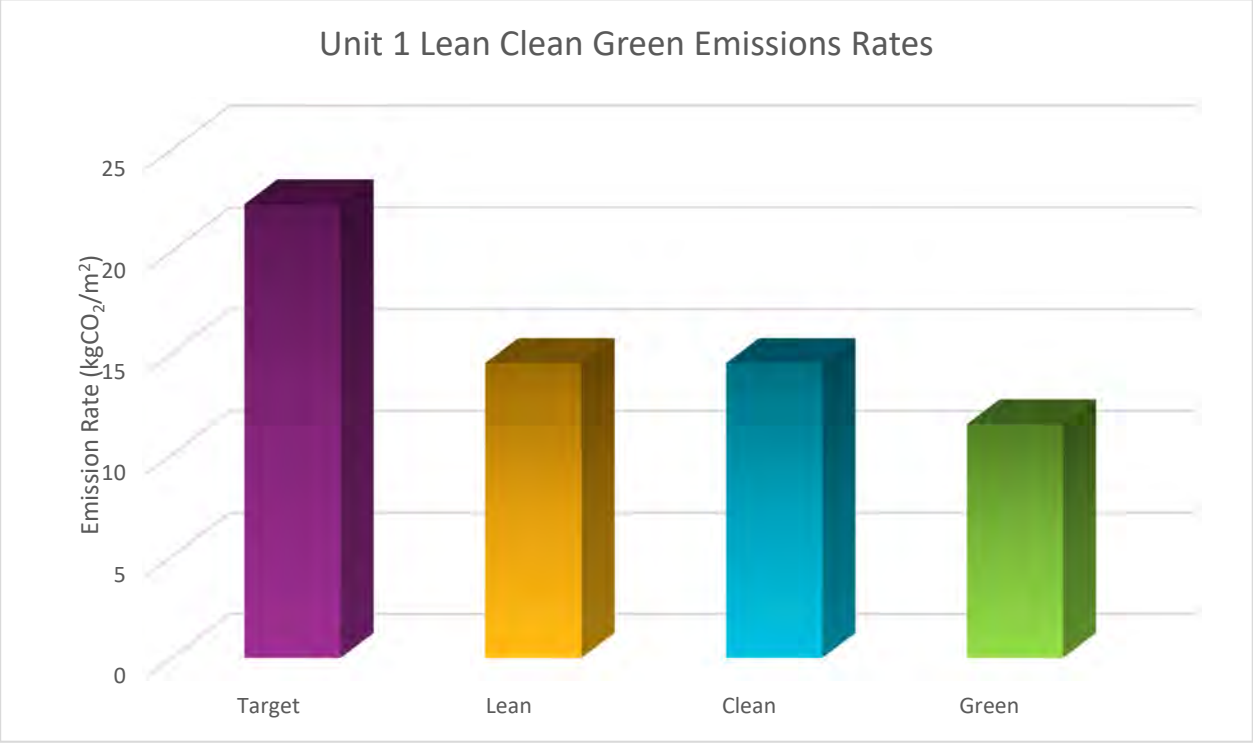


Figure 3: Unit 1 lean clean green emissions rates

The resultant BRUKL and EPC documents for the Lean and Clean version of this unit are included in Appendix A – Unit 1 Lean Clean BRUKL and EPC and for the green building in Appendix B – Unit 1 Green BRUKL and EPC.

Representative Unit 9

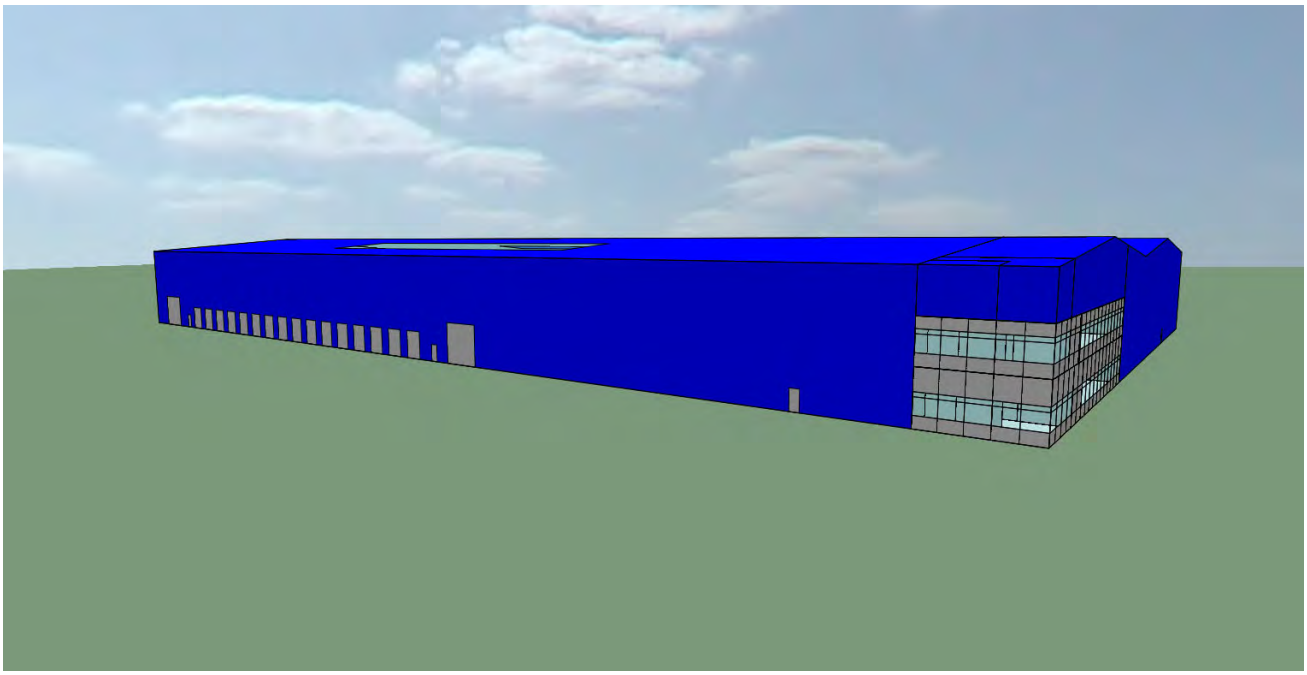


Figure 4: Unit 9 thermal model

Unit 9 is the smallest of the proposed large units on the site, the model includes 14,700 m^2 of warehouse space, 430 m^2 of office space, no staff welfare or hub space is included in the mode. A rendered view of the Unit 1 thermal model is show in Figure 4.

The LTHW hot water system is assumed to have 900 l of storage and a secondary circulation loop length of 400 m.

Following the energy hierarchy detailed above for this building suggests that an overall reduction in in the BER over the TER of 53% is possible once the impacts of the Be lean and Be green elements have been included.

A summary of the results for this unit is given in Table 2, showing a target emissions rate of 20.0 $kgCO_2/m^2$ for this building. The Be lean improvements demonstrate a building emissions rate of 11.9 $kgCO_2/m^2$, a reduction of 41%. With the addition of a photovoltaic array with an annual yield of approximately 71.5 MWh the Be green building offers a building emissions rate of 9.5 $kgCO_2/m^2$, an improvement of 53% over the TER and 20% over the Be lean BER.

Based on the methodology described in the Supplementary Planning Document Sustainable Construction Guide the residual carbon emissions from this building, including unregulated consumption, can be expected to be approximately 425 tonnes per year, suggesting a carbon offset payment in the region of £85,000.

Table 2: Unit 9 summary results

	TER	BER		PV Yield		Residual Carbon (tonnes)				Carbon fund
	$kgCO_2/m^2$			kWh/m^2		Reg.	Unreg.	PV	Total	contribution
Lean	20	11.9	41%			178	276		454	£90,794
Clean	20	11.9	41%			178	276		454	£90,794
Green	20	9.5	53%	4.65	20%	178	276	-31	423	£84,641

The calculations for this unit indicate an EPC rating of A12 is achievable with the inclusion of the Be lean and Be clean measures.

The reductions in emissions rates for this building at each stage of the energy hierarchy are shown graphically in Figure 5.

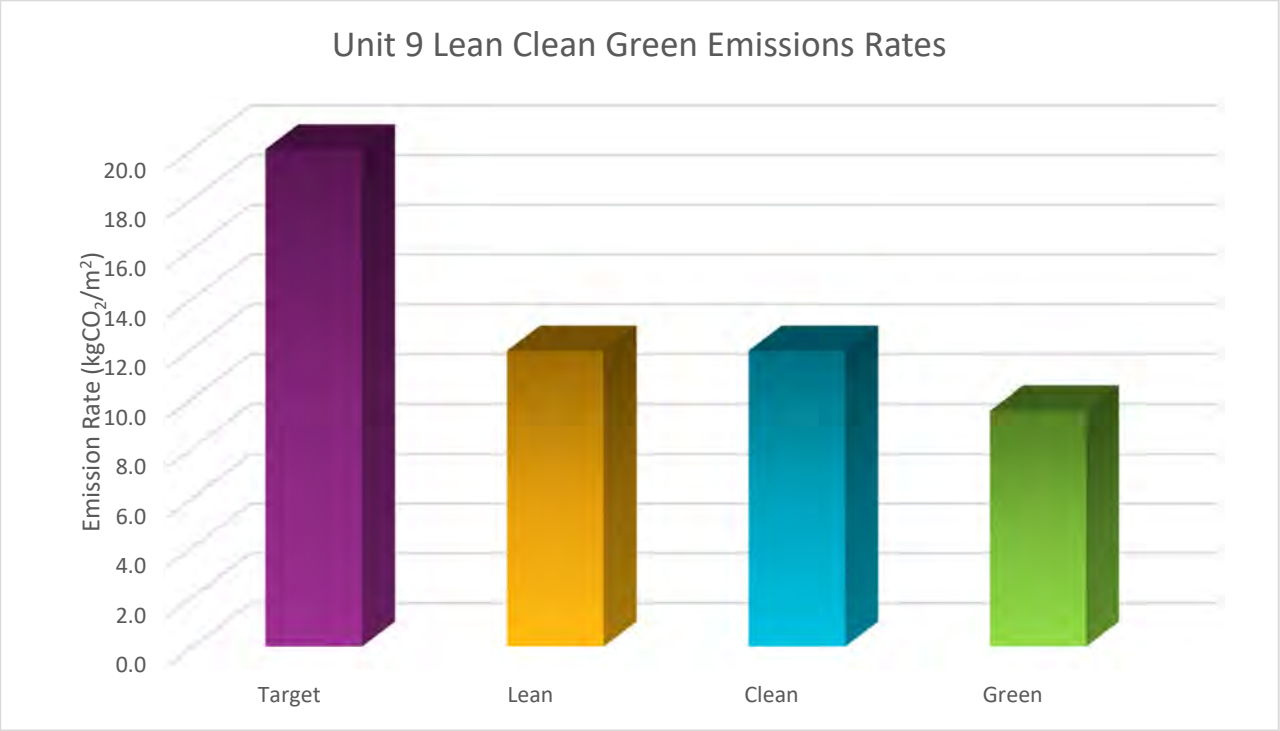


Figure 5: Unit 9 lean clean green emissions rates

The resultant BRUKL and EPC documents for the Lean and Clean version of this unit are included in Appendix C – Unit 9 Lean Clean BRUKL and EPC and for the green building in Appendix D – Unit 9 Green BRUKL and EPC.

Medium unit indicative result

Representative Unit 7

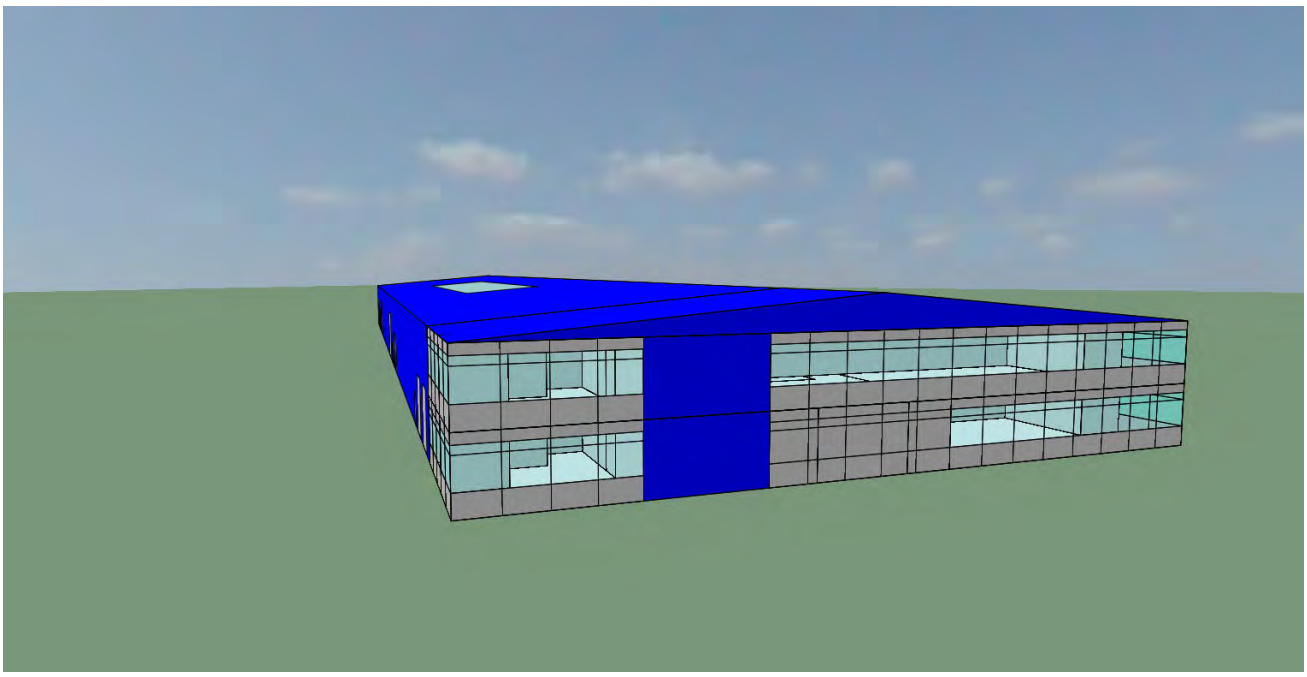


Figure 6: Unit 7 thermal model

Unit 7 is representative of the medium sized warehouse units in the development, the model includes 4,570 m^2 of warehouse space, 390 m^2 of office space and 83 m^2 staff welfare space; there is no hub office. A rendered view of the Unit 1 thermal model is show in Figure 6.

The LTHW hot water system is assumed to have 500 l of storage and a secondary circulation loop length of 200 m.

Following the energy hierarchy detailed above for this building suggests that an overall reduction in in the BER over the TER of 41% is possible once the impacts of the Be lean and Be green elements have been included.

A summary of the results for this unit is given in Table 3, showing a target emissions rate of 12.8 $kgCO_2/m^2$ for this building. The Be lean improvements demonstrate a building emissions rate of 9.5 $kgCO_2/m^2$, a reduction of 26%. With the addition of a photovoltaic array with an annual yield of approximately 20.9MWh the Be green building offers a building emissions rate of 7.5 $kgCO_2/m^2$, an improvement of 41% over the TER and 21% over the Be lean BER.

Based on the methodology described in the Supplementary Planning Document Sustainable Construction Guide the residual carbon emissions from this building, including unregulated consumption, can be expected to be approximately 100 tonnes per year, suggesting a carbon offset payment in the region of £20,000.

Table 3: Unit 7 summary results

	TER	BER		PV Yield		Residual Carbon (tonnes)				Carbon fund
	$kgCO_2/m^2$			kWh/m^2		Reg.	Unreg.	PV	Total	contribution
Lean	12.8	9.5	26%			43	67		109	£21,842
Clean	12.8	9.5	26%			43	67		109	£21,842
Green	12.8	7.5	41%	3.91	21%	43	67	-9	100	£20,042

The calculations for this unit indicate an EPC rating of A12 is achievable with the inclusion of the Be lean and Be clean measures.

The reductions in emissions rates for this building at each stage of the energy hierarchy are shown graphically in Figure 7.

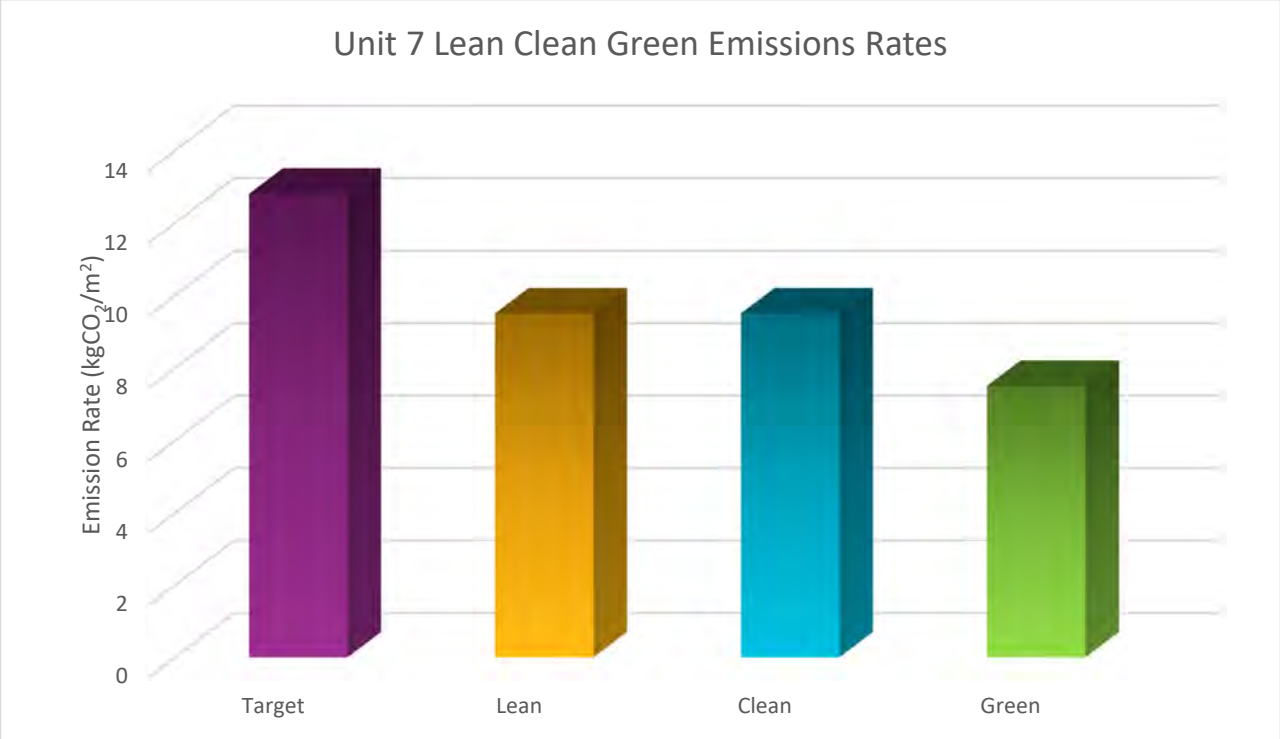


Figure 7: Unit 7 lean clean green emissions rate

The resultant BRUKL and EPC documents for the Lean and Clean version of this unit are included in Appendix E – Unit 7 Lean Clean BRUKL and EPC and for the green building in Appendix F – Unit 7 Green BRUKL and EPC.

Office Unit indicative result

Representative Unit 6

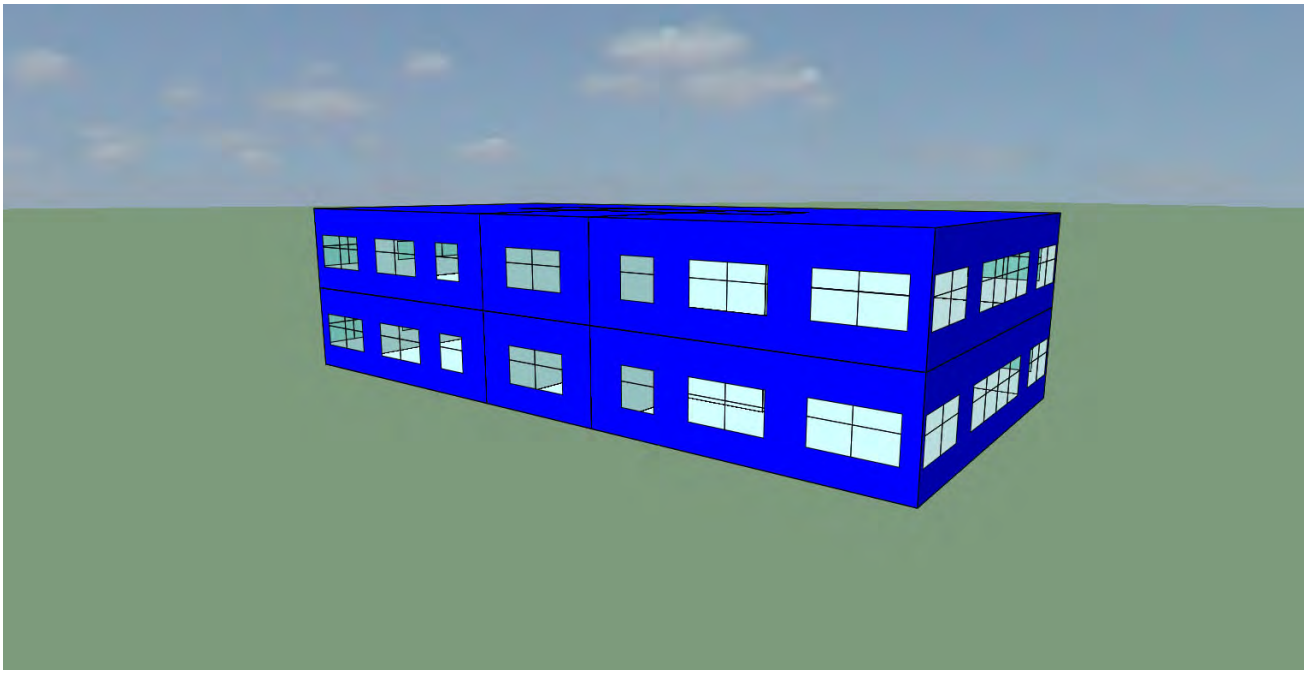


Figure 8: Unit 6 thermal model

Unit 6 is the proposed office building. The model includes 800 m^2 of speculative office space along with 170 m^2 of auxiliary space. A rendered view of the Unit 6 model is shown in Figure 8.

The office building LTHW domestic hot water system is assumed to be served by a 200 l storage tank and a secondary circulation loop length of 50 m.

Following the energy hierarchy detailed above for this building suggests that an overall reduction in the BER over the TER or 37% is possible one the impacts of the Be lean and Be green elements have been included.

A summary of the results for this unit is given in Table 4, showing a target emissions rate of 16.7 $kgCO_2/m^2$ for this building. The Be lean improvements demonstrate a building emissions rate of 13.67 $kgCO_2/m^2$, a reduction of 21%. With the addition of a photovoltaic array with an annual yield of approximately 5.1MWh the Be green building offers a building emissions rate of 10.57 $kgCO_2/m^2$, an improvement of 37% over the TER and 20% over the Be lean BER.

Based on the methodology described in the Supplementary Planning Document Sustainable Construction Guide the residual carbon emissions from this building, including unregulated consumption, can be expected to be approximately 23 tonnes per year, suggesting a carbon offset payment in the region of £4,500.

Table 4: Unit 6 summary results

	TER	BER		PV Yield		Residual Carbon (tonnes)				Carbon fund
	$kgCO_2/m^2$			kWh/m^2		Reg.	Unreg.	PV	Total	contribution
Lean	16.7	13.2	21%			10	15		25	£5,012
Clean	16.7	13.2	21%			10	15		25	£5,012
Green	16.7	10.5	37%	5.28	20%	10	15	-2	23	£4,573

The calculations for this unit indicate an EPC rating of A15 is achievable with the inclusion of the Be lean and Be clean measures.

The reductions in emissions rates for this building at each stage of the energy hierarchy are shown graphically in Figure 9.

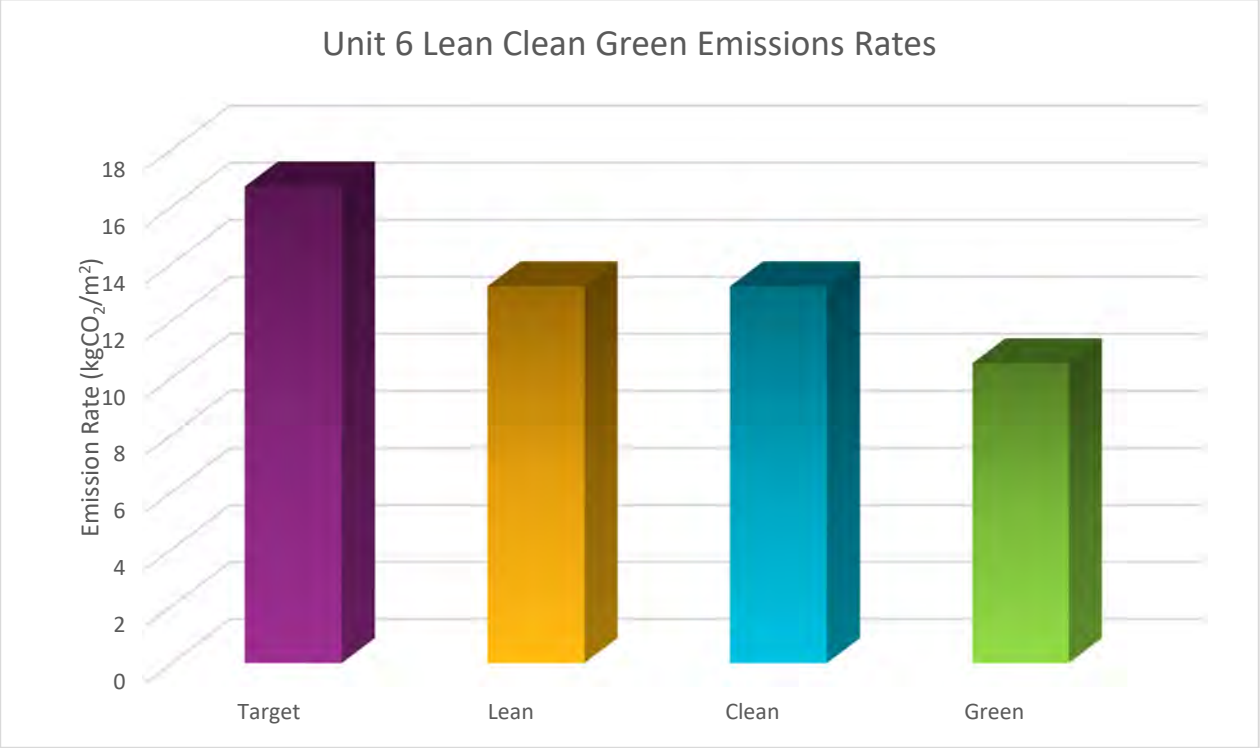


Figure 9: Unit 6 lean clean green emissions rates

The resultant BRUKL and EPC documents for the Lean and Clean version of this unit are included in Appendix G – Unit 6 Lean Clean BRUKL and EPC and for the green building in Appendix H – Unit 6 Green BRUKL and EPC.

Scaled sitewide results

Based on the energy model results for the indicative buildings presented above, scaling calculations have been made to predict the energy hierarchy results for the remaining units and estimate the photovoltaic array sizes and carbon offset payment for the whole development.

Sitewide energy hierarchy

The results presented in Table 5 indicate that across the site, an overall improvement over the target emissions rate of 49% achievable with the sustainability strategies outlined in this report, including a 35% improvement via demand reductions from fabric and servicing efficiencies and a further 21% reduction from onsite renewable energy production.

Table 5: Sitewide scaled energy hierarchy results

	Emissions Rate ($kgCO_2/m^2$)				Improvement over TER			Renewable reduction over Lean
	Target	Lean	Clean	Green	Lean	Clean	Green	
Unit 1	22.3	14.5	14.5	11.5	35.0%	35.0%	48.4%	20.7%
Unit 2	22.5	14.7	14.7	11.7	34.4%	34.4%	48.0%	20.8%
Unit 3	21.8	14.1	14.1	11.2	35.7%	35.7%	49.0%	20.7%
Unit 4	21.2	13.3	13.3	10.6	37.2%	37.2%	50.1%	20.5%
Unit 5	12.8	9.5	9.5	7.5	25.5%	25.5%	41.4%	21.3%
Unit 6	16.7	13.2	13.2	10.5	21.0%	21.0%	37.1%	20.5%
Unit 7	12.8	9.5	9.5	7.5	25.8%	25.8%	41.4%	21.1%
Unit 8	12.8	9.5	9.5	7.5	25.5%	25.5%	41.4%	21.3%
Unit 9	20.0	11.9	11.9	9.5	40.5%	40.5%	52.5%	20.2%
Unit 10	21.3	13.5	13.5	10.7	36.8%	36.8%	49.8%	20.6%
Site	21.2	13.7	13.7	10.9	35.3%	35.3%	48.7%	20.7%

Sitewide renewable generation

The results presented in Table 6 show the target annual photovoltaic array electrical generation for each unit to achieve a site total 1,208 MWh/annum. Indicative array parameters are also presented based on 275 Wp photovoltaic panels and assumed array orientation and inclinations.

Table 6: Sitewide scaled indicative PV array sizes

	Annual Yield	Array location			Array size*		
	kWh	Orientation [°]	Inclination [°]	MCS Kk	kWp	m^2	no. panels
Unit 1	277,918	30	5	859	323.5	1883	1177
Unit 2	337,494	35	5	857	393.8	2293	1433
Unit 3	192,233	35	5	857	224.3	1306	816
Unit 4	123,941	35	5	857	144.6	842	526
Unit 5	22,286	45	5	853	26.1	154	96
Unit 6	5,103	45	30	925	5.5	34	21
Unit 7	20,932	45	5	853	24.5	144	90
Unit 8	18,076	45	5	853	21.2	125	78
Unit 9	71,543	20	5	862	83.0	483	302
Unit 10	138,308	20	5	862	160.4	934	584
Site	1,207,834	-	-	-	1407.1	8197	5123

*Indicative size based on 275 Wp panels

Carbon offset payments

Statement K3 of Policy SC1 indicates that a carbon offset contribution is due for the residual carbon emissions of the development, to be calculated according to MKC SPD Sustainable Construction Guide, April 2007. The expected carbon offset payment for this development are presented in Table 7 for each unit, broken down by regulated and unregulated carbon emissions along with the reductions provided by onsite renewables. If the development is progressed in a manner consistent with this report it is expected that the total sitewide carbon offset contribution will be in the region of £1.05 million, equivalent to £4.83/m^2.

Table 7: Sitewide scaled indicative carbon offset payments

	Carbon offset payment				
Unit	Regulated	Unregulated	PV Reduction	Net Payment	£/m^2
Unit 1	£114,617	£175,224	-£23,901	£265,940	£5.56
Unit 2	£139,000	£209,862	-£29,025	£319,838	£5.59
Unit 3	£79,548	£125,408	-£16,532	£188,423	£5.49
Unit 4	£51,597	£85,703	-£10,659	£126,641	£5.36
Unit 5	£9,061	£14,194	-£1,917	£21,339	£3.74
Unit 6	£2,087	£2,925	-£439	£4,573	£4.73
Unit 7	£8,511	£13,332	-£1,800	£20,042	£3.74
Unit 8	£7,350	£11,513	-£1,555	£17,308	£3.74
Unit 9	£35,555	£55,239	-£6,153	£84,641	£5.50
Unit 10	£57,477	£94,056	-£11,894	£139,639	£5.40
Total				£1,066,394	£4.83

As detailed in the relevant SPD, the calculated carbon offset payments include both regulated and unregulated emissions; Figure 10 illustrates the balance between regulated and unregulated contributions to the offset payment.

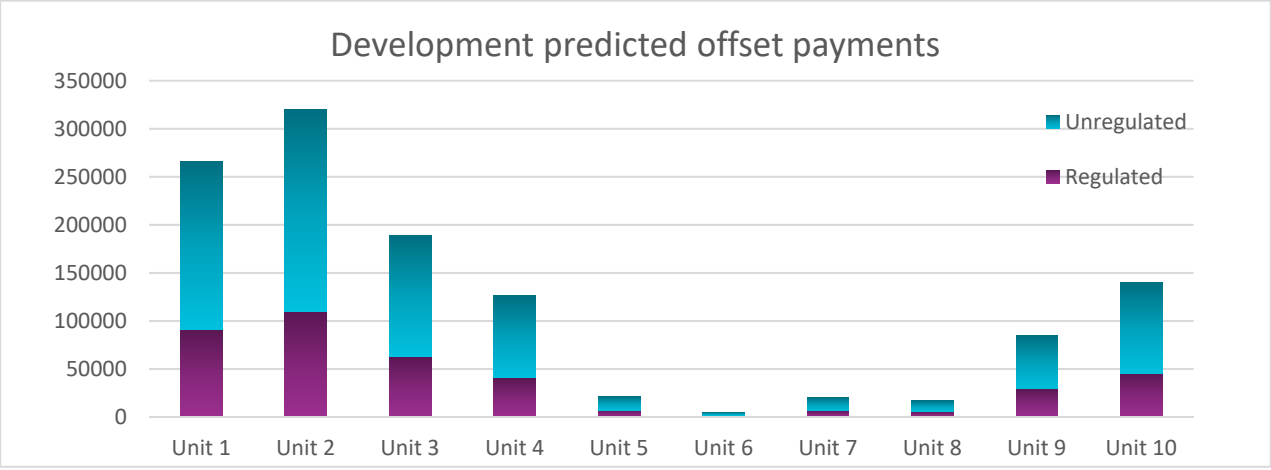


Figure 10: Regulated and unregulated components of offset payments

Energy storage

Energy storage can be employed in suitable applications to provide several environmental and economic benefits. The most significant applications are storing locally generated renewable energy when production is higher than demand, this is typically more efficient than exporting to the grid, and peak shaving, where local energy storage is used to reduce peak demand from the grid by drawing from the store at peak times and charging the store when demand is low, this has the benefit of reducing peak load on the grid and reducing demand charging.

In the case of the buildings proposed for this development it is anticipated that the peak PV electrical generation will be consumed entirely by the base demand of the building, with no need to export power to the grid, so battery storage relating to the PV arrays is not needed.

Given the speculative nature of the development it is not possible at this stage to determine if any of the units on site will be suitable for peak shaving applications, it is anticipated that this will be determined by tenants as part of the fit out process.

Climate change

The proposed buildings have been designed with climate change as a key driver of performance. By targeting sitewide carbon reductions via fabric and service efficiencies well in excess of the requirements of policy SC1 the ongoing impact of the development on the environment is minimised compared to similar developments.

The development also includes design features to ensure that the development is robust to expected climate change conditions without requiring extensive modification or unreasonable increases in energy use. The warehouse areas have been insulated beyond Part L minimum requirements, this insures that if frost protection heating is needed in the warehouses reduces amounts of energy will be required to maintain the protection level.

In areas of the development where comfort cooling is required such as the warehouse office, curtain walling is employed to increase the overall U-value of the space, this allows the building to naturally reject heat, reducing the dominant cooling loads.

SC1: Materials & waste

Due to the nature of the development the existing buildings on site (small agricultural buildings in poor condition) are not suitable for reuse. Reuse would remain insignificant in the context of the development. The proposed development is in keeping with other similar developments in the immediate area.

The material generated from demolition of the existing buildings on site will be used for the redevelopment where viable. Any material that cannot be reused will be diverted from landfill unless waste regulations require otherwise. Excavated soil and hardscaping will also be retained on site where viable.

The proposed buildings will be steel framed and will therefore be easily deconstructed at the end of the building's lifetime allowing for reuse or recycling of the steel. This would also facilitate any future change or extension, enabling the adaptation of uses to meet changing social or economic needs.

All materials used within the construction will be selected with reference to the BRE's Green Guide for specification. The Green Guide demonstrates the specification of materials with low overall environmental impacts. External walls and roofs, which will make up the majority of materials used within the development, are anticipated to be a coated steel built up profiled panel with insulation which is A+ rated within the Green Guide. Hard landscaping materials are anticipated to be A or B rated. Materials and labour will be locally sourced where possible, reducing the impact of construction both at a local and wider level.

Roof areas of the warehouse units are required for rooflights to reduce energy consumption and associated CO_2 emissions associated with lighting requirements. Additionally there is an authority requirement to install renewable technologies. The most suitable technology has been identified within this report to be roof mounted photovoltaic panels. These additional uses for the roof area restrict viability for installation of green roofs.

Green walls have also been considered for this development, however, are not proposed due to insignificant impact on both water management and biodiversity in context of the whole development. The proposals include for the adaptation of existing watercourses to create swales and attenuation ponds for managing surface water run-off. The drainage strategy will adequately manage the volume and run-off rates of rainwater, into the climate change environment, and the integration of green walls will have insignificant effect on this strategy. An additional consideration is that of warmer, drier climates where a green wall may depend on irrigation that is unable to be sustained through summer months by harvested rainwater. This risks the use of potable water for irrigation and thus would negate any water management benefits. The swales and attenuation ponds will create an environment of greater ecological value than that that could be provided within the green walls. It is therefore considered that the overall development will sufficiently address ecological enhancement without the need for a green wall that would come with increased management issues.

Each unit will be provided with dedicated space to accommodate appropriate recycling storage that is easily accessible. This will be in addition to space for general waste collection. In the large units, where high volumes of packaging may be anticipated, there will also be designated space for a compactor or baler to be installed so that volumes of waste may be reduced and managed efficiently.

Each unit will be provided with ample space to accommodate compactors./Bailers if required as well as space for local authority recycling containers.

SC1: Water

The water hierarchy is used to prioritise water conservation activities. The greatest opportunity for reducing the use of potable water lies with the reduction of water use, before reuse and recycling. By reduction in water demand, pressures of mains water supply is reduced. SC1 focuses on the 'reuse' aspect of the hierarchy, through the use of either untreated rainwater or greywater.

These development proposals propose the following minimum performance specifications for sanitaryware to be installed, which would achieve a greater than 25% improvement over the BREEAM benchmark for water consumption.

- WCs – 4.5 L flush
- Taps – 5 L/minute
- Showers – 8 L/minute

External landscaping will rely only on precipitation once established and therefore there will be no irrigation demands.

While the use of rainwater or greywater could further reduce mains water use, there are additional considerations that must be taken. Installation of a grey or rainwater system, that could serve only WC flushing within this development, requires double the amount of pipework to be installed, as well as water storage. This, along with use of untreated water, can lead to significant maintenance issues that lead to redundant systems, filled by potable water. Additionally, seasonal variations in rainfall mean that in long dry summers, when mains water pressures are at their peak, a rainwater system that had used its supply would be of no benefit in reducing those pressures.

It is overall considered that the approach to reduce the mains water requirements through the use of efficient sanitaryware fulfils the intent of the policy to reduce pressure of the mains water supply.

SC2: Local energy networks

Policy SC2 of Plan:MK requires any proposal for non-residential developments over 1000m^2 to consider the integration of community energy networks in the development, taking account of the site's characteristics and the existing power demands on adjacent sites.

The proposed development is positioned on an approximately triangular plot in a peri-urban location on the south-eastern periphery of Milton Keynes. The location is not near any existing community energy scheme.

Industrial warehouse developments typically represent poor opportunities for community heating systems as the large warehouse spaces are typically only heated for frost protection rather than human comfort, while internal gains within the warehouse in combination with Part L compliant building fabric tend to maintain conditions above a frost protection setting.

The results of the minimal warehouse heating demand is that heating and cooling demand, even for large scale developments is driven by the heating and cooling demand of the much smaller office space in the development. For example, the NCM calculations for Unit 1 of the development suggest that the heating load is around 2% of the regulated energy use.

Appendix A – Unit 1 Lean Clean BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 1 Lean Clean

As designed

Date: Thu Jul 04 09:28:53 2019

Administrative information

Building Details

Address: Unit 1 Lean Clean, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	14.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.35	0.35	0100000B:Surf[47]
Floor	0.25	0.11	0.25	01000007:Surf[0]
Roof	0.25	0.23	0.23	01000020:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.36	1.5	01000007:Surf[2]
Personnel doors	2.2	2.2	2.2	01000020:Surf[20]
Vehicle access & similar large doors	1.5	1.5	1.5	0100000B:Surf[1]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

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

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- HVAC 04(CORE): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

4- HVAC 04(WELF): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

5- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

6- HVAC 03(HUB): HTG MV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	0.7
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

7- HVAC 02(HUB): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

8- HVAC 02(WELF): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

9- HVAC 03(WELF): HTG MV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	0.7
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- DHW 02: Electric PoU

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.04
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01.00.01 Recepton	-	1.5	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01.00.05 Female WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.06 Male WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.11 Canteen	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
01.01.05 Female WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.06 Male WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
01.01.H1 Driver Reception	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H2 Hub Office	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H3 Hub WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.H4 Hub Shower	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
01.02.05 Female WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.06 Male WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
01.00.10 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.09 Shower	-	-	-	1.5	-	-	-	-	-	-	N/A
01.00.08 Changing	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H5 Driver Reception	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H6 Hub Office	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H7 Hub WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.H8 Hub Shower	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01.00.01 Recepton	-	80	22	342
01.00.02 Stair	-	80	-	72
01.00.04 Circulation	-	80	-	51
01.00.05 Female WC	-	80	-	158
01.00.06 Male WC	-	80	-	160
01.00.07 Acc. WC	-	80	-	45
01.00.11 Canteen	-	80	-	2237
01.00.12 Stair	-	80	-	67
01.01.01 Lobby	-	80	-	158
01.01.02 Stair	-	80	-	62
01.01.04 Circulation	-	80	-	40
01.01.05 Female WC	-	80	-	140
01.01.06 Male WC	-	80	-	141
01.01.07 Acc. WC	-	80	-	45

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01.01.08 Open Plan Office	100	-	-	9305
01.01.09 Stair	-	80	-	57
01.01.H1 Driver Reception	80	-	-	644
01.01.H2 Hub Office	80	-	-	318
01.01.H3 Hub WC	-	80	-	122
01.01.H4 Hub Shower	-	80	-	37
01.02.01 Lobby	-	80	-	158
01.02.02 Stair	-	80	-	62
01.02.04 Circulation	-	80	-	40
01.02.05 Female WC	-	80	-	140
01.02.06 Male WC	-	80	-	141
01.02.07 Acc. WC	-	80	-	45
01.02.08 Open Plan Office	100	-	-	9305
01.02.09 Stair	-	80	-	57
01.03.01 Plant Deck	80	-	-	682
01.03.02 Stair	-	80	-	92
01.00.10 WC	-	80	-	607
01.00.09 Shower	-	80	-	273
01.00.08 Changing	80	-	-	4657
01.00.00 Warehouse	100	-	-	174660
01.01.H5 Driver Reception	80	-	-	644
01.01.H6 Hub Office	80	-	-	318
01.01.H7 Hub WC	-	80	-	122
01.01.H8 Hub Shower	-	80	-	37

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?
01.00.01 Recepton	NO (-6.5%)	NO
01.00.11 Canteen	NO (-6.7%)	NO
01.01.01 Lobby	NO (-6.8%)	NO
01.01.08 Open Plan Office	NO (-7.5%)	NO
01.01.H1 Driver Reception	NO (-57.9%)	NO
01.01.H2 Hub Office	NO (-46.7%)	NO
01.02.01 Lobby	NO (-6.8%)	NO
01.02.08 Open Plan Office	NO (-7.5%)	NO
01.00.08 Changing	N/A	N/A
01.00.00 Warehouse	NO (-26.2%)	NO
01.01.H5 Driver Reception	NO (-63.3%)	NO
01.01.H6 Hub Office	NO (-34.3%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	45711.4	45711.4
External area [m²]	101644	101644
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	2	3
Average conductance [W/K]	30330.7	26097.2
Average U-value [W/m²K]	0.3	0.26
Alpha value* [%]	10.03	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**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	1.61	0.74
Cooling	0.8	1.55
Auxiliary	0.97	0.72
Lighting	17.88	34.01
Hot water	16.68	16.23
Equipment*	44.86	44.86
TOTAL**	**37.93**	**53.24**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	19.07	24.26
Primary energy* [kWh/m²]	85.97	129.67
Total emissions [kg/m²]	14.5	22.3

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	209.8	0	68.2	0	2.1	0.85	0	0.91	0
	Notional	0	0	0	0	0	0	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	33.2	0	10.8	0	22.1	0.85	0	0.91	0
	Notional	75	0	24.2	0	1.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	56.5	0	18.4	0	9.2	0.85	0	0.91	0
	Notional	25.2	0	8.1	0	31.3	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	48	124.6	3.4	9.3	5.9	3.92	3.74	4	5
	Notional	20.5	0	6.6	0	5.5	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	314.1	0	102.1	0	23.5	0.85	0	0.91	0
	Notional	16	250.2	1.7	18.3	3.6	2.56	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	145.8	0	47.4	0	8	0.85	0	0.91	0
	Notional	282.6	0	91.1	0	33.1	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	30.3	77.1	2.1	5.7	6.9	3.92	3.74	4	5
	Notional	115.6	0	37.2	0	4.8	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	376.6	0	122.4	0	25.2	0.85	0	0.91	0
	Notional	3.3	154.3	0.4	11.3	4.2	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	98.6	168.8	7	12.5	6.3	3.92	3.74	4	5
	Notional	60.3	0	19.4	0	35.9	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	20.4	244.6	2.2	17.9	3.8	2.56	3.79	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.33	01000005:Surf[1]
Floor	0.2	0.1	0100000B:Surf[0]
Roof	0.15	0.23	01000020:Surf[1]
Windows, roof windows, and rooflights	1.5	1.3	0100000B:Surf[89]
Personnel doors	1.5	2.2	01000020:Surf[20]
Vehicle access & similar large doors	1.5	1.5	0100000B:Surf[1]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	2

Energy Performance Certificate

Non-Domestic Building

HM Government

Unit 1 Lean Clean
South Caldecotte
Milton Keynes

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

17 This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Air Conditioning
Total useful floor area (m^2):	45711.398
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	14.54
Primary energy use (kWh/m^2 per year):	85.97

Benchmarks

Buildings similar to this one could have ratings as follows:

26 If newly built

68 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.11 using calculation engine ApacheSim v7.0.11
Property Reference:	000000000000
Assessor Name:	Nathan Evans
Assessor Number:	LCEA091856
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Yonder Limited
Employer/Trading Address:	Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA
Issue Date:	04 Jul 2019
Valid Until:	03 Jul 2029 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at:
www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

Appendix B – Unit 1 Green BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 1 Green

As designed

Date: Thu Jul 04 10:04:10 2019

Administrative information

Building Details

Address: Unit 1 Green, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	11.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.35	0.35	0100000B:Surf[47]
Floor	0.25	0.11	0.25	01000007:Surf[0]
Roof	0.25	0.23	0.23	01000020:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.36	1.5	01000007:Surf[2]
Personnel doors	2.2	2.2	2.2	01000020:Surf[20]
Vehicle access & similar large doors	1.5	1.5	1.5	0100000B:Surf[1]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

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

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- HVAC 04(CORE): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

4- HVAC 04(WELF): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

5- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

6- HVAC 03(HUB): HTG MV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	0.7
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

7- HVAC 02(HUB): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

8- HVAC 02(WELF): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

9- HVAC 03(WELF): HTG MV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	0.7
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- DHW 02: Electric PoU

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.04
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01.00.01 Recepton	-	1.5	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01.00.05 Female WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.06 Male WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.11 Canteen	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
01.01.05 Female WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.06 Male WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
01.01.H1 Driver Reception	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H2 Hub Office	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H3 Hub WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.H4 Hub Shower	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
01.02.05 Female WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.06 Male WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
01.00.10 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.00.09 Shower	-	-	-	1.5	-	-	-	-	-	-	N/A
01.00.08 Changing	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H5 Driver Reception	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H6 Hub Office	-	-	-	1.5	-	-	-	-	-	-	N/A
01.01.H7 Hub WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.01.H8 Hub Shower	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01.00.01 Recepton	-	80	22	342
01.00.02 Stair	-	80	-	72
01.00.04 Circulation	-	80	-	51
01.00.05 Female WC	-	80	-	158
01.00.06 Male WC	-	80	-	160
01.00.07 Acc. WC	-	80	-	45
01.00.11 Canteen	-	80	-	2237
01.00.12 Stair	-	80	-	67
01.01.01 Lobby	-	80	-	158
01.01.02 Stair	-	80	-	62
01.01.04 Circulation	-	80	-	40
01.01.05 Female WC	-	80	-	140
01.01.06 Male WC	-	80	-	141
01.01.07 Acc. WC	-	80	-	45

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01.01.08 Open Plan Office	100	-	-	9305
01.01.09 Stair	-	80	-	57
01.01.H1 Driver Reception	80	-	-	644
01.01.H2 Hub Office	80	-	-	318
01.01.H3 Hub WC	-	80	-	122
01.01.H4 Hub Shower	-	80	-	37
01.02.01 Lobby	-	80	-	158
01.02.02 Stair	-	80	-	62
01.02.04 Circulation	-	80	-	40
01.02.05 Female WC	-	80	-	140
01.02.06 Male WC	-	80	-	141
01.02.07 Acc. WC	-	80	-	45
01.02.08 Open Plan Office	100	-	-	9305
01.02.09 Stair	-	80	-	57
01.03.01 Plant Deck	80	-	-	682
01.03.02 Stair	-	80	-	92
01.00.10 WC	-	80	-	607
01.00.09 Shower	-	80	-	273
01.00.08 Changing	80	-	-	4657
01.00.00 Warehouse	100	-	-	174660
01.01.H5 Driver Reception	80	-	-	644
01.01.H6 Hub Office	80	-	-	318
01.01.H7 Hub WC	-	80	-	122
01.01.H8 Hub Shower	-	80	-	37

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?
01.00.01 Recepton	NO (-6.5%)	NO
01.00.11 Canteen	NO (-6.7%)	NO
01.01.01 Lobby	NO (-6.8%)	NO
01.01.08 Open Plan Office	NO (-7.5%)	NO
01.01.H1 Driver Reception	NO (-57.9%)	NO
01.01.H2 Hub Office	NO (-46.7%)	NO
01.02.01 Lobby	NO (-6.8%)	NO
01.02.08 Open Plan Office	NO (-7.5%)	NO
01.00.08 Changing	N/A	N/A
01.00.00 Warehouse	NO (-26.2%)	NO
01.01.H5 Driver Reception	NO (-63.3%)	NO
01.01.H6 Hub Office	NO (-34.3%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	45711.4	45711.4
External area [m²]	101644	101644
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	2	3
Average conductance [W/K]	30330.7	26097.2
Average U-value [W/m²K]	0.3	0.26
Alpha value* [%]	10.03	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**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	1.61	0.74
Cooling	0.8	1.55
Auxiliary	0.97	0.72
Lighting	17.88	34.01
Hot water	16.68	16.23
Equipment*	44.86	44.86
TOTAL**	**37.93**	**53.24**

* 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	5.81	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	19.07	24.26
Primary energy* [kWh/m²]	85.97	129.67
Total emissions [kg/m²]	11.5	22.3

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	209.8	0	68.2	0	2.1	0.85	0	0.91	0
	Notional	0	0	0	0	0	0	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	33.2	0	10.8	0	22.1	0.85	0	0.91	0
	Notional	75	0	24.2	0	1.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	56.5	0	18.4	0	9.2	0.85	0	0.91	0
	Notional	25.2	0	8.1	0	31.3	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	48	124.6	3.4	9.3	5.9	3.92	3.74	4	5
	Notional	20.5	0	6.6	0	5.5	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	314.1	0	102.1	0	23.5	0.85	0	0.91	0
	Notional	16	250.2	1.7	18.3	3.6	2.56	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	145.8	0	47.4	0	8	0.85	0	0.91	0
	Notional	282.6	0	91.1	0	33.1	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	30.3	77.1	2.1	5.7	6.9	3.92	3.74	4	5
	Notional	115.6	0	37.2	0	4.8	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	376.6	0	122.4	0	25.2	0.85	0	0.91	0
	Notional	3.3	154.3	0.4	11.3	4.2	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	98.6	168.8	7	12.5	6.3	3.92	3.74	4	5
	Notional	60.3	0	19.4	0	35.9	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	20.4	244.6	2.2	17.9	3.8	2.56	3.79	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.33	01000005:Surf[1]
Floor	0.2	0.1	0100000B:Surf[0]
Roof	0.15	0.23	01000020:Surf[1]
Windows, roof windows, and rooflights	1.5	1.3	0100000B:Surf[89]
Personnel doors	1.5	2.2	01000020:Surf[20]
Vehicle access & similar large doors	1.5	1.5	0100000B:Surf[1]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	2

Energy Performance Certificate

Non-Domestic Building

HM Government

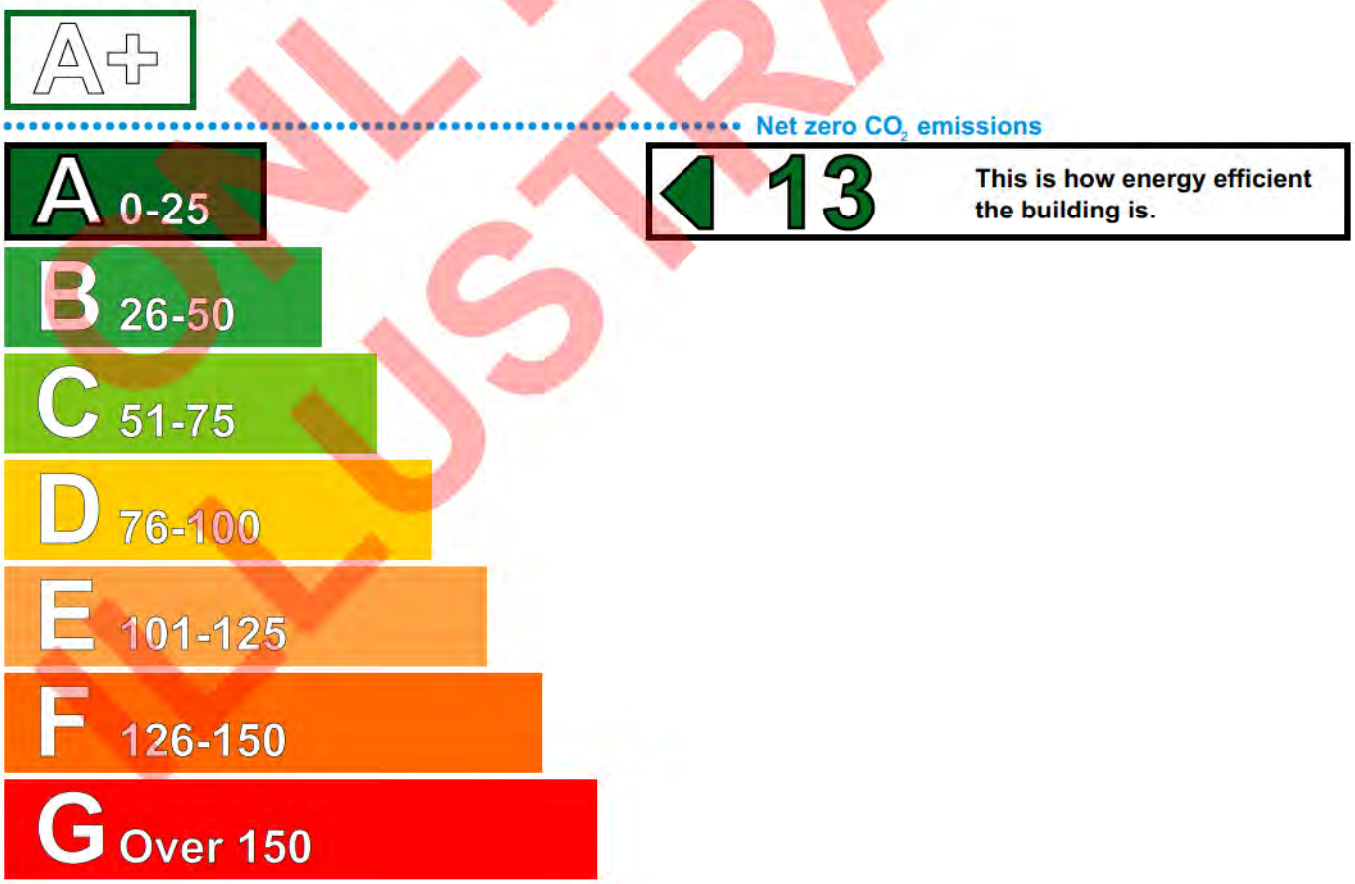
Unit 1 Green
South Caldecotte
Milton Keynes

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient



Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Air Conditioning
Total useful floor area (m^2):	45711.398
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	11.52
Primary energy use (kWh/m^2 per year):	85.97

Benchmarks

Buildings similar to this one could have ratings as follows:

26 If newly built

68 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.11 using calculation engine ApacheSim v7.0.11
Property Reference:	000000000000
Assessor Name:	Nathan Evans
Assessor Number:	LCEA091856
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Yonder Limited
Employer/Trading Address:	Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA
Issue Date:	04 Jul 2019
Valid Until:	03 Jul 2029 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at:
www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

Appendix C – Unit 9 Lean Clean BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 9 Lean Clean

As designed

Date: Thu Jul 04 09:10:51 2019

Administrative information

Building Details

Address: Unit 9 Lean Clean, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	20
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	20
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	11.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.35	0.35	60000003:Surf[0]
Floor	0.25	0.1	0.1	60000005:Surf[0]
Roof	0.25	0.23	0.23	60000003:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.34	1.5	60000005:Surf[2]
Personnel doors	2.2	2.2	2.2	60000016:Surf[1]
Vehicle access & similar large doors	1.5	1.5	1.5	60000016:Surf[8]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

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

Building services

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

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

1- HVAC 04(CORE): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.19	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

4- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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
U6.00.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A
U6.00.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.00.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.00.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.00.08 Office	-	1.5	-	-	-	-	-	-	-	-	N/A
U6.01.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
U6.01.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.01.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.01.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.01.08 Office	-	1.5	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
U6.00.01 Reception	-	80	22	273
U6.00.02 Stair	-	80	-	60
U6.00.04 Circulation	-	80	-	34
U6.00.05 WC	-	80	-	106
U6.00.06 WC	-	80	-	113
U6.00.07 Acc. WC	-	80	-	23
U6.00.08 Office	100	-	-	1272
U6.00.09 Stair	-	80	-	60
U6.01.01 Lobby	-	80	22	154
U6.01.02 Stair	-	80	-	50
U6.01.04 Circulation	-	80	-	30
U6.01.05 WC	-	80	-	89
U6.01.06 WC	-	80	-	91
U6.01.07 Acc. WC	-	80	-	23
U6.01.08 Office	100	-	-	1384
U6.01.09 Stair	-	80	-	50
U6.02.01 Stair	-	80	-	51
U6.02.02 Plant	80	-	-	192
U6.00.00 Warehouse	100	-	-	64206

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?
U6.00.01 Reception	NO (-16.4%)	NO
U6.00.08 Office	NO (-8.8%)	NO
U6.01.01 Lobby	NO (-19.1%)	NO
U6.01.08 Office	NO (-9%)	NO
U6.00.00 Warehouse	NO (-26.2%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	15382.5	15382.5
External area [m²]	36778	36778
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	10439.1	9638.53
Average U-value [W/m²K]	0.28	0.26
Alpha value* [%]	10.01	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**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	0.99	0.51
Cooling	0.3	0.55
Auxiliary	0.43	0.28
Lighting	18.31	35.14
Hot water	9.34	7.47
Equipment*	43.95	43.95
TOTAL**	**29.38**	**43.96**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	10.08	9.85
Primary energy* [kWh/m²]	70.89	118
Total emissions [kg/m²]	11.9	20

* 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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	171.5	0	55.7	0	2.1	0.85	0	0.91	0
	Notional	0	0	0	0	0	0	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	247.5	0	80.4	0	24.2	0.85	0	0.91	0
	Notional	100.1	0	32.2	0	1.2	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	98.6	110.9	7	8.2	5.9	3.92	3.74	4	5
	Notional	122.9	0	39.6	0	34.4	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	181	176.4	12.8	13.1	7	3.92	3.74	4	5
	Notional	32.3	218.1	3.5	16	3.6	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	38.4	256	4.2	18.8	4.2	2.56	3.79	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.35	60000003:Surf[0]
Floor	0.2	0.1	60000005:Surf[0]
Roof	0.15	0.23	60000003:Surf[1]
Windows, roof windows, and rooflights	1.5	1.3	60000016:Surf[30]
Personnel doors	1.5	2.2	60000016:Surf[1]
Vehicle access & similar large doors	1.5	1.5	60000016:Surf[8]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Energy Performance Certificate

Non-Domestic Building

HM Government

Unit 9 Lean Clean
South Caldecotte
Milton Keynes

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

14 This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Air Conditioning
Total useful floor area (m^2):	15382.500
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	11.95
Primary energy use (kWh/m^2 per year):	70.89

Benchmarks

Buildings similar to this one could have ratings as follows:

24 If newly built

64 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.11 using calculation engine ApacheSim v7.0.11
Property Reference:	000000000000
Assessor Name:	Nathan Evans
Assessor Number:	LCEA091856
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Yonder Limited
Employer/Trading Address:	Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA
Issue Date:	04 Jul 2019
Valid Until:	03 Jul 2029 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

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To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

Appendix D – Unit 9 Green BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 9 Green

As designed

Date: Thu Jul 04 09:19:37 2019

Administrative information

Building Details

Address: Unit 9 Green, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	20
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	20
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	9.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.35	0.35	60000003:Surf[0]
Floor	0.25	0.1	0.1	60000005:Surf[0]
Roof	0.25	0.23	0.23	60000003:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.34	1.5	60000005:Surf[2]
Personnel doors	2.2	2.2	2.2	60000016:Surf[1]
Vehicle access & similar large doors	1.5	1.5	1.5	60000016:Surf[8]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

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

Building services

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

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

1- HVAC 04(CORE): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.19	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

4- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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
U6.00.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A
U6.00.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.00.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.00.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.00.08 Office	-	1.5	-	-	-	-	-	-	-	-	N/A
U6.01.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
U6.01.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.01.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.01.07 Acc. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
U6.01.08 Office	-	1.5	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
U6.00.01 Reception	-	80	22	273
U6.00.02 Stair	-	80	-	60
U6.00.04 Circulation	-	80	-	34
U6.00.05 WC	-	80	-	106
U6.00.06 WC	-	80	-	113
U6.00.07 Acc. WC	-	80	-	23
U6.00.08 Office	100	-	-	1272
U6.00.09 Stair	-	80	-	60
U6.01.01 Lobby	-	80	22	154
U6.01.02 Stair	-	80	-	50
U6.01.04 Circulation	-	80	-	30
U6.01.05 WC	-	80	-	89
U6.01.06 WC	-	80	-	91
U6.01.07 Acc. WC	-	80	-	23
U6.01.08 Office	100	-	-	1384
U6.01.09 Stair	-	80	-	50
U6.02.01 Stair	-	80	-	51
U6.02.02 Plant	80	-	-	192
U6.00.00 Warehouse	100	-	-	64206

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?
U6.00.01 Reception	NO (-16.4%)	NO
U6.00.08 Office	NO (-8.8%)	NO
U6.01.01 Lobby	NO (-19.1%)	NO
U6.01.08 Office	NO (-9%)	NO
U6.00.00 Warehouse	NO (-26.2%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	15382.5	15382.5
External area [m^2]	36778	36778
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	10439.1	9638.53
Average U-value [W/m^2K]	0.28	0.26
Alpha value* [%]	10.01	10

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

Building Use

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	0.99	0.51
Cooling	0.3	0.55
Auxiliary	0.43	0.28
Lighting	18.31	35.14
Hot water	9.34	7.47
Equipment*	43.95	43.95
TOTAL**	**29.38**	**43.96**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	4.65	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	10.08	9.85
Primary energy* [kWh/m^2]	70.89	118
Total emissions [kg/m^2]	9.5	20

* 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
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[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	247.5	0	80.4	0	24.2	0.85	0	0.91	0
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More energy efficient

A+

Net zero CO_2 emissions

A 0-25

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Assessor Number:	LCEA091856
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Yonder Limited
Employer/Trading Address:	Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA
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Valid Until:	03 Jul 2029 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

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Appendix E – Unit 7 Lean Clean BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 7 Lean Clean

As designed

Date: Thu Jul 04 08:40:50 2019

Administrative information

Building Details

Address: Unit 7 Lean Clean, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	12.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	12.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	9.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.35	0.35	B1000017:Surf[10]
Floor	0.25	0.16	0.16	B1000005:Surf[0]
Roof	0.25	0.23	0.23	B1000000:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.8	2	B1000017:Surf[1]
Personnel doors	2.2	2.2	2.2	B1000017:Surf[5]
Vehicle access & similar large doors	1.5	1.5	1.5	B1000017:Surf[11]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

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

Building services

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

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

1- HVAC 04(CORE): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

4- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

5- HVAC 02(WELF): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

6- HVAC 03(WELF): HTG MV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	0.7
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.007
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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
B1.00.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.00.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.07 Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.01.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.07 Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.00.11 Shower	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.12 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.00.10 Locker	-	-	-	1.5	-	-	-	-	-	-	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	
B1.00.01 Reception	-	80	22	237
B1.00.02 Stair	-	80	-	46
B1.00.04 Circulation	-	80	-	35
B1.00.05 WC	-	80	-	112
B1.00.06 WC	-	80	-	114
B1.00.07 Acc WC	-	80	-	35
B1.00.09 Stair	-	80	-	46
B1.01.01 Lobby	-	80	22	237
B1.01.02 Stair	-	80	-	46

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B1.01.04 Circulation	-	80	-	35
B1.01.05 WC	-	80	-	112
B1.01.06 WC	-	80	-	114
B1.01.07 Acc WC	-	80	-	35
B1.01.08 Open Plan Office	100	-	-	1456
B1.01.09 Stair	-	80	-	46
B1.00.11 Shower	-	80	-	30
B1.00.12 WC	-	80	-	65
B1.00.08 Open Plan Office	100	-	-	870
B1.00.10 Locker	80	-	-	679
B1.00.00 Warehouse	100	-	-	20035

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?
B1.00.01 Reception	NO (-9.1%)	NO
B1.01.01 Lobby	NO (-9.1%)	NO
B1.01.08 Open Plan Office	NO (-18.8%)	NO
B1.00.08 Open Plan Office	NO (-19.1%)	NO
B1.00.10 Locker	N/A	N/A
B1.00.00 Warehouse	NO (-26.3%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	5357.5	5357.5
External area [m²]	12328.5	12328.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	5
Average conductance [W/K]	4501.36	3740.49
Average U-value [W/m²K]	0.37	0.3
Alpha value* [%]	10.13	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**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	4.24	2.74
Cooling	0.93	1.03
Auxiliary	1.36	1.03
Lighting	8.65	17
Hot water	13.04	11.1
Equipment*	30.46	30.46
TOTAL**	**28.21**	**32.9**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	35.17	25.73
Primary energy* [kWh/m²]	58	76.45
Total emissions [kg/m²]	9.5	12.8

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	283.1	0	92	0	2.1	0.85	0	0.91	0
	Notional	0	0	0	0	0	0	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	119.6	0	38.9	0	18.3	0.85	0	0.91	0
	Notional	163.6	0	52.7	0	1.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	69.3	0	22.5	0	8	0.85	0	0.91	0
	Notional	107.8	0	34.7	0	25.5	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	129.2	124.8	9.1	9.3	5.9	3.92	3.74	4	5
	Notional	37.4	0	12.1	0	4.8	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	684.1	0	222.3	0	22.2	0.85	0	0.91	0
	Notional	52.4	146.3	5.7	10.7	3.6	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	150.2	168.2	10.6	12.5	7	3.92	3.74	4	5
	Notional	456.7	0	147.1	0	31	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	53.6	168.6	5.8	12.4	4.2	2.56	3.79	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.33	B1000006:Surf[1]
Floor	0.2	0.16	B1000005:Surf[0]
Roof	0.15	0.23	B1000000:Surf[0]
Windows, roof windows, and rooflights	1.5	1.5	B1000005:Surf[1]
Personnel doors	1.5	2.2	B1000017:Surf[5]
Vehicle access & similar large doors	1.5	1.5	B1000017:Surf[11]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Energy Performance Certificate

Non-Domestic Building

HM Government

Unit 7 Lean Clean
South Caldecotte
Milton Keynes

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

15 **This is how energy efficient the building is.**

Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Air Conditioning
Total useful floor area (m^2):	5357.500
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	9.52
Primary energy use (kWh/m^2 per year):	58

Benchmarks

Buildings similar to this one could have ratings as follows:

21 If newly built

55 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.11 using calculation engine ApacheSim v7.0.11
Property Reference:	000000000000
Assessor Name:	Nathan Evans
Assessor Number:	LCEA091856
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Yonder Limited
Employer/Trading Address:	Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA
Issue Date:	04 Jul 2019
Valid Until:	03 Jul 2029 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at:
www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

Appendix F – Unit 7 Green BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 7 Green

As designed

Date: Thu Jul 04 08:50:14 2019

Administrative information

Building Details

Address: Unit 7 Green, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	12.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	12.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	7.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.35	0.35	B1000017:Surf[10]
Floor	0.25	0.16	0.16	B1000005:Surf[0]
Roof	0.25	0.23	0.23	B1000000:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.8	2	B1000017:Surf[1]
Personnel doors	2.2	2.2	2.2	B1000017:Surf[5]
Vehicle access & similar large doors	1.5	1.5	1.5	B1000017:Surf[11]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

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

Building services

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

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

1- HVAC 04(CORE): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

4- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

5- HVAC 02(WELF): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

6- HVAC 03(WELF): HTG MV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	0.7
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.007
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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
B1.00.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.00.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.07 Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.01 Lobby	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.01.05 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.06 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.07 Acc WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.01.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.00.11 Shower	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.12 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1.00.08 Open Plan Office	-	1.5	-	-	-	-	-	-	-	-	N/A
B1.00.10 Locker	-	-	-	1.5	-	-	-	-	-	-	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	
B1.00.01 Reception	-	80	22	237
B1.00.02 Stair	-	80	-	46
B1.00.04 Circulation	-	80	-	35
B1.00.05 WC	-	80	-	112
B1.00.06 WC	-	80	-	114
B1.00.07 Acc WC	-	80	-	35
B1.00.09 Stair	-	80	-	46
B1.01.01 Lobby	-	80	22	237
B1.01.02 Stair	-	80	-	46

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B1.01.04 Circulation	-	80	-	35
B1.01.05 WC	-	80	-	112
B1.01.06 WC	-	80	-	114
B1.01.07 Acc WC	-	80	-	35
B1.01.08 Open Plan Office	100	-	-	1456
B1.01.09 Stair	-	80	-	46
B1.00.11 Shower	-	80	-	30
B1.00.12 WC	-	80	-	65
B1.00.08 Open Plan Office	100	-	-	870
B1.00.10 Locker	80	-	-	679
B1.00.00 Warehouse	100	-	-	20035

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?
B1.00.01 Reception	NO (-9.1%)	NO
B1.01.01 Lobby	NO (-9.1%)	NO
B1.01.08 Open Plan Office	NO (-18.8%)	NO
B1.00.08 Open Plan Office	NO (-19.1%)	NO
B1.00.10 Locker	N/A	N/A
B1.00.00 Warehouse	NO (-26.3%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	5357.5	5357.5
External area [m²]	12328.5	12328.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	5
Average conductance [W/K]	4501.36	3740.49
Average U-value [W/m²K]	0.37	0.3
Alpha value* [%]	10.13	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**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	4.24	2.74
Cooling	0.93	1.03
Auxiliary	1.36	1.03
Lighting	8.65	17
Hot water	13.04	11.1
Equipment*	30.46	30.46
TOTAL**	**28.21**	**32.9**

* 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	3.91	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	35.17	25.73
Primary energy* [kWh/m²]	58	76.45
Total emissions [kg/m²]	7.5	12.8

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	283.1	0	92	0	2.1	0.85	0	0.91	0
	Notional	0	0	0	0	0	0	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	119.6	0	38.9	0	18.3	0.85	0	0.91	0
	Notional	163.6	0	52.7	0	1.2	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	69.3	0	22.5	0	8	0.85	0	0.91	0
	Notional	107.8	0	34.7	0	25.5	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	129.2	124.8	9.1	9.3	5.9	3.92	3.74	4	5
	Notional	37.4	0	12.1	0	4.8	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	684.1	0	222.3	0	22.2	0.85	0	0.91	0
	Notional	52.4	146.3	5.7	10.7	3.6	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	150.2	168.2	10.6	12.5	7	3.92	3.74	4	5
	Notional	456.7	0	147.1	0	31	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	53.6	168.6	5.8	12.4	4.2	2.56	3.79	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.33	B1000006:Surf[1]
Floor	0.2	0.16	B1000005:Surf[0]
Roof	0.15	0.23	B1000000:Surf[0]
Windows, roof windows, and rooflights	1.5	1.5	B1000005:Surf[1]
Personnel doors	1.5	2.2	B1000017:Surf[5]
Vehicle access & similar large doors	1.5	1.5	B1000017:Surf[11]
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Energy Performance Certificate

Non-Domestic Building

HM Government

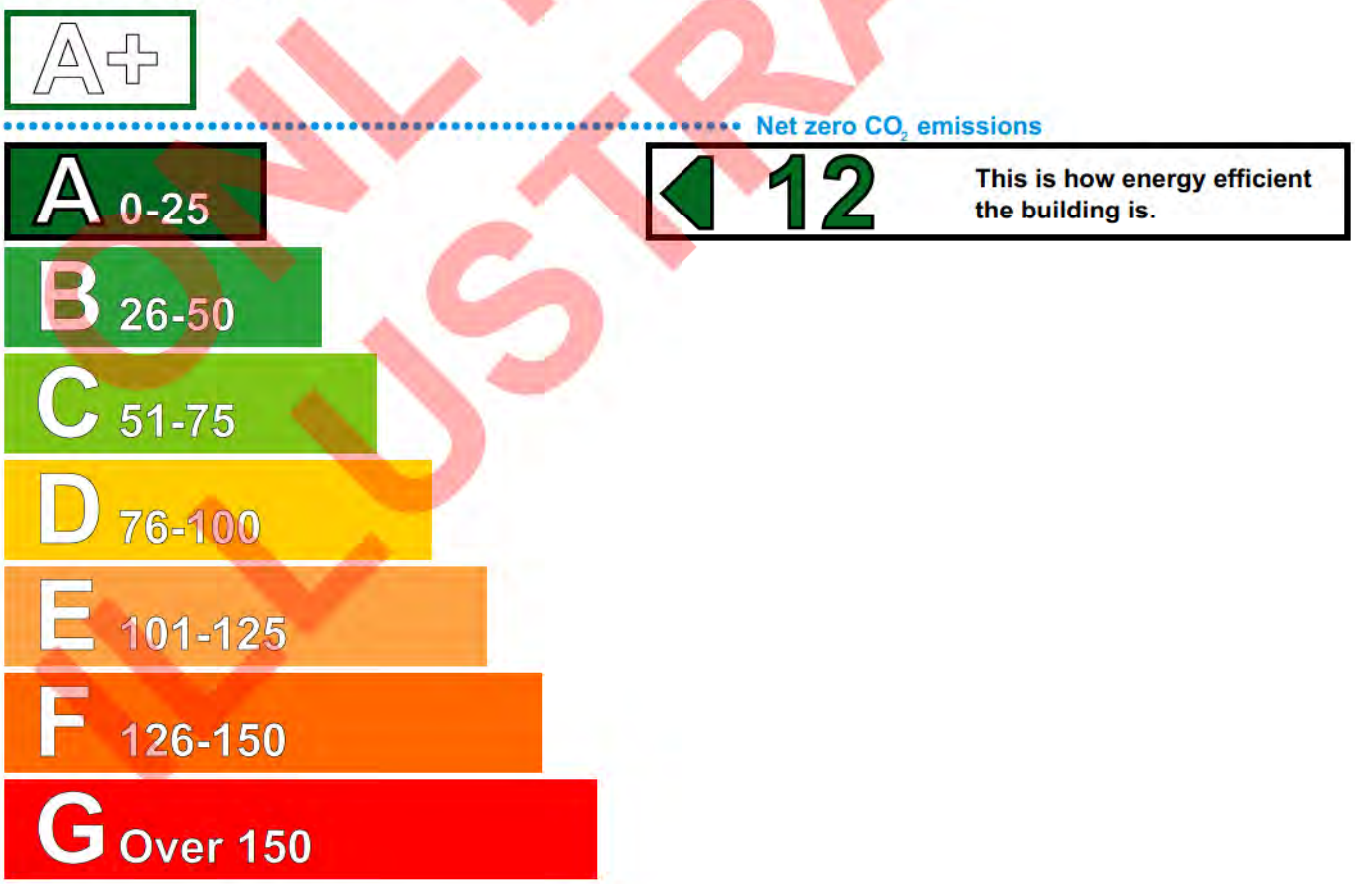
Unit 7 Green
South Caldecotte
Milton Keynes

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient



Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Air Conditioning
Total useful floor area (m^2):	5357.500
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	7.49
Primary energy use (kWh/m^2 per year):	58

Benchmarks

Buildings similar to this one could have ratings as follows:

21 If newly built

55 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.11 using calculation engine ApacheSim v7.0.11
Property Reference:	000000000000
Assessor Name:	Nathan Evans
Assessor Number:	LCEA091856
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Yonder Limited
Employer/Trading Address:	Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA
Issue Date:	04 Jul 2019
Valid Until:	03 Jul 2029 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at:
www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

Appendix G – Unit 6 Lean Clean BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 6 Lean Clean

As designed

Date: Thu Jul 04 10:31:25 2019

Administrative information

Building Details

Address: Unit 6 Lean Clean, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	16.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	16.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	13.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	00000001:Surf[5]
Floor	0.25	0.2	0.2	00000001:Surf[0]
Roof	0.25	0.18	0.18	00000005:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	00000001:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	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- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.007
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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**
00.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00.03 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
00.04 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
00.05 Open Office	-	1.5	-	-	-	-	-	-	-	-	N/A
01.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A
01.03 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.04 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.05 Open Office	-	1.5	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00.01 Reception	-	100	22	129
00.02 Stair	-	80	-	55
00.03 WC	-	80	-	82
00.04 WC	-	80	-	82
00.05 Open Office	100	-	-	2444
01.01 Reception	-	100	22	129
01.02 Stair	-	80	-	55
01.03 WC	-	80	-	82
01.04 WC	-	80	-	82
01.05 Open Office	100	-	-	2444

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?
00.01 Reception	NO (-53.9%)	NO
00.05 Open Office	NO (-48.7%)	NO
01.01 Reception	NO (-53.9%)	NO
01.05 Open Office	NO (-48.7%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	967.2	967.2
External area [m²]	1714.4	1714.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	582.8	0
Average U-value [W/m²K]	0.34	0
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	6.73
Cooling	5.67	7.07
Auxiliary	4.28	3.26
Lighting	10.65	15.67
Hot water	4.47	2.65
Equipment*	37.01	37.01
TOTAL**	**29.67**	**35.38**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	123.36	149.77
Primary energy* [kWh/m²]	86.95	114.57
Total emissions [kg/m²]	13.2	16.7

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	63.2	0	20.5	0	1.7	0.85	0	0.91	0
	Notional	55.8	0	18	0	1	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	38.3	0	12.4	0	16.6	0.85	0	0.91	0
	Notional	34.4	0	11.1	0	23.4	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	46.9	84.9	3.3	6.3	3.4	3.92	3.74	4	5
	Notional	54.4	107.3	5.9	7.9	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	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	00000001:Surf[5]
Floor	0.2	0.2	00000001:Surf[0]
Roof	0.15	0.18	00000005:Surf[0]
Windows, roof windows, and rooflights	1.5	1.5	00000001:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

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

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

Energy Performance Certificate

Non-Domestic Building

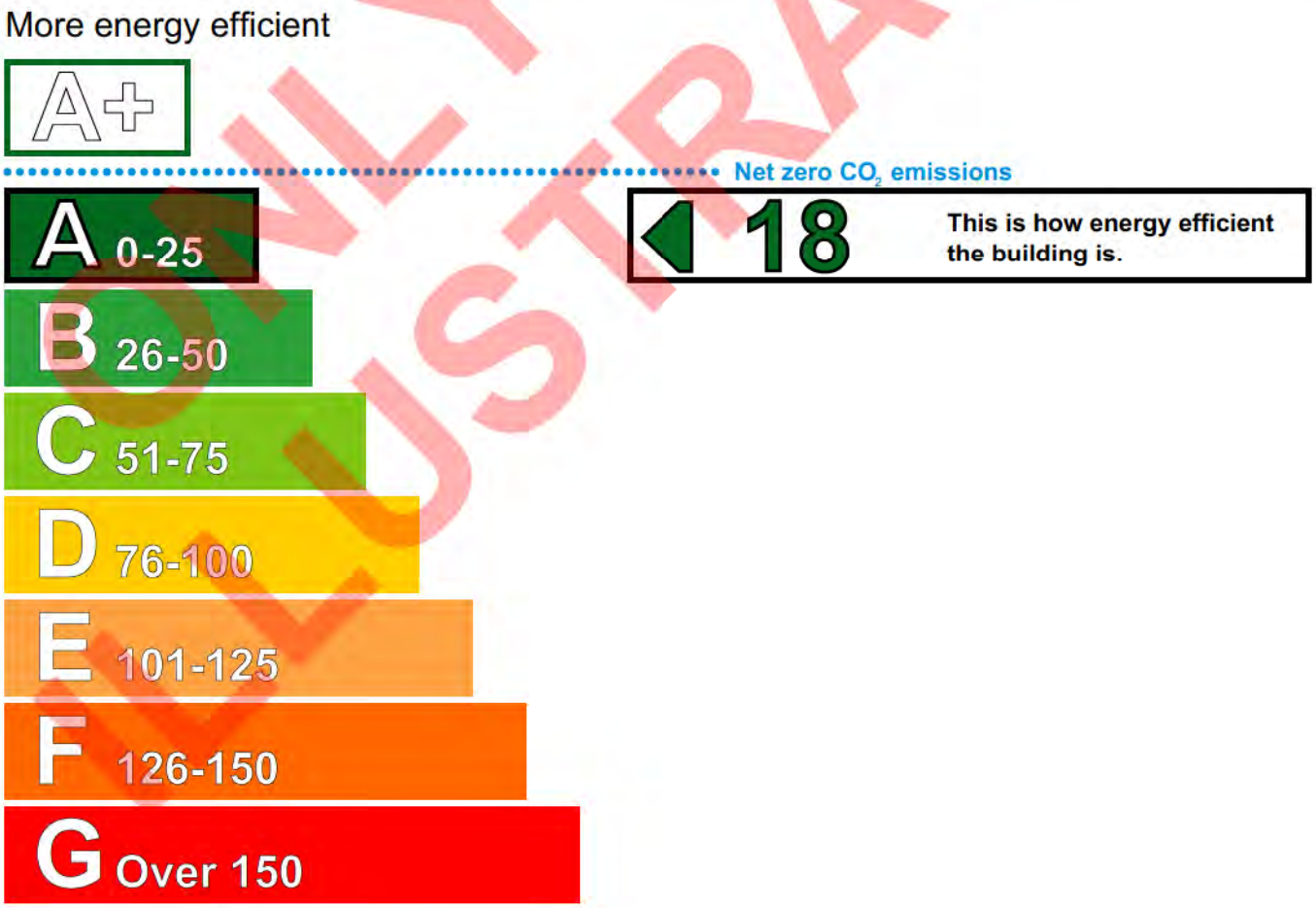
HM Government

Unit 6 Lean Clean
South Caldecotte
Milton Keynes

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating



Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Air Conditioning
Total useful floor area (m^2):	967.200
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	13.25
Primary energy use (kWh/m^2 per year):	86.95

Benchmarks

Buildings similar to this one could have ratings as follows:

23 If newly built

62 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.11 using calculation engine ApacheSim v7.0.11
Property Reference:	000000000000
Assessor Name:	Nathan Evans
Assessor Number:	LCEA091856
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Yonder Limited
Employer/Trading Address:	Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA
Issue Date:	04 Jul 2019
Valid Until:	03 Jul 2029 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

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This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

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Appendix H – Unit 6 Green BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Unit 6 Green

As designed

Date: Thu Jul 04 10:32:26 2019

Administrative information

Building Details

Address: Unit 6 Green, Milton Keynes,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01134 931 280

Address: Yonder Limited, Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	16.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	16.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	10.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	00000001:Surf[5]
Floor	0.25	0.2	0.2	00000001:Surf[0]
Roof	0.25	0.18	0.18	00000005:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	00000001:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

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

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

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	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- HVAC 04(OFFI): VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 01(CORE): HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.					

3- HVAC 02(CORE): HTG EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.3	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW 01: Gas Fired

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.007
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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**
00.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00.03 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
00.04 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
00.05 Open Office	-	1.5	-	-	-	-	-	-	-	-	N/A
01.01 Reception	-	1.5	-	-	-	-	-	-	-	-	N/A
01.03 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.04 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.05 Open Office	-	1.5	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00.01 Reception	-	100	22	129
00.02 Stair	-	80	-	55
00.03 WC	-	80	-	82
00.04 WC	-	80	-	82
00.05 Open Office	100	-	-	2444
01.01 Reception	-	100	22	129
01.02 Stair	-	80	-	55
01.03 WC	-	80	-	82
01.04 WC	-	80	-	82
01.05 Open Office	100	-	-	2444

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?
00.01 Reception	NO (-53.9%)	NO
00.05 Open Office	NO (-48.7%)	NO
01.01 Reception	NO (-53.9%)	NO
01.05 Open Office	NO (-48.7%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	967.2	967.2
External area [m²]	1714.4	1714.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	582.8	0
Average U-value [W/m²K]	0.34	0
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	6.73
Cooling	5.67	7.07
Auxiliary	4.28	3.26
Lighting	10.65	15.67
Hot water	4.47	2.65
Equipment*	37.01	37.01
TOTAL**	**29.67**	**35.38**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	5.28	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	123.36	149.77
Primary energy* [kWh/m²]	86.95	114.57
Total emissions [kg/m²]	10.5	16.7

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Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

15 This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Air Conditioning
Total useful floor area (m^2):	967.200
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	10.51
Primary energy use (kWh/m^2 per year):	86.95

Benchmarks

Buildings similar to this one could have ratings as follows:

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