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Energy Statement Mid Kent Golf Club

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Newark (Head) Office:

Newark Beacon, Beacon Hill Office Park,
Cafferata Way, Newark, Notts, NG24 2TN.
Tel: 01636 653 055

London Office:

344-354 Gray's Inn Road, King's Cross,
London WC1X 8BP.
Tel: 0207 033 3757

Birmingham Office:

2nd Floor Quayside Tower, 252-260 Broad St,
Birmingham B1 2HF.
Tel: 0121 285 2785

info@mesbuildingsolutions.co.uk | www.mesbuildingsolutions.co.uk

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About MES Building Solutions

MES Building Solutions is an established consultancy practice specialising in providing building solutions throughout the UK.

We offer a full range of services for both residential and commercial buildings from small individual properties through to highly complex mixed use developments.

We are an industry leader in delivering a professional, accredited and certified service to a wide range of clients including architects, developers, builders, housing associations, the public sector and private householders.

Employing highly qualified staff, our team comes from a variety of backgrounds within the construction industry with combined knowledge of building design, engineering, assessment, construction, development, research and surveying.

We are renowned for our creative thinking and provide a high quality, honest and diligent service.

MES Building Solutions maintains its position at the forefront of changes in planning, building regulations and neighbourly matters, as well as technological advances. Our clients, large or small are therefore assured of a cost effective, cohesive and fully integrated professional service.



List of contents

1. Introduction
 - 1.1 Executive Summary
 - 1.2 Planning Policy
 - 1.3 SAP 10
2. Description of development
 - 2.1 Location
 - 2.2 Details of development
3. Energy Statement
 - 3.1 Energy Hierarchy
 - 3.2 Calculating Baseline Energy Demand
 - 3.3 'Be Lean & Be Clean' – Building Efficiency Improvements
 - 3.4 'Be Green' – CO₂ reduction through the use of renewable or LZC technologies
4. Overheating

Appendix A – SBEM Calculations for 'Baseline'

Appendix B – SBEM Calculations for 'Be Lean, Be Clean'

Appendix C – SBEM Calculations for 'Be Green'

Appendix D – Potential ASHP Data Sheet

Appendix E – PV generation calculation



Section 1: Introduction

1.1 Executive Summary

MES Building Solutions has been engaged to provide an energy statement in order to address the requirements of Gravesham Borough Council in relation to the proposed development at Mid Kent Golf Club. The purpose of this energy statement is to provide an overview of how energy and carbon efficiency will be promoted both during and after construction and to establish the predicted energy requirements for the proposed development. It will illustrate how energy efficiency measures in conjunction with renewable generation can be used to reduce the predicted energy consumption and associated carbon dioxide emissions.

The applicable planning policies this report will address are detailed in the Gravesham Local Plan Core Strategy. The relevant policies dovetail, with policy CS15 from the Merton Core Strategy covering the same ground as the London Plan 2021 policies SI2 & SI3. London Plan 2021 policy SI4 is also covered in this report under Section 4 and policy SI5 is covered in Section 5.

The energy and carbon reductions required have been achieved by following the energy hierarchy, which includes:

- Calculation of estimated baseline energy consumption & CO₂ emissions using SBEM calculations
- Implementation of the energy hierarchy (be lean, be clean, be green)
- Calculation of estimated energy consumption & CO₂ emissions at each stage of energy hierarchy
- Calculation of estimated final energy consumption & CO₂ emissions
- Calculation of reduction in emissions achieved
- Calculation of contribution from renewable, decentralised or low carbon generation, if applicable

In line with the favoured approach of Merton Council and the GLA we have calculated the total energy requirement for the development using Part L 2013 SAP calculations for a representative sample of the apartments. For the commercial unit an indicative SBEM calculation has been used modelled in IES Apache. SAP10 carbon factors have then been applied to the modelled energy consumption used to calculate the resulting CO₂ emissions from the development. This is in line with the guidance contained in paragraph 9.2.6 of the London Plan 2021. For the



proposed development at Mid Kent Golf Club this has been achieved by the use of;

- Improved building fabric over the Part L 2013 baseline requirements.
- Use of an ASHP for space heating

Tables 1b & 1c, below, show the modelled performance based on the SBEM calculations for each stage of the Energy Hierarchy. Further details can be found in Section 3 and the appendices to this report.

	Energy Consumption (kWh per annum)	Carbon Dioxide Emissions (Tonnes CO ₂ per annum)	
	Regulated	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	230,895	48.6	10
After energy demand reduction	228,403	48.1	10
After renewable energy	109,304	25.5	10

Table 1b: Total energy consumption and carbon emissions – SAP10

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	48.6		
Be Lean, Be Clean	48.1	0.5	1%
Be Green	25.5	22.6	47%
Cumulative Total	-	23.2	48%

Table 1c: Total savings in regulated carbon emissions – SAP10

In line with London Plan 2021 policy S14 an overheating assessment has been undertaken using the Good Homes Alliance Overheating Risk Tool. The completed tool can be found in Appendix E with full details contained in Section 4 of this report.

1.2 Planning Policy

In terms of planning policy relating to energy and carbon emissions, the relevant provisions in the Gravesham Borough Core Strategy Local Plan are contained in policy CS18 – which is reproduced below for information.



Policy CS18: Climate Change

Flood Risk

5.14.36 With the exception of the previously developed sites along the Thames Riverside (see Policies CS03, CS04 and CS05) and those other regeneration sites which have already been evaluated in accordance with the sequential and exception tests at the application stage, development will be directed sequentially to those areas at least risk of flooding.

5.14.37 Proposals in areas at risk of flooding must be accompanied by a Flood Risk Assessment (in accordance with national policy and Environment Agency standing guidance as appropriate) and a Flood Risk Management Plan (if required) to demonstrate that they are adequately defended and safe over their lifetime. Planning permission will be refused for schemes which do not pass the sequential and exception tests.

5.14.38 The Council will prioritise the maintenance, improvement or replacement of flood defence infrastructure over other land uses where relevant. In addition to meeting their own flood defence and management needs, the Council will expect new development to take advantage of opportunities to reduce the causes and impacts of flooding from all sources where it is technically and financially feasible.

Water Quality

5.14.39 As part of its approach to climate change and environmental improvement, the Council will have regard to the delivery of the Water Framework Directive and associated Thames River Basin Management Plan objectives to support water bodies being progressively improved to “good” status over the plan period.

Sustainable Drainage and Surface Water Run-Off

5.14.40 The Council will seek to minimise the impact of drainage from new development on waste water systems. In particular, the Council will:

- Require that surface water run-off from all new development has, as a minimum, no greater adverse impact than the existing use; and
- Require the use of Sustainable Drainage Systems on all developments where technically and financially feasible.

Water Demand Management

5.14.41 The Council will seek to manage the supply of water in the Borough and reduce the impact of new development on the supply of potable water as much as possible. In particular, the Council will:

- Require all new homes to be built to at least level 3/4 of the Code for Sustainable Homes in terms of water use (105 litres per person per day consumption). Where it can be demonstrated that a development is unable to meet these standards, or the additional standards set out below, permission will only be granted if provision is made for compensatory water savings elsewhere in the Borough;
- Seek 5% of homes on Key Sites to act as exemplars by meeting level 5/6 of the Code for Sustainable Homes in terms of water use (80 litres per person per day consumption);



- Require all non-residential developments of 1,000 sq m and above to meet the BREEAM "excellent" standards of water efficiency and include provision for the collection of rainwater; and
- Support proposals to retrofit existing residential properties in ways which reduce water consumption.

Carbon Reduction

5.14.42 The Council will seek to reduce the overall carbon footprint of the Borough. In particular, the Council will:

- In the context of national policy on the transition to zero carbon development via amendments to Part L of the Building Regulations, require proposals for development of the Key Sites throughout the Borough and other major development elsewhere in the Gravesend Town Centre Opportunity Area to consider the potential and include proposals for low carbon and renewable energy generation, including combined heat and power. Where choosing not to do so, applicants must submit evidence which demonstrates that compliance is not technically or financially feasible or that improved fabric energy efficiency or an allowable solution results in improved carbon saving benefits;
- Support stand-alone decentralised, renewable or low carbon energy development where it is compatible with national policies for protecting the Green Belt and where it accords with policies in this plan, in particular those relating to Development and Design Principles, Transport, Green Infrastructure, and Heritage and the Historic Environment; and
- Support other proposals which lead to a reduction in carbon footprint including the retrofitting of existing homes and businesses, including local initiatives based on carbon off-setting via allowable solution

This report will address the requirements of CS18 that relate to carbon reduction.

1.3 SAP 10

The following guidance was issued by the GLA, in October 2018, for all new developments;

'Grid electricity has been significantly decarbonised since the last update of Part L in April 2014 and in July 2018 the Government published updated carbon emission factors (SAP 10) demonstrating this. These new emission factors will however not be incorporated into Part L of the Building Regulations until the Government has consulted on new Building Regulations.

The impact of these new emission factors is significant in that technologies generating on-site electricity (such as gas-engine CHP and solar PV) will not achieve the carbon savings they have to date. It is therefore anticipated that developments will need to utilise alternative or additional technologies to meet the 35 per cent on-site carbon



reduction target, including using zero emission or local secondary heat sources.

The GLA has decided that from January 2019 and until central Government updates Part L with the latest carbon emission factors, planning applicants are encouraged to use the SAP 10 emission factors for referable applications when estimating CO₂ emission performance against London Plan policies.'

The above is a reflection that the SAP2012 carbon factors are now over 10 years old, and significantly out of date. The use of SAP2012 carbon factors can result in developments targeting specifications that do not achieve the required carbon reductions – for example, significantly less PV generation is required when using SAP2012 carbon factors as when using SAP10 carbon factors.

As a result of the above guidance, and to ensure the accuracy and relevance of the proposed specification, MES have based all calculations within this report on the SAP10 carbon factors – these can be found in Table 2, below.

Emissions kg/CO ₂ /kWh		
	Part L 2013	SAP 10
Mains Gas	0.216	0.210
Electricity	0.519	0.233

Table 1d: Part L 2013 and SAP10 emission factors



Section 2: Description of development

2.1 Location

This report is produced in support of a planning application to Gravesend Borough Council for the proposed development at Mid Kent Golf Club

The site is situated due south of the centre of Gravesend, about 1.6km away from Gravesend rail station, with the site also fairly close to Ebbsfleet International station and the A2/M2 corridor. An aerial photo of the site location can be found as Figure 2.1, below.



Figure 2.1: Aerial photo of site location

2.2 Details of development

The proposed development is for the extension and remodelling of the clubhouse at East Kent Golf Club. The work to the thermal fabric of the building consists of a two-storey extension to the western side. There is also a limited amount of internal remodelling – which is restricted to the bar and hospitality areas of the western ‘half’ of the building.

Excerpts from relevant drawings can be found in Figures 2.2 to 2.9 below.





Figure 2.2: Existing Ground Floor Plan – application area marked

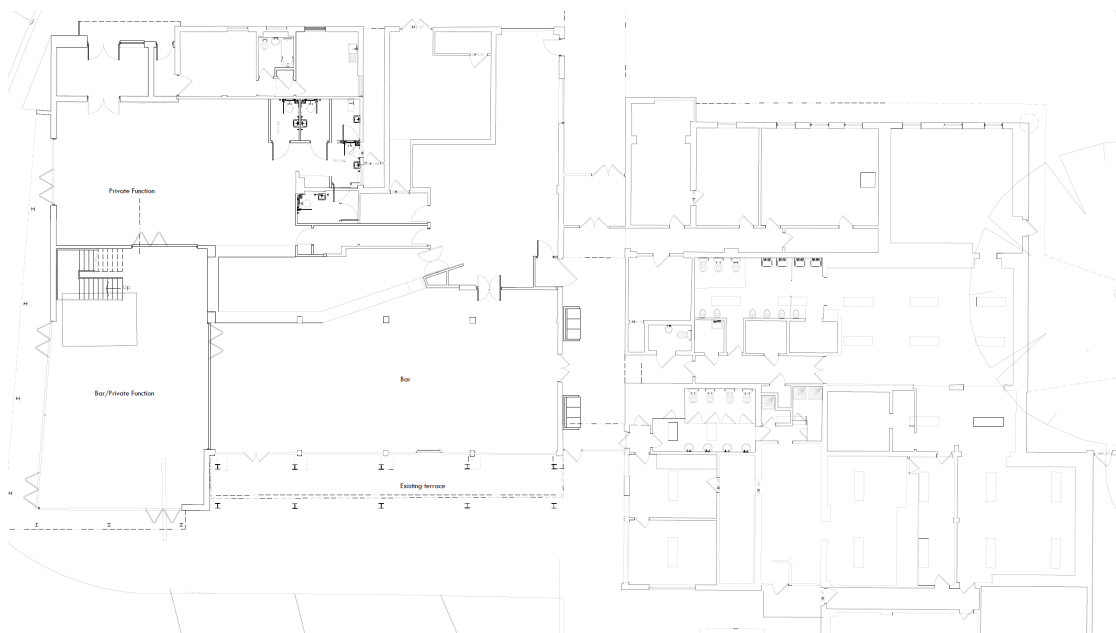


Figure 2.3: Proposed Ground Floor Plan



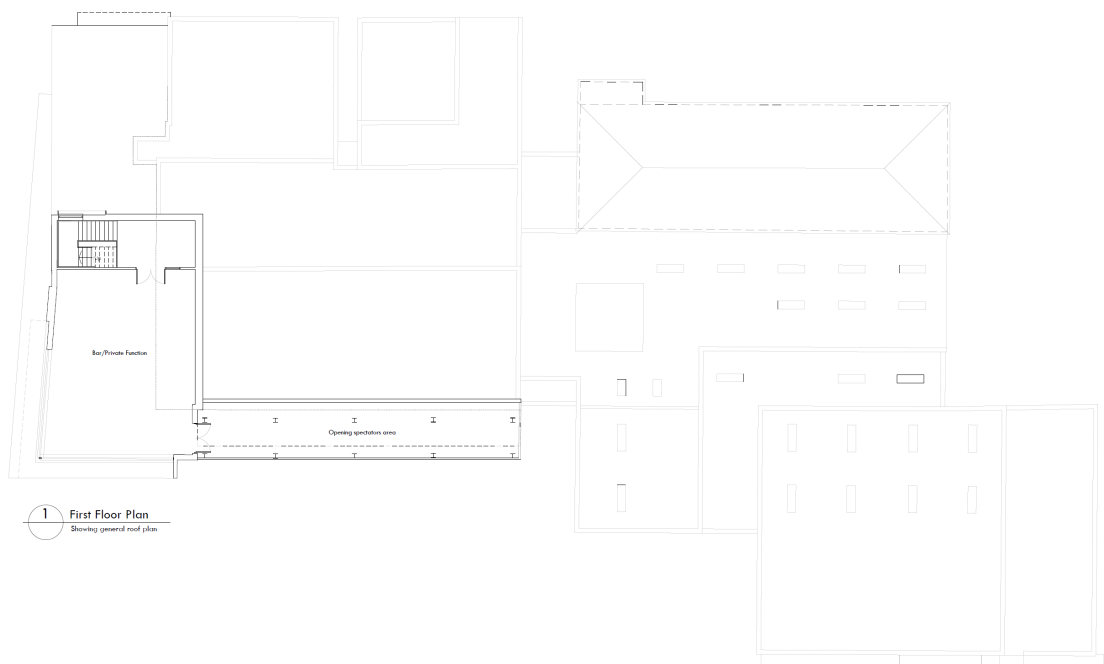


Figure 2.4: Proposed First Floor Plan

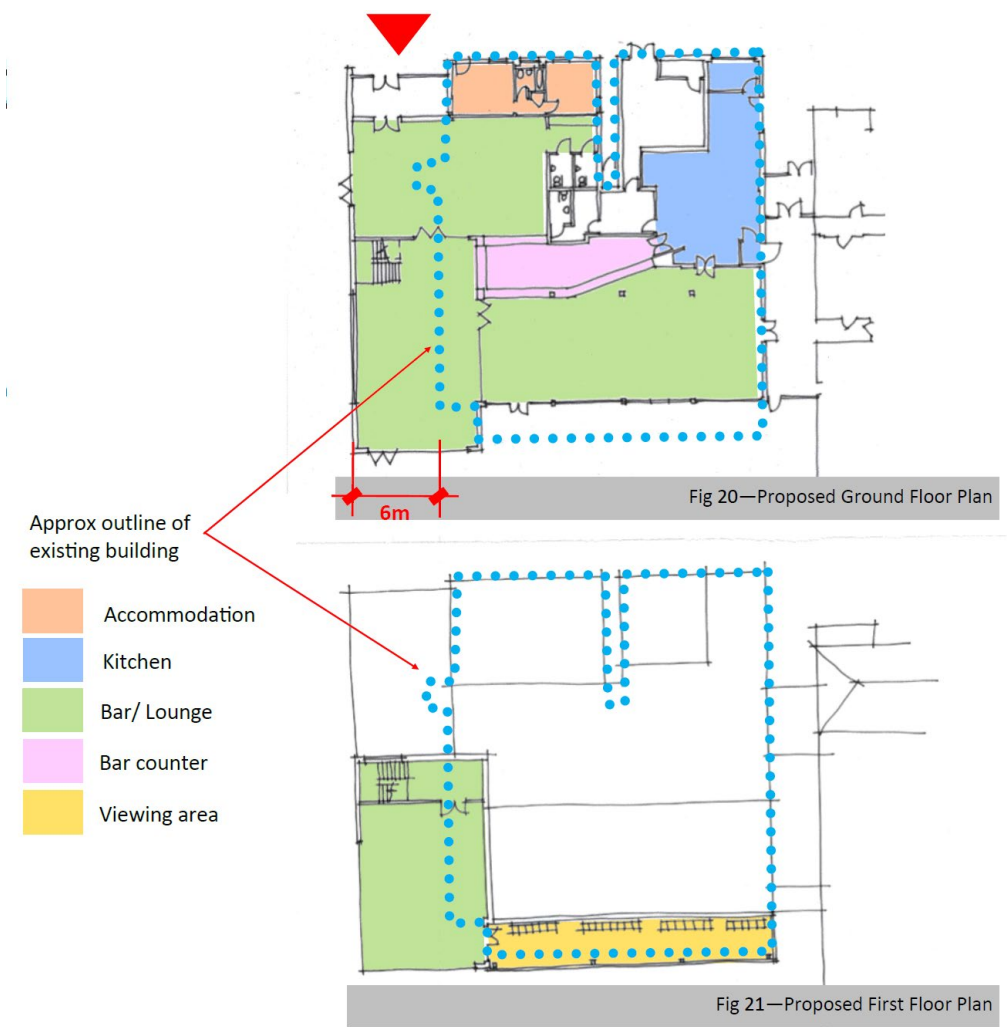


Figure 2.5: Proposed Floor Plans – areas marked





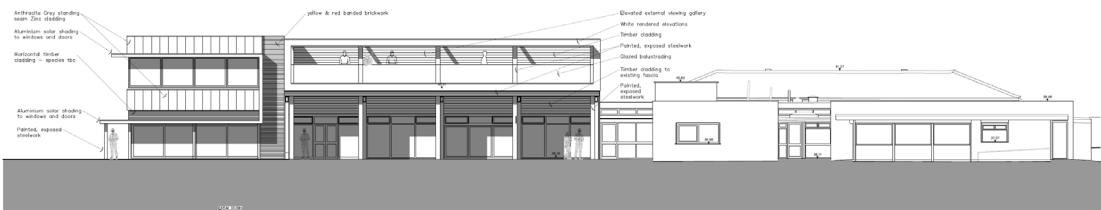
1 North Elevation

Figure 2.6: Proposed North Elevation



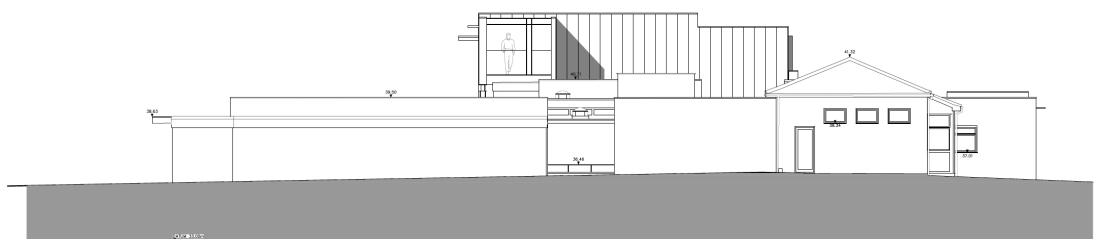
1 West Elevation

Figure 2.7: Proposed West Elevation



1 South Elevation

Figure 2.8: Proposed South Elevation



1 East Elevation

Figure 2.9: Proposed East Elevation



Section 3: Energy

3.1 The Energy Hierarchy

In order to address energy efficiency the design team have adopted the energy hierarchy. The energy hierarchy is generally accepted as the most effective way of reducing a buildings' carbon emissions.

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy
4. Be seen: monitor, verify and report on energy performance

Development proposals should:

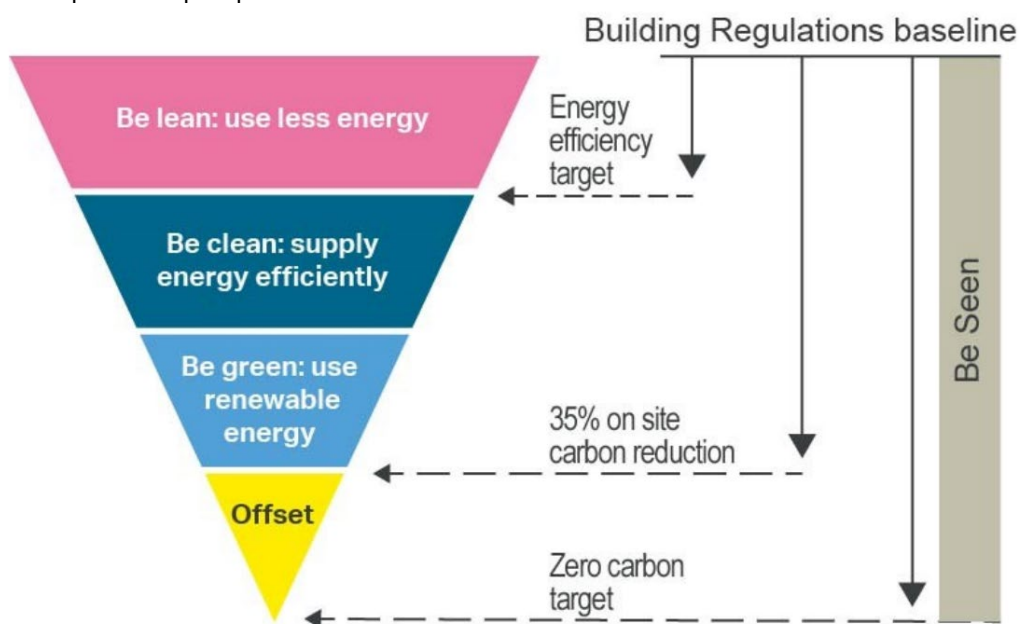


Figure 3.1: The Energy Hierarchy

- **Reducing energy demand**

The first step in the process of reducing the overall energy used and CO₂ produced by the building is to minimise the energy required to heat it. A well-insulated building envelope and passive design will reduce the energy requirement for heating and ventilating the building.

- **Energy efficient systems**

The second step is to specify services and controls, lighting and appliances that are energy efficient and which result in further reduction in energy requirements.

- **Making use of Low or zero-carbon (LZC) technologies**

When the energy demand has been reduced by implementing the processes of improving the fabric and energy efficiency, then LZC

technologies can be employed to reduce the environmental impact of the remaining energy consumption.

- **Monitoring and reporting**

Ensure comprehensive monitoring and reporting of energy demand and carbon emissions. Major developments are required to undertake this process for at least five years.

3.2 Calculating Baseline Energy Demand

The first step is to calculate a Building Regulations Part L2B 2013 compliant specification in order to establish baseline emissions for the development. The proposed extension does not exceed the threshold to be considered as a standalone new-build (extension that is more than 100m² and more than 25% of the floor area of the existing building) so the baseline energy has been calculated following the minimum requirements of L2B. Calculated energy data using the government's approved methodology (SBEM via IES) has been used to establish baseline energy requirements which comply with the L2B 2013 minimum elemental standards. To calculate the associated carbon emissions SAP10 carbon factors have been used.

The baseline emissions and energy consumption figures have been taken from a Part L2B compliant SBEM model (using IES Apache). For the purposes of this report only the western 'half' of the building, as shown in Figure 2.5, has been considered. The results are shown in Table 3a below. Full details (baseline SBEM BRUKL) can be found in Appendix A.

	Energy Consumption (kWh per annum)	Carbon Dioxide Emissions (Tonnes CO ₂ per annum)	
	Regulated	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	230,895	48.6	10

Table 3a: Regulated and unregulated carbon dioxide emissions (SAP10)

The strategic aim is to reduce carbon emissions overall, so that while planning decisions and monitoring requirements will be underpinned by the targets expressed above, the requirement for energy assessments to include separate details of unregulated emissions is to recognise explicitly the additional contribution that can be made through use of efficient equipment, building controls and good management practices, including green leases. Unregulated emissions are, therefore, presented above but are not taken into account when calculating percentage improvements.



3.3 'Be Lean & Be Clean' – Building Efficiency Improvements

The first steps of the energy hierarchy looks at reducing energy consumption in the building through improvements to its fabric ('Be Lean') and through using energy efficiency in the building ('Be Clean'). This reduces the energy required to run the building and thus the emissions associated with that energy use. For the purposes of this report these steps have been combined – as there are no existing or proposed district heating networks that can be accessed as part of the 'Be Clean' step.

The current 2013 Part L is already reasonably stringent in terms of fabric performance targets. It can, therefore, be difficult to achieve further improvements over the fabric specification used for the 'Baseline'. As such, further opportunities for improvement to the building fabric and services beyond those which meet the current 2013 Building Regulations requirements can be difficult. However, some further improvements are possible by considering the following steps:

- Reduce elemental U-Values

Element	'Baseline' Specification	'Be Lean, Be Clean' Specification
New External Walls	0.28W/m ² K	0.26W/m ² K
Existing External Walls	1.60W/m ² K	1.60W/m ² K
New Ground Floor	0.22W/m ² K	0.22W/m ² K
Existing Ground Floor	0.58W/m ² K	0.58W/m ² K
New Flat Roof	0.18W/m ² K	0.12W/m ² K
Existing Flat Roof	1.80W/m ² K	1.80W/m ² K
New Windows	1.80W/m ² K	1.80W/m ² K
Existing Windows	3.69W/m ² K	3.69W/m ² K
New Doors	1.80W/m ² K	1.80W/m ² K
Existing Doors	3.00W/m ² K	3.00W/m ² K
Air Permeability	25m ³ /m ² /hr	25m ³ /m ² /hr
Ventilation	Natural	Natural
Lighting	LED throughout	LED throughout
Space Heating	Existing Mains Gas Boiler	Existing Mains Gas Boiler
Controls	Localised control over temperature	Localised control over temperature
DHW	Dedicated cylinder fed from boiler	Dedicated cylinder fed from boiler
LZC Technology	none	none

Table 3c: 'Be Lean, Be Clean' specification



The improved 'Be Lean' carbon dioxide emissions and energy consumption figures as taken from the SBEM model for the above specification are shown in Tables 3d & 3e below:

	Energy Consumption (kWh per annum)	Carbon Dioxide Emissions (Tonnes CO ₂ per annum)	
	Regulated	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	230,895	48.6	10
After energy demand reduction	228,403	48.1	10

Table 3d: Total reduction in energy use and carbon emissions – SAP10

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	48.6		
Be Lean, Be Clean	48.1	0.5	1%

Table 3e: Total savings in regulated carbon emissions – SAP10

3.4 'Be Green' – CO₂ reduction through the use of renewable or low carbon technology

This section will examine the available renewable energy generation technologies and determine which is most appropriate for the proposed development.

Available Renewable Generation Technologies

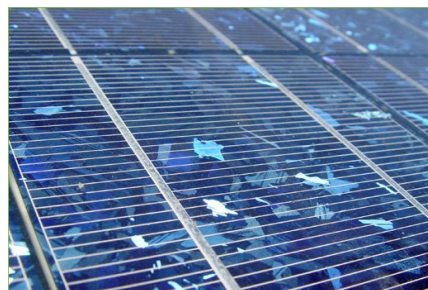
Energy resources accepted as renewable or low carbon technologies are defined by the Department of Energy and Climate Change Low Carbon Buildings Program as:

- Solar photovoltaics
- Wind turbines
- Small hydro
- Solar thermal hot water
- Ground source heat pumps
- Air source heat pumps
- Bio-energy
- Renewable CHP
- Micro CHP (Combined heat and power)



Solar Photovoltaics

Solar panel electricity systems, also known as solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells do not need direct sunlight to work – they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting. When excess power is generated this can be sold back to the grid or stored onsite.



With a large flat roof over the existing clubhouse there is scope for installation of a PV array. However, the proposed extension does form an occupied area at first floor level on the southern side of the clubhouse – which means that installation of any PV to the north of this will be significantly shaded. This means that any PV installation would need to be situated on the 'eastern' part of the clubhouse. This is, therefore, considered to be a suitable technology for use on this development.

Wind Turbines

Wind turbines harness the power of the wind and use it to generate electricity. Forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines. Urban sites such as the location of this development are generally unsuitable for wind turbine installations due to the interrupted turbulent wind flows caused by surrounding buildings and large obstacles. There are also possible issues with noise and 'flicker' for the neighbouring buildings.



The urban nature of the site and lack of space mean that a wind turbine cannot be recommended as a viable option for this development. There are also general issues surrounding the use of building mounted turbines with the potential for excessive noise and vibration within the building and the effect of flicker on surrounding buildings and amenity spaces.

Table 3h: Average wind speeds for the site

45m above ground level	6.4m/s
25m above ground level	5.8m/s
10m above ground level	5.2m/s



Small Hydro Generation

Hydroelectricity generation uses running water to generate electricity, whether it is a small stream or a larger river. All streams and rivers flow downhill. Before the water flows down the hill, it has potential energy because of its height. Hydro power systems convert this potential energy into kinetic energy in a turbine, which drives a generator to produce electricity. Small, or 'micro' hydro generation requires a reliable source of flowing water with a reasonably constant flow velocity. Systems of this nature are normally installed in locations with a natural moving water source such as a river, stream or spring where part of the flow can be diverted through a generator.



There is no such source of flowing water in this case and small hydro generation is not an option for this development.

Solar Water heating



Solar water heating systems use free heat from the sun to warm domestic hot water. Solar hot water heating can generate a large proportion of a buildings annual DHW requirement. The displaced fuel would be mains gas meaning that the CO₂ savings of this type of system would be relatively low due to the low carbon intensity of the displaced fuel.

This technology requires significant hot water storage to be provided in order to function. As the redeveloped part of the clubhouse does not contain the changing rooms and showers it is unlikely that there will be significant DHW use that would require storing the hot water. As such, this is not considered a suitable technology for this development.

Heat Pumps

Heat pumps use similar technology as refrigerators but reversed. A refrigerant liquid is used as a medium to extract heat from a source and convert it into useful heat energy. The heat source used can be generally one of three types; the ground, the air or a body of water. Both ground and water sourced heat pumps use a long circuitous pipe through which a refrigerant is pumped. In ground sourced heat pumps this can be either a coiled pipe or 'slinky' that is buried in a series of

horizontal trenches or a loop inside a vertical bore hole to depths that can be up to 200m or deeper. Water sourced heat pumps generally use a similar system to the 'slinky' used for ground sourced systems but either floated on or submerged in a body of water (either a large pool or running water source). Air source heat pumps have a refrigerant coil mounted outside the building through which is passed air so that heat can be extracted. All three types of heat pump generally use the collected heat from the source to heat water. The heated water can then be used for space heating and DHW. Heat pumps require an input of energy to drive pumps, this is usually electricity and so their renewable generation is the difference between the input and output energy. Most have very good efficiencies; energy produced by heat pumps is typically in the region of 2.5 times that which is required to run them, giving efficiencies of 250% and above.



Ground source heat pumps are not going to be considered for this development due to the limited area that is being redeveloped. In order for a GSHP to be viable a series of trenches would need to be dug to locate the ground loops, which would require additional groundworks and disruption to the car park. As such the use of an air source heat pump would be more appropriate. This would, therefore, be a suitable technology for use on the proposed development.

Bio Energy

The Low Carbon Buildings Program (LCBP) defines biomass as follows:

"Biomass is often called 'bioenergy' or 'biofuels'. These biofuels are produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products. Biofuels fall into two main categories:

- *Woody biomass includes forest products, untreated wood products, energy crops, short rotation coppice (SRC), e.g. willow.*
- *Non-woody biomass includes animal waste, industrial and biodegradable municipal products from food processing and high energy crops, e.g. rape, sugar cane, maize."*



For small-scale domestic [and small scale commercial] applications of biomass the fuel usually takes the form of wood pellets, wood chips and logs. The LCBP goes on to state:

“There are two main ways of using biomass to heat a domestic property:

- *Stand-alone stoves providing space heating for a single room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 5-11 kW in output, and some models can be fitted with a back boiler to provide water heating.*
- *Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW”*

(<http://www.lowcarbonbuildings.org.uk/micro/biomass>)

This technology is dismissed as the space requirements needed for the boiler and pellet store make this impractical along with complying with the clean air zone requirements.

‘Be Green’ Modelled Performance

The relevant identified technologies for this development are, therefore, ASHPs and PV.

The proposal is, therefore, to use ASHPs for the space heating in the remodelled part of the clubhouse. A PV array will also be provided on the roof of the ‘eastern’ half of the clubhouse. Although there is a large flat roof area the amount of PV that can be installed is limited by the rooflights. As such it would appear that an array of around 8kWp (20 x 400Wp panels) would be reasonable – a rough layout can be found in Figure 3.2, below.

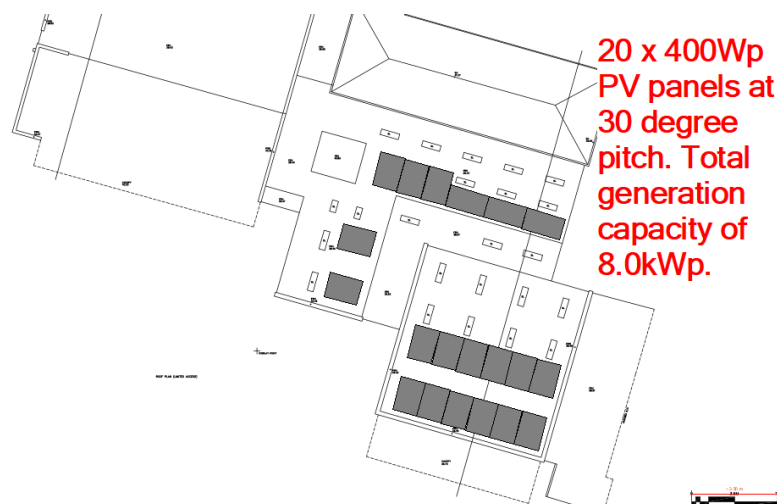


Figure 3.2: Outline PV layout

The final specification for the scheme is shown below in table 3i. A datasheet for a potential ASHP external condenser can be found as Appendix D – locating this unit(s) on the western end of the building would be the most appropriate location. These units can be acoustically screened – but air needs to flow around and through the unit(s), so any screening should not compromise the air movement around the unit(s). The expected generation from the 8kWp PV array has been calculated using the Energy Saving Trust's online tool – this estimates an annual generation of 7,565kWh. Details of this calculation can be found in Appendix E to this report.

Element	'Be Green' Specification
New External Walls	0.26W/m ² K
Existing External Walls	1.60W/m ² K
New Ground Floor	0.22W/m ² K
Existing Ground Floor	0.58W/m ² K
New Flat Roof	0.12W/m ² K
Existing Flat Roof	1.80W/m ² K
New Windows	1.80W/m ² K
Existing Windows	3.69W/m ² K
New Doors	1.80W/m ² K
Existing Doors	3.00W/m ² K
Air Permeability	25m ³ /m ² /hr
Ventilation	Natural
Lighting	LED throughout
Space Heating	ASHP
Controls	Fan coil units with room controllers
DHW	Instantaneous point of use
LZC Technology	8kWp PV array

Table 3i: 'Be Green' specification

The final 'Be Green' carbon dioxide emissions and energy consumption figures as taken from the SBEM model for the above specification are shown in Tables 3j & 3k below. Full details (SBEM BRUKL) can be found in Appendix C.



	Energy Consumption (kWh per annum)	Carbon Dioxide Emissions (Tonnes CO ₂ per annum)	
	Regulated	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	230,895	48.6	10
After energy demand reduction	228,403	48.1	10
After renewable energy	109,304	25.5	10

Table 3j: Total reduction in energy use and carbon emissions – SAP10

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	48.6		
Be Lean, Be Clean	48.1	0.5	1%
Be Green	25.5	22.6	47%
Cumulative Total	-	23.2	48%

Table 3k: Total savings in regulated carbon emissions – SAP10

Section 4: Overheating

As the proposed development has been modelled using SBEM, an assessment of solar gain and the impact of this on the building can be made using the L2A Criterion 3¹ approach.

The results of this assessment, as taken from the 'Be Green' BRUKL (see Appendix B) can be found below;

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?
Z0/01 Bar - Public Space	YES (+13.3%)	NO
Z0/02 Bar/Private Function	NO (-44.1%)	NO
Z0/04 Private Function	NO (-80.1%)	NO
Z0/07 Residential Bed/Lounge	NO (-92%)	NO
Z0/09 Residential Kitchen	NO (-84.7%)	NO
Z0/14 Bar Servery	N/A	N/A
Z1/02 Bar/Function Room	NO (-48.3%)	NO

Image 4.1: 'Be Green' Criterion 3 results

As can be seen, the only area that fails the solar gain criteria is the main bar area. This is actually an existing space, that has no new elements – including glazing – provided as part of these works. As such, this should be no worse than the current situation in this space.

It should also be noted that the SBEM Criterion 3 approach only considers the area of glazing and its g-value (the solar transmittance through the glass). It does not, therefore, account for shading of glazing – and as can be seen from the elevation image below there is shading provided to all large glazed areas.



Image 4.2: Façade shading

¹ Approved Document L2A (2013 edition), paragraphs 2.50 to 2.53, page 17

As can be seen, shading is provided to the new windows in the extension (in rooms Z0/02 & Z0/04) – shown in red – and also over the windows to both bar (Z0/01) from the existing roof that has the new viewing terrace on top. This shading will further reduce the solar gain into these spaces.

This suggests that the proposed building is unlikely to have significant risk of overheating. Should a more detailed analysis be required then a full TM52 assessment could be undertaken post-planning as part of the detailed design development.



Appendix A

SBEM Calculation for 'Baseline'



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Part of the **FOCUS** consultancy group

Project name

Baseline

As designed

Date: Fri May 06 17:31:47 2022

Administrative information**Building Details**

Address: Mid Kent Golf Club., Singlewell Road, Gravesend,
DA11 7RB

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.14

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: MES Building Solutions

Telephone number: 01636 653 055

Address: Newark Beacon, Beacon Hill Office Park,
Cafferata Way, Newark, NG24 2TN

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

The building does not comply with England Building Regulations Part L 2013

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	38.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	38.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	73.7
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.83	1.7	"Z000000D_W-1_A0"
Floor	0.25	0.51	0.58	"Z0000001_F"
Roof	0.25	1.29	1.8	"Z0000001_C"
Windows***, roof windows, and rooflights	2.2	2.59	3.69	"Z0000001_W2_O0"
Personnel doors	2.2	3	3	"Z0000014_W8_O0"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	25

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Gas Boiler - Radiators

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.81	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- SYST0002-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.143
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
Z0/08 Residential Bath	0.3	-	-	-	-	-	-	-	-	-	-	N/A
Z0/13 Kitchen	-	-	-	-	-	-	-	-	0.3	-	-	N/A
Z0/14 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
Z0/15 WC	0.3	-	-	-	-	-	-	-	-	-	-	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	
Z0/01 Bar - Public Space	-	100	-	312
Z0/02 Bar/Private Function	-	100	-	241
Z0/03 Circulation	-	100	-	15
Z0/04 Private Function	-	100	-	240
Z0/05 Lobby	-	100	-	25
Z0/06 Residential Lobby	-	100	-	12
Z0/07 Residential Bed/Lounge	-	100	-	39

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Z0/08 Residential Bath	-	100	-	-	18
Z0/09 Residential Kitchen	-	100	-	-	66
Z0/10 Residential Corridor	-	100	-	-	9
Z0/13 Hall	-	100	-	-	8
Z0/13 Kitchen	-	100	-	-	573
Z0/14 Bar Servery	-	100	-	-	89
Z0/14 Circulation	-	100	-	-	36
Z0/14 WC	-	100	-	-	28
Z0/15 WC	-	100	-	-	42
Z1/01 Circulation	-	100	-	-	41
Z1/02 Bar/Function Room	-	100	-	-	204
Z0/11 Bar Store	100	-	-	-	23
Z0/12 Plant	100	-	-	-	24

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?
Z0/01 Bar - Public Space	YES (+13.3%)	NO
Z0/02 Bar/Private Function	NO (-43.7%)	NO
Z0/04 Private Function	NO (-79.9%)	NO
Z0/07 Residential Bed/Lounge	NO (-92%)	NO
Z0/09 Residential Kitchen	NO (-84.7%)	NO
Z0/14 Bar Servery	N/A	N/A
Z1/02 Bar/Function Room	NO (-47.9%)	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]	702	702
External area [m ²]	1702.1	1702.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	25	3
Average conductance [W/K]	1816.41	623.58
Average U-value [W/m ² K]	1.07	0.37
Alpha value* [%]	6.02	17.76

* 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
	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
5	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
95	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	128.15	33.25
Cooling	0	0
Auxiliary	1.9	1.04
Lighting	6.77	8.17
Hot water	192.09	123.21
Equipment*	58.83	58.83
TOTAL**	328.91	165.68

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

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	519.27	278.2
Primary energy* [kWh/m ²]	417.31	218.47
Total emissions [kg/m ²]	73.7	38.5

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

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	349.4	143	134.2	0	2	0.72	0	0.81	0
Notional	102.7	171.9	34.8	0	1.1	0.82	0	----	----
[ST] No Heating or Cooling									
Actual	1012.1	70.7	0	0	0	0	0	0	0
Notional	311.2	42.7	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{I-Typ}	U _{I-Min}	Surface where the minimum value occurs*
Wall	0.23	0.28	"Z0000005_W0"
Floor	0.2	0.22	"Z0000005_F"
Roof	0.15	0.18	"Z0000014_C"
Windows, roof windows, and rooflights	1.5	1.8	"Z0000005_W1_O0"
Personnel doors	1.5	3	"Z0000014_W8_O0"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{I-Typ} = Typical individual element U-values [W/(m²K)]			U _{I-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	25

Appendix B

SBEM Calculation for 'Be Lean, Be Clean'



mes
building solutions
Part of the **FOCUS** consultancy group

Project name

Be Lean_ Be Clean

As designed

Date: Fri May 06 17:28:10 2022

Administrative information

Building Details

Address: Mid Kent Golf Club., Singlewell Road, Gravesend,
DA11 7RB

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.14

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: MES Building Solutions

Telephone number: 01636 653 055

Address: Newark Beacon, Beacon Hill Office Park,
Cafferata Way, Newark, NG24 2TNCriterion 1: The calculated CO₂ emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	38.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	38.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	72.9
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 -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.8	1.7	"Z000000D_W-1_A0"
Floor	0.25	0.48	0.58	"Z0000001_F"
Roof	0.25	1.28	1.8	"Z0000001_C"
Windows***, roof windows, and rooflights	2.2	2.35	3.69	"Z0000001_W2_O0"
Personnel doors	2.2	3	3	"Z0000014_W8_O0"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	25

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Gas Boiler - Radiators

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.81	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- SYST0002-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.143
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
Z0/08 Residential Bath	0.3	-	-	-	-	-	-	-	-	-	-	N/A
Z0/13 Kitchen	-	-	-	-	-	-	-	-	0.3	-	-	N/A
Z0/14 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
Z0/15 WC	0.3	-	-	-	-	-	-	-	-	-	-	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	
Z0/01 Bar - Public Space	-	100	-	312
Z0/02 Bar/Private Function	-	100	-	241
Z0/03 Circulation	-	100	-	15
Z0/04 Private Function	-	100	-	240
Z0/05 Lobby	-	100	-	25
Z0/06 Residential Lobby	-	100	-	12
Z0/07 Residential Bed/Lounge	-	100	-	39

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
Z0/08 Residential Bath	-		100	-	18
Z0/09 Residential Kitchen	-		100	-	66
Z0/10 Residential Corridor	-		100	-	9
Z0/13 Hall	-		100	-	8
Z0/13 Kitchen	-		100	-	573
Z0/14 Bar Servery	-		100	-	89
Z0/14 Circulation	-		100	-	36
Z0/14 WC	-		100	-	28
Z0/15 WC	-		100	-	42
Z1/01 Circulation	-		100	-	41
Z1/02 Bar/Function Room	-		100	-	204
Z0/11 Bar Store		100	-	-	23
Z0/12 Plant		100	-	-	24

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?
Z0/01 Bar - Public Space	YES (+13.3%)	NO
Z0/02 Bar/Private Function	NO (-44.1%)	NO
Z0/04 Private Function	NO (-80.1%)	NO
Z0/07 Residential Bed/Lounge	NO (-92%)	NO
Z0/09 Residential Kitchen	NO (-84.7%)	NO
Z0/14 Bar Servery	N/A	N/A
Z1/02 Bar/Function Room	NO (-48.3%)	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 [m ²]	702	702
External area [m ²]	1702.1	1702.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	25	3
Average conductance [W/K]	1751.88	623.58
Average U-value [W/m ² K]	1.03	0.37
Alpha value* [%]	6.24	17.76

* 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
	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
5	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
95	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	124.6	33.25
Cooling	0	0
Auxiliary	1.9	1.04
Lighting	6.77	8.17
Hot water	192.09	123.21
Equipment*	58.83	58.83
TOTAL**	325.36	165.68

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

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	510.17	278.2
Primary energy* [kWh/m ²]	412.98	218.47
Total emissions [kg/m ²]	72.9	38.5

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

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	339.7	143.2	130.5	0	2	0.72	0	0.81	0
Notional	102.7	171.9	34.8	0	1.1	0.82	0	----	----
[ST] No Heating or Cooling									
Actual	1012.1	70.7	0	0	0	0	0	0	0
Notional	311.2	42.7	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{I-Typ}	U _{I-Min}	Surface where the minimum value occurs*
Wall	0.23	0.23	"Z0000005_W0"
Floor	0.2	0.12	"Z0000005_F"
Roof	0.15	0.12	"Z0000014_C"
Windows, roof windows, and rooflights	1.5	1.4	"Z0000005_W1_O0"
Personnel doors	1.5	3	"Z0000014_W8_O0"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{I-Typ} = Typical individual element U-values [W/(m²K)]			U _{I-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	25

Appendix C

SBEM Calculations for 'Be Green'



mes
building solutions
Part of the FOCUS consultancy group

Project name

Be Green

As designed

Date: Fri May 06 17:18:25 2022

Administrative information

Building Details

Address: Mid Kent Golf Club., Singlewell Road, Gravesend,
DA11 7RB

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.14

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: MES Building Solutions

Telephone number: 01636 653 055

Address: Newark Beacon, Beacon Hill Office Park,
Cafferata Way, Newark, NG24 2TN

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

The building does not comply with England Building Regulations Part L 2013

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	56.1
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	56.1
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	86.4
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.8	1.7	"Z000000D_W-1_A0"
Floor	0.25	0.48	0.58	"Z0000001_F"
Roof	0.25	1.28	1.8	"Z0000001_C"
Windows***, roof windows, and rooflights	2.2	2.35	3.69	"Z0000001_W2_O0"
Personnel doors	2.2	3	3	"Z0000014_W8_O0"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	25

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Elec. Panel

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- Residential Combi Boiler Electric

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- SYST0004-DHW

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

2- SYST0005-DHW

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
Z0/13 Kitchen	-	-	-	-	-	-	-	-	0.3		-	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
Z0/14 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
Z0/15 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
Z0/08 Residential Bath	0.3	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value	60	60	22		
Z0/01 Bar - Public Space	-	100	-	312	
Z0/02 Bar/Private Function	-	100	-	241	
Z0/03 Circulation	-	100	-	15	
Z0/04 Private Function	-	100	-	240	
Z0/05 Lobby	-	100	-	25	
Z0/13 Kitchen	-	100	-	573	
Z0/14 Bar Served	-	100	-	89	
Z1/01 Circulation	-	100	-	41	
Z1/02 Bar/Function Room	-	100	-	204	
Z0/06 Residential Lobby	-	100	-	12	
Z0/13 Hall	-	100	-	8	
Z0/14 Circulation	-	100	-	36	
Z0/14 WC	-	100	-	28	
Z0/15 WC	-	100	-	42	
Z0/07 Residential Bed/Lounge	-	100	-	39	
Z0/08 Residential Bath	-	100	-	18	
Z0/09 Residential Kitchen	-	100	-	66	
Z0/10 Residential Corridor	-	100	-	9	
Z0/11 Bar Store	100	-	-	23	
Z0/12 Plant	100	-	-	24	

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?
Z0/01 Bar - Public Space	YES (+13.3%)	NO
Z0/02 Bar/Private Function	NO (-44.1%)	NO
Z0/03 Circulation	N/A	N/A
Z0/04 Private Function	NO (-80.1%)	NO
Z0/05 Lobby	NO (-69.6%)	NO
Z0/13 Kitchen	NO (-61.5%)	NO
Z0/14 Bar Served	N/A	N/A
Z1/01 Circulation	NO (-93.4%)	NO
Z1/02 Bar/Function Room	NO (-48.3%)	NO
Z0/07 Residential Bed/Lounge	NO (-92%)	NO
Z0/09 Residential Kitchen	NO (-84.7%)	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 [m ²]	702	702
External area [m ²]	1702.1	1702.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	25	3
Average conductance [W/K]	1751.88	623.58
Average U-value [W/m ² K]	1.03	0.37
Alpha value* [%]	6.24	17.76

* 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
	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
5	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
95	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	44.23	14.94
Cooling	8.44	11.84
Auxiliary	0.52	0.24
Lighting	6.77	8.17
Hot water	106.52	123.21
Equipment*	58.83	58.83
TOTAL**	166.47	158.41

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

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	518.54	278.41
Primary energy* [kWh/m ²]	511.07	230.3
Total emissions [kg/m ²]	86.4	56.1

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	298.2	152.2	22.2	9.9	0.1	3.73	4.26	4	6
Notional	96.1	180.4	11	13.9	0.2	2.43	3.6	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	751.6	108.4	261	0	5.9	0.8	0	1	0
Notional	178.1	110.3	60.4	0	0.9	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	715.7	78.3	222.9	0	2.4	0.89	0	1	0
Notional	135	92.8	45.8	0	1.3	0.82	0	----	----
[ST] No Heating or Cooling									
Actual	1012.1	70.7	0	0	0	0	0	0	0
Notional	311.2	42.7	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{I-Typ}	U _{I-Min}	Surface where the minimum value occurs*
Wall	0.23	0.23	"Z0000005_W0"
Floor	0.2	0.12	"Z0000005_F"
Roof	0.15	0.12	"Z0000014_C"
Windows, roof windows, and rooflights	1.5	1.4	"Z0000005_W1_O0"
Personnel doors	1.5	3	"Z0000014_W8_O0"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{I-Typ} = Typical individual element U-values [W/(m²K)]			U _{I-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	25

Appendix D

Potential ASHP Data Sheet



Heating

Product Information

CAHV-P500YB-HPB

Ecodan Air Source Heat Pump

Making a
World of
Difference



CAHV Monobloc Heat Pump System



Certificate Number: MCS HP0002
Product Reference: CAHV-P500YB-HPB

The Ecodan CAHV air source heat pump monobloc system can operate singularly, or form part of a multiple unit system. The CAHV also comes equipped with a wide range of controller features as standard.

A multiple unit system has the ability to cascade available units on and off to meet the load from a building. As an example of this modulation, a 16 unit system allows 0.5kW increments of capacity, from 18kW all the way up to 688kW. This level of modulation is unprecedented within the heating industry and with cascade and rotation built in as standard, the Ecodan CAHV system is perfectly suited to a wide range of commercial applications.

Key Features

- Multiple unit cascade control of up to 688kW capacity
- Split refrigerant circuits within each CAHV provide 50% back up
- Ability to rotate units based on accumulated run hours
- Provides from 25°C up to 70°C water flow temperatures without boost heaters
- Low maintenance, hermetically-sealed monobloc design
- Low on-site refrigerant volume
- HIC (Zubadan) technology delivers 43kW at -3°C with minimal drop off down to -20°C



Air Conditioning | Heating
Ventilation | Controls



ecodan[®]
Renewable Heating Technology

MODEL		CAHV-P500YB-HPB
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A++
	η_{L_s}	125%
	SCOP	3.19
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A+
	η_{L_s}	139%
	SCOP	3.54
HEATING ^{*1} (A-3/W35)	Capacity (kW)	42.6
	Power Input (kW)	15.2
	COP	2.80
OPERATING AMBIENT TEMPERATURE (°C DB)		-20~+40°C
SOUND PRESSURE LEVEL AT 1M (dBA) ^{*2,3}		59
LOW NOISE MODE (dBA) ^{*2}		Variable
FLOW RATE(l/min)		126
WATER PRESSURE DROP (kPa)		18
DIMENSIONS (mm)	Width	1978
	Depth	759
	Height	1710 (1650 without legs)
WEIGHT (kg)		526
ELECTRICAL SUPPLY		380-415v, 50Hz
PHASE		3
NOMINAL RUNNING CURRENT [MAX] (A)		17.6 [52.9]
FUSE RATING - MCB SIZES (A) ^{*4}		63

*1 Under normal heating conditions at outdoor temp: -3°CDB / -4°CWB, outlet water temp 35°C, inlet water temp 30°C

*2 Under normal heating conditions at outdoor temp: 7°CDB / 6°CWB, outlet water temp 35°C, inlet water temp 30°C as tested to BS EN14511

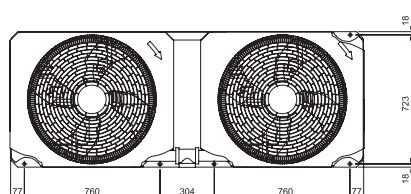
*3 Sound power level of the CAHV-P500YB-HPB is 70.7dBA. Tested to BS EN12102

*4 MCB Sizes BS EN60898-2 & BS EN60947-2

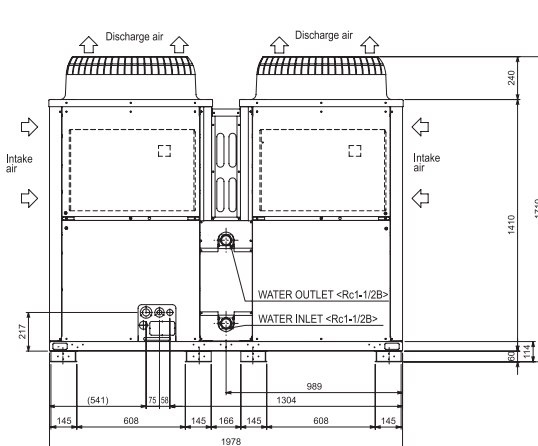
η_{L_s} is the seasonal space heating energy efficiency (SSHEE) η_{L_w} is the water heating energy efficiency

DIMENSIONS

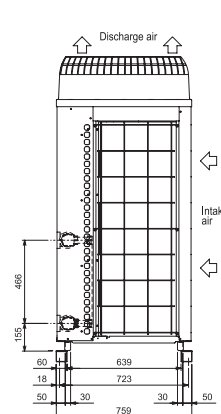
Upper View



Front View



Side View



Telephone: 01707 282880

email: heating@meuk.mee.com web: heating.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environmental Systems Division
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England General Enquiries Telephone: 01707 282880 Fax: 01707 278881

IRELAND Mitsubishi Electric Europe Westgate Business Park, Ballymount, Dublin 24, Ireland
Telephone: Dublin (01) 419 8800 Fax: Dublin (01) 419 8890 International code: (003531)

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Appendix E

PV generation calculation



mes
buildingsolutions
Part of the **FOCUS** consultancy group

Solar Energy Calculator

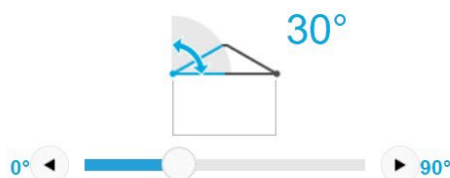
Property details

The amount of sunlight a roof is exposed to depends on the location of a property, the amount of shading the roof receives, the slope of the roof and the direction of the slope. These factors can be specified below.

Roof slope

[Need help?](#)

The slider below will help you specify the slope angle of the most suitable roofspace. It's worth noting that the typical roof slope for the average UK home is about 30 degrees.



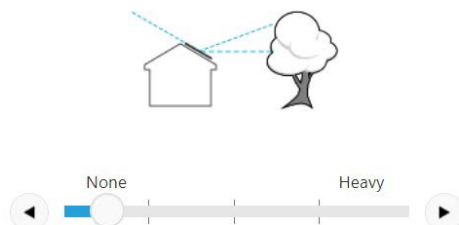
0° is a flat roof and 90° means that you want to install PV panels on a vertical surface such as a wall.

Shading

[Need help?](#)

Use the slider to indicate how much shading you expect to have on your roof where the solar PV system will be installed.

None or very
little
less than
20%
of sky



Roof direction

[Need help?](#)

The slider below will help you specify the direction of the most suitable roofspace.

Adjust the map to find your property and then adjust the compass to align it with the desired direction.



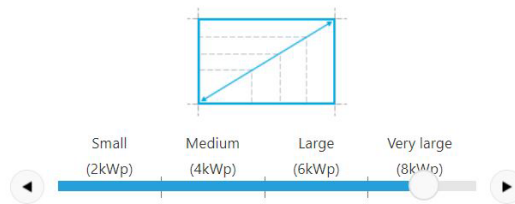
Please adjust slide bar to correct direction

Installation size

[Need help?](#)

Please choose the size of the system you're interested in installing.

Our standard assumption is Medium (4kWp) as this is around the average size of solar PV panels that have been installed on domestic properties. Typical solar electricity systems usually require 10-20m² of unshaded space. Smaller systems are possible, but less likely to be cost effective.



OR, If you know it, what is the specific peak generation of the system you plan to install in kilowatts?

(Optional)

When you are at home

Please tell us when you are typically at home during the week to help us estimate how much of the electricity you will use

Home all day

Back

Next

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Solar Energy Calculator

Your results

[Assumptions](#)

For more information, please read the calculator assumptions.

Potential annual benefit
£741

Potential CO₂ saving
1,748 kg / year

Potential fuel bill saving
£504 / year

Potential payments from
SEG
(at 4.1 p/kWh)
£237 year

Potential lifetime benefit
£17,904

Potential lifetime CO₂
saving
41,088 kg

Potential lifetime fuel bill
saving
£12,411

Potential lifetime
payments from SEG
(at 4.1 p/kWh)
£5,494

Estimated installation costs
£10,469

Estimated lifetime maintenance costs
£1,450

Potential lifetime net benefit
£5,985

Size of the system

8 kWp

Energy generated by the
panels

7,565 kWh / year

Next steps

- We recommend you get three quotes to compare costs and services and be sure to consider planning permission.
- Explore the Smart Export Guarantee tariffs available to you on the [Solar Trade Association website](#).
- [Sign up to Energywire](#), our monthly e-newsletter, for energy saving tips, news and more.

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