GREEN BUILDING DESIGN CONSULTANTS

Building Services Consulting Engineers

Grove Cottage,
151 London Road,
Bishop's Stortford,
CM23 3JX

Low to Zero Carbon Energy and External Plant Feasibility Report – Rev B

June 2022

Project: **Grove Cottage,**
151 London Road,
Bishop's Stortford,
CM23 3JX

Client: **Moult Walker Chartered Surveyors**
5 Bridge Street
Bishop Stortford
CM23 2JU

Document: **Low to Zero Carbon Energy and External Plant Feasibility Report – Rev B**

Date: **June 2022**

Prepared by: Jaejae Dimmock
Checked by: Huw Davies
Approved by: Simon Green

Revision	Date	Description	Prepared	Checked	Approved
0	5th May 2022	Document Issue	JD	HD	SG
A	16th May 2022	Document Issue	JD	HD	SG
B	6th June 2022	Document Issue	JD	HD	SG

EXECUTIVE SUMMARY

- Grove cottage nursery is set to be demolished and a new Nursery built in its place

- This report uses the energy hierarchy set out by East Herts District Plan | Sustainability SPD and Part L2A of the Building Regulations – Conservation of Fuel and Power

- Energy Efficient Measures
    - Lower u-values to reduce heating loss
    - Lower Air Leakage Rate
    - Efficient LED lighting with motion sensors and daylight controls

- Design and Development with Clean Energy
    - Air Source Heat Pump for Radiator or Underfloor Heating System
    - Mechanical Ventilation with Heat Recovery for fresh air
    - Instantaneous Hot Water

- Renewable Energy
    - PV Cells to generate green electrical energy from the sun

- As the building has an educational purpose, we have benchmarked the requirements against BB 101

Result	Target CO2 Emission Rate	Building CO2 Emission Rate	% Below Part L Requirement
BRUKL	11.4 kgCO2/m2.annum	6.8 kgCO2/m2.annum	40%

Result	Building EPC	If existing Building Benchmark	% Improvement	If Newly Built Benchmark	% Improvement
EPC	A|14	C|63	70%	A|24	40%

- Potential cost of energy saving over Part L Minimum standard building

Iteration	Electrical Use per Annum (kWh)	Gas Use per Annum (kWh)	Cost of Energy per Annum (£)
As Designed	23,854.2	0	£6,679.18[1]
Part L Minimum[2]	29,067.6	11,771.8	£8,962.95[1]

[1]Based on Current Average as of June 2022 Electricity - £0.28/kWh and Gas - £0.07/kWh
[2]This includes higher u-values, less efficient lights, a gas boiler, less efficient heat recovery, no PV

CONTENTS

1.0 Introduction

1.1 Purpose of This Document

This document aims to set out a review of the low to zero energy options and the impact of external plant that shall provide heating, domestic hot water, fresh air and power to Grove Cottage. The review has incorporated baseline requirements for a typical BB101 compliant nursery.

1.2 Reservations

This report has been prepared for the sole use of the Client, Moult Walker Chartered Surveyors and the appointed design team. It is intended to be informative for use in the redevelopment project. It is not intended to be a detailed technical specification or to form part of any contractual documentation. Green Building Design Consultants do not accept any responsibility for its use by other parties.

1.3 Building Description

Grove cottage is set to be demolished and its place a new 3-storey nursery is to be erected. The building will consist of ground, first and second floors with an external play area.

The new nursery will need to be provided with heating, domestic hot water, lighting and power to cater for children at Ground floor, adults at First floor, as well as staff offices on the Second Floor. The Nursery is to be located in Bishops Stortford.

1.4 Planning Policies

To satisfy the requirement to reduce the energy and the carbon emissions of buildings this report uses the energy hierarchy set out by East Herts District Plan | Sustainability SPD:

- Policy CC2 Climate Change Mitigation
- Policy DES4 Design of Development
- Policy CC3 Renewable and Low Carbon Energy

Part L2A of the Building Regulations – Conservation of Fuel and Power sets out the minimum requirements for a new building other than dwellings to reduce its energy usage.

2.0 Energy Efficient Measures

2.1 Heating Energy and Passive Design

The main fundamental way to reduce the heat load on the building is to have low u-values, which are a sum of the thermal resistances of the layers that make up an entire building element for its construction. This reduces the heat loss from the building which in turn reduces how much energy is required to heat the building. Part L sets out the minimum u-values of new buildings and to further decrease the heat loss it is proposed that this development has even lower u values as set out below:

Element	U Values from Part L	Proposed U Values	Source
External U-Value	0.35 w/m^{2}k	0.2 w/m^{2}k	Additional Insulation
Ground Floor U-Value	0.25 w/m^{2}k	0.2 w/m^{2}k	Additional Insulation
Roof U-Value	0.25 w/m^{2}k	0.18 w/m^{2}k	Additional Insulation
Window U-Value	2.2 w/m^{2}k	1 w/m^{2}k	Triple Glazed Windows
Air Tightness	10 m^3/hr.m^2@50Pa	5 m^3/hr.m^2@50Pa	Improved Thermal Bridging and seals

2.2 Lighting Energy

Currently, all lighting now is LED which is the most efficient way to light a building. There are a variety of lighting panels that can suit all styles of room. By putting a smart lighting control system, the lights can even change colour which may suit any sensory room in the nursery.

To also eliminate the chance of lights being left on when they are not required all rooms should have an absence detector combined with a daylight sensor. By doing this the lights can be manually turned on and when the detector does not sense movement for an extended period of time they will shut off.

Similarly with daylight sensing if there is sufficient lighting from natural daylight the lights will turn off thus saving more energy.

Element	Part L Requirement	Proposed Design	Source
Lighting Efficiency	60 lm/W	120 lm/W	Standard minimum value for modern LED lights
Controls	None	Motion Sensing and Daylight Sensors	Additional Insulation

3.0 Design and Development with Clean Energy

3.1 Heating Generators

Three new primary heating sources were considered to provide heat to the building:

- A new gas fired condensing boiler system
- A new air source heat pump system
- Electric Heating

Technology	Advantages	Disadvantages
Gas Fired Condensing Boiler System	• Minimal space required for installation • Cheaper to install • No fuel storage • In full condensing mode it can be 107% efficient	• Relies on fossil fuel which the UK is committed to phasing out supplies and cost in future is uncertain • Possible carbon monoxide leakage
Air Source Heat Pump System	• Much higher efficiency • Can be positioned away from the building • Lower carbon foot print • No fuel storage • Efficient even at low ambient temperatures • Can be powered by wind or solar energy • Long life span if serviced properly • Liable for Government Grants	• High installation cost • Builders work to run cables/pipework from condenser to thermal store • Works better with highly new buildings • Radiators will need to be slightly larger due to the lower output due to reduced temperatures • Electricity currently costs more than gas per kWhr • May require upgrade to the existing electrical supply • Has to be external
Electric Heating	• No central source required • No internal structure such as pipework • Can go anywhere	• Most expensive • Most in-efficient

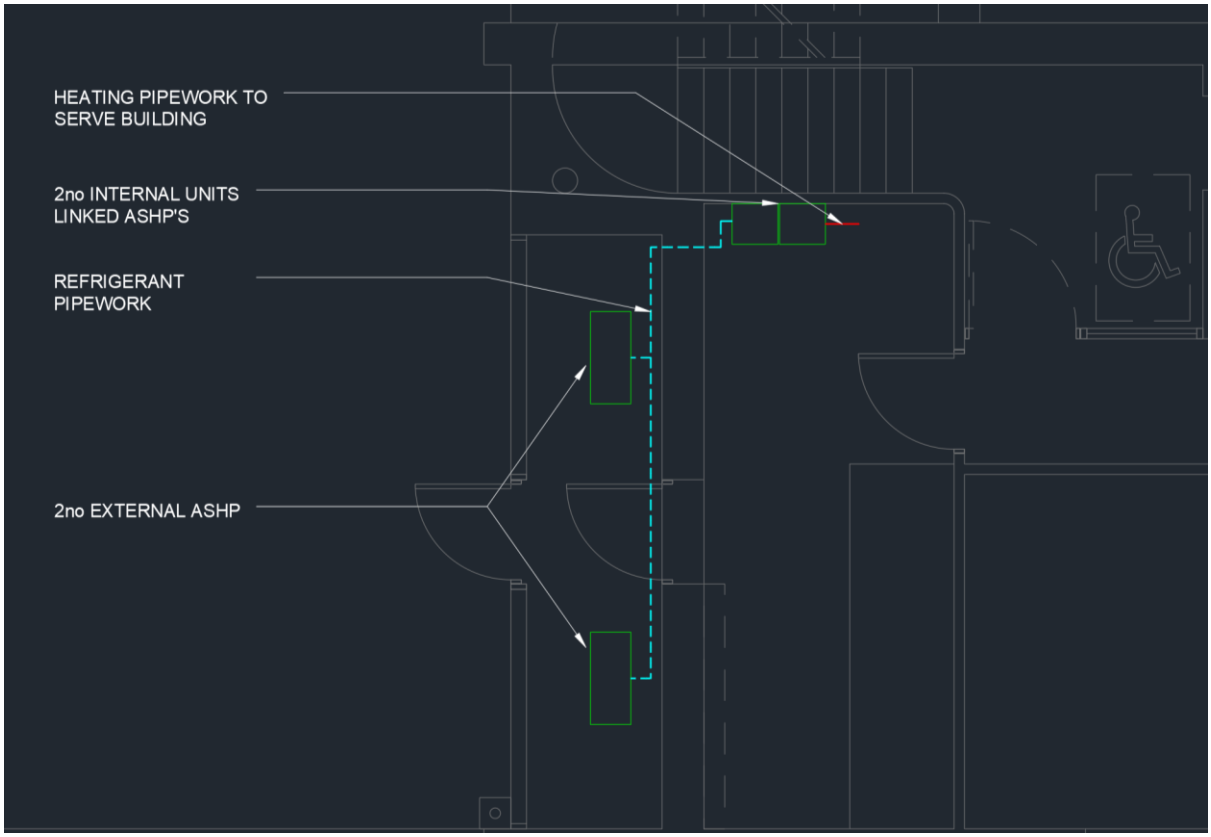
The most energy efficient and practical heating system is the air source heat pump and this is the technology that this report will proceed with.

Up until a few years ago air/ground source heat pumps used to be limited due to their low output temperatures – typically around 50^{o}C. Now they are fully capable of producing higher temperatures of up to 65^{o}C which means they do not require a fossil fuel heat source (such as a gas boiler) to increase their output temperature.

Air source heat pumps are much more energy efficient than a gas fired boiler, however electrical energy costs more than gas and also has a higher CO2 emissions factor. To work optimally they would require a space outside that has adequate air flow. They can be concealed in several ways which include:

- Hit and miss fencing
- Shrubbery
- Vinyl wrapping

An air source heat pump is well suited to either low surface temperature radiators and/or underfloor heating. An internal unit is required that links to the outside ASHP via refrigerant pipework. There is a heat exchanger in the internal unit which then provides the low temperature hot water to the building for its heating as shown below.



This design is based on the Daikin Altherma 3 system. The external units are 740(H) x 884(W) x 388(D) and the internal units are 840(H) x 440(W) x 390(D).

External ASHP

Internal Unit

The building is to be heated by LTHW under floor heating. This ensures there are no hot surfaces for children to scold them self's on and also gives the building maximum flexibility as there will be no radiators on the walls.

Element	Part L Requirement	Proposed Design	Source
Air Source Heat Pump with Radiators/UFH	2.5	3.32	Daikin Altherma 3 System
Controls	None	Optimum Start Stop Local Room Temperature Weather Compensation	Standard as part of Unit

3.1.2 Heating Technologies Not Considered in this Analysis

Ground Source Heat Pump

Although a ground source heat pump has the same efficiency as an air sourced unit the cost to install one is significantly higher due to the added expense of digging a trench or borehole. Furthermore, as the Nursery is located in the middle of the town there is not enough space to dig into the ground.

Biomass Boiler

A biomass boiler works like a regular boiler but instead of using gas or oil it uses wood chips/pellets. The fundamental downside to these boilers is that the fuel source needs to be stored on site which can take up significant space. There are also less efficient.

Finally due to the fumes produced when burning the wood chips/pellets the flue needs to be 10m above the building meaning it is not suited for a building in a town centre as this will not suit the aesthetic look and will have planning issues.

Combined Heat and Power Unit

This is an engine that can provide power to the building and waste heat is then used to heat the building. Due to the buildings size and therefore low heat loss, it is not suited. Furthermore, there are more efficient and economic beneficial ways to provide power to the building – such as solar cells.

3.2 Mechanical Ventilation with Heat Recovery

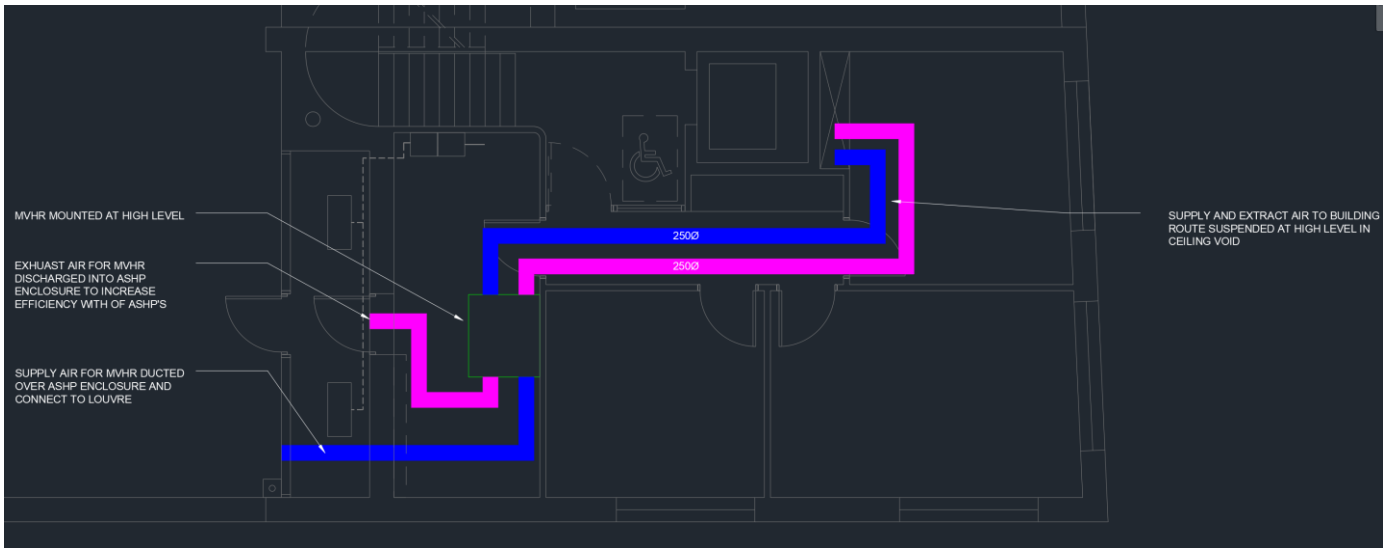
Although the building potentially has openable windows managed by the staff for ventilation, which will work well in summer, in the winter it can have the opposite effect as opening windows will let cold air in and increase the load on the heating system. By installing an MVHR it ensures the building can be well ventilated and the heat energy can be recovered to limit the amount of wasted energy.

According to the department of education's document, *Statutory framework for the early year's foundation stage Setting the standards for learning, development and care for children from birth to five* in section 3.58 it states that the number of children is equal to 2.5m2 per child.

To ensure compliance with BB101 and the TM52 criteria to ensure there is not a significant build of CO2 575l/s of fresh air will need to be provided to the building. As there is office space as well 10l/s per person should be provided to ensure compliance with Part F of the building regulations.

Floor	Room	Ventilation l/s	Source
Ground	Nursery	245	BB 101
	Office	10	Part F of the Building Regulations
First	Activity Space	210	BB 101
	Lounge	70	Part F of the Building Regulations
Second	Office01	10	
	Office02	20	
	Office03	10	
	Total	**575**	

By adding CO2 sensors to each room, it ensures that fresh air is only being provided to the occupied rooms and therefore not wasting energy. The MVHR can be positioned at high level in the store room in the second floor with its supply and exhaust air ducted too external. The supply and extract to and from the building can be run in 250mm circular duct at high level and rise in the riser provided



The design is based on a Daikin VAM2000J7VEB which has the dimensions 731(H) x 1354(W) x 1172(D).

The MVHR will also have a summer bypass function to allow the fresh air, in the right conditions, to be brought straight into the building which will create free cooling.

Element	Part L Requirement	Proposed Design	Source
Fan Power	1.9 W/(l/s)	1.5 W/(l/s)	Daikin VAM2000J7VEB
Heat Recovery	50%	85%	
Controls	None	CO2 Sensors	Remote sensors in ductwork

3.3 Hot Water Energy

The most space effective and energy efficient method is to produce the hot water to wash hand basins and sinks via instantaneous local electric water heaters. This means hot water is only being produced when required as opposed to having a central hot water cylinder that has to store a lot of water for extended periods.

These water heaters can be located under sinks or in cupboards nearby. They can also have their output temperatures set so they are safe for children.

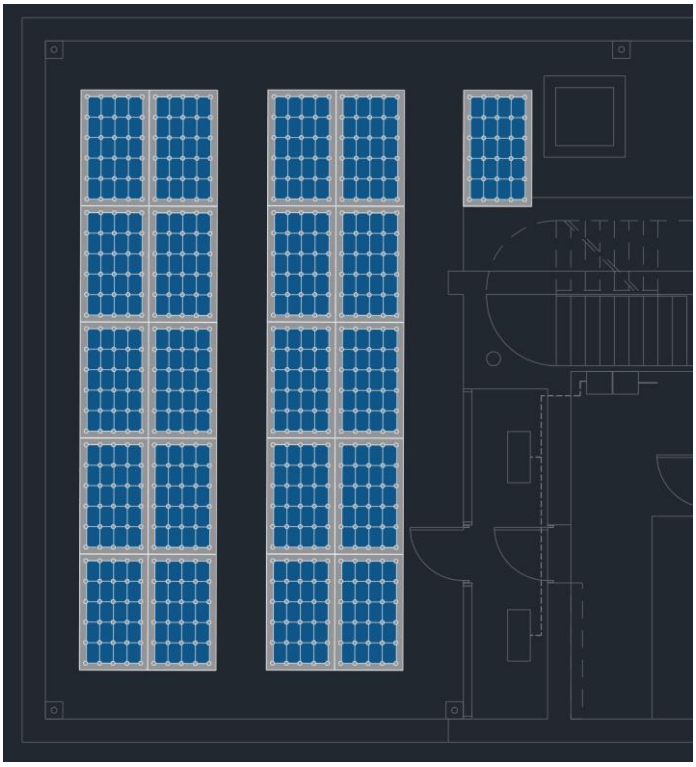
Element	Part L Requirement	Proposed Design	Source
Hot Water Generation Efficiency	1	1	Most Practical Way for the Building

4.0 Renewable Energy

4.1 PV Cells

Photovoltaic (PV) cells or better known as solar panels are used to turn the suns energy into electrical power. Panels can typically produce around 380W to 500W. This electrical power is fed into a panel in the building which is then linked to the incoming mains. It will then use the available solar energy to provide power to the building and if there is not enough will then supplement with the grid supplied electricity. This will be particularly beneficial in the building as if it's heated by an ASHP, these are electrically driven.

There is approximately 90m^2 on the 1st floor roof. This roof is south east facing and will therefore be ideal for PV panels.



21 panels could approximately be fit onto the roof allowing for adequate space for maintenance. Considering around 20% of shading from adjacent buildings and trees over a year these panels could produce 6.36MWh of free electricity to power the building.

When the building is not being used the PV cells are not being utilised, for example on the weekends. Any surplus solar energy can be fed back into the grid and the Nursery can benefit from payments from the government based on a feed in tarrif.

Element	Part L Requirement	Proposed Design	Source
PV Energy Output	None	6.36MWh	Standard Minimum

5.0 Conclusions and Results

By fulling adopting the energy reduction measures stated throughout this report the following results can be achieved:

Result	Target CO2 Emission Rate	Building CO2 Emission Rate	% Below Part L Requirement
BRUKL	11.4 kgCO2/m2.annum	6.8 kgCO2/m2.annum	40%

The full BRUKL report can be found in Appendix A

Result	Building EPC	If existing Building Benchmark	% Improvement	If Newly Built Benchmark	% Improvement
EPC	A|14	C|63	70%	A|24	40%

The full EPC can be found in Appendix B.

A BRUKL or Building Regulations UK Part L report is a report that shows whether or not a building complies with Part L. An EPC or Energy Performance Certificate is a rating of a building to show how efficient it is. The lower the number, the more efficient it is with A being most efficient and G being least efficient.

As can be seen by inputting the following measures:

- Reduced U-Values over Part L requirements
- More Efficient Lights
- Electrical Instantaneous Hot Water Generation
- Air Source Heat Pump for Heating
- Mechanical Ventilation with Heat Recovery
- PV cells on roof

The proposed development will by 40% better than that requirement by Part L of the building regulations requirement. It will also be 70% better than an existing building of its type and 40% better than a new building of its type.

This is achieved by going beyond the minimum standard in every way. Utilising the PV combined with the building only having electrical energy makes for a significant in the energy used and therefore the carbon emissions.

For comparison if the same building was built to the minimum Part L Standard using a gas fired boiler with no PV, then there is a potential saving of £2,283.77 or 25%. It is important to note that this is based on a standard Nursery as governed by the input data set out in the National Calculation Methodology.

Iteration	Electrical Use per Annum (kWh)	Gas Use per Annum (kWh)	Cost of Energy per Annum (£)
As Designed	23,854.2	0	£6,679.18[1]
Part L Minimum[2]	29,067.6	11,771.8	£8,962.95[1]

[1]Based on Current Average as of June 2022 Electricity - £0.28/kWh and Gas - £0.07/kWh
[2]This includes higher u-values, less efficient lights, a gas boiler, less efficient heat recovery, no PV

Appendix A – Full BRUKL Report

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Grove Cottage

As designed

Date: Mon May 16 20:17:46 2022

Administrative information

Building Details

Address: 151 London Road, Bishop's Stortford,, CM23 3JX

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: Jaejae Dimmock

Telephone number: Phone

Address: Street Address, City, Postcode

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	11.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	11.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	6.8
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	00000003:Surf[1]
Floor	0.25	0.2	0.2	00000003:Surf[0]
Roof	0.25	0.18	0.18	00000012:Surf[8]
Windows***, roof windows, and rooflights	2.2	1	1.02	00000003:Surf[2]
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	0.9 to 0.95

1- heating System

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.32	-	0.2	0	0.85
Standard value	2.5*	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 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- Hot Water

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	0.005
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**
00-DWC	-	-	0.4	-	-	-	-	-	-	-	N/A
00-NURSARY	-	-	-	1.5	-	-	-	-	-	-	N/A
00-OFFICE	-	-	-	1.5	-	-	-	-	-	-	N/A
00-PLAYROOM COTS	-	-	-	1.5	-	-	-	-	-	-	N/A
00-TOILET CHANGING	-	-	0.4	-	-	-	-	-	-	-	N/A
00-TOILET CHANGING	-	-	0.4	-	-	-	-	-	-	-	N/A
01-ACTIVITY SPACE	-	-	-	1.5	-	-	-	-	-	-	N/A
01-CHANGING PLACES TOILET	-	-	0.4	-	-	-	-	-	-	-	N/A
01-DWC	-	-	0.4	-	-	-	-	-	-	-	N/A
01-SENSORY ROOM/CRASH ROOM	-	-	-	1.5	-	-	-	-	-	-	N/A
01-WC	-	-	0.4	-	-	-	-	-	-	-	N/A
02-OFFICE01	-	-	-	1.5	-	-	-	-	-	-	N/A
02-OFFICE02	-	-	-	1.5	-	-	-	-	-	-	N/A
02-OFFICE03	-	-	-	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-ADULT LEARNING ENTRANCE	-	120	-	16
00-CORRIDOR	-	120	-	20
00-DWC	-	120	-	21
00-KITCHEN	-	120	-	109
00-LIFT LOBBY	-	120	-	25
00-NURSARY	120	-	-	377
00-NURSARY ENTRANCE	-	120	-	14
00-OFFICE	120	-	-	96
00-PLAYROOM COTS	120	-	-	66
00-STAIRS	-	120	-	21
00-TOILET CHANGING	-	120	-	25
00-TOILET CHANGING	-	120	-	25
01-ACTIVITY SPACE	120	-	-	323
01-ACTIVITY SPACE LOBBY	-	120	-	13
01-CHANGING PLACES TOILET	-	120	-	45
01-DWC	-	120	-	21
01-KITCHEN LOBBY	-	120	-	8
01-KITCHEN/LOUNGE	-	120	-	108
01-LIFT LOBBY	-	120	-	31
01-SENSORY ROOM/CRASH ROOM	120	-	-	122
01-STAIRS	-	120	-	22
01-WC	-	120	-	16
02-LIFT LOBBY	-	120	-	18
02-OFFICE01	120	-	-	92
02-OFFICE02	120	-	-	109
02-OFFICE03	120	-	-	84
02-STAIR LOBBY	-	120	-	13
02-STAIRS	-	120	-	14

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-NURSARY	NO (-68.3%)	YES
00-OFFICE	NO (-71%)	YES
00-PLAYROOM COTS	N/A	N/A
01-ACTIVITY SPACE	NO (-76.4%)	YES
01-KITCHEN/LOUNGE	NO (-69.2%)	YES
01-SENSORY ROOM/CRASH ROOM	NO (-66.5%)	YES
02-OFFICE01	NO (-86%)	YES
02-OFFICE02	NO (-74.2%)	YES
02-OFFICE03	NO (-68.3%)	YES

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	516.5	516.5
External area [m^2]	973.7	973.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	292.31	473.33
Average U-value [W/m^2K]	0.3	0.49
Alpha value* [%]	10.22	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
	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
100	**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	3.32	5.11
Cooling	0	0
Auxiliary	4.33	3
Lighting	4.62	9.38
Hot water	13.47	4.95
Equipment*	20.45	20.45
TOTAL**	**25.74**	**22.44**

* 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	12.35	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]	37.22	47.08
Primary energy* [kWh/m^2]	78.22	67.16
Total emissions [kg/m^2]	6.8	11.4

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	37.2	0	3.3	0	4.3	3.12	0	3.32	0
	Notional	47.1	0	5.1	0	3	2.56	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	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	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	00000003:Surf[1]
Floor	0.2	0.2	00000003:Surf[0]
Roof	0.15	0.18	00000012:Surf[8]
Windows, roof windows, and rooflights	1.5	0.72	0000000E:Surf[0]
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

Appendix B – Full EPC

Energy Performance Certificate

Non-Domestic Building

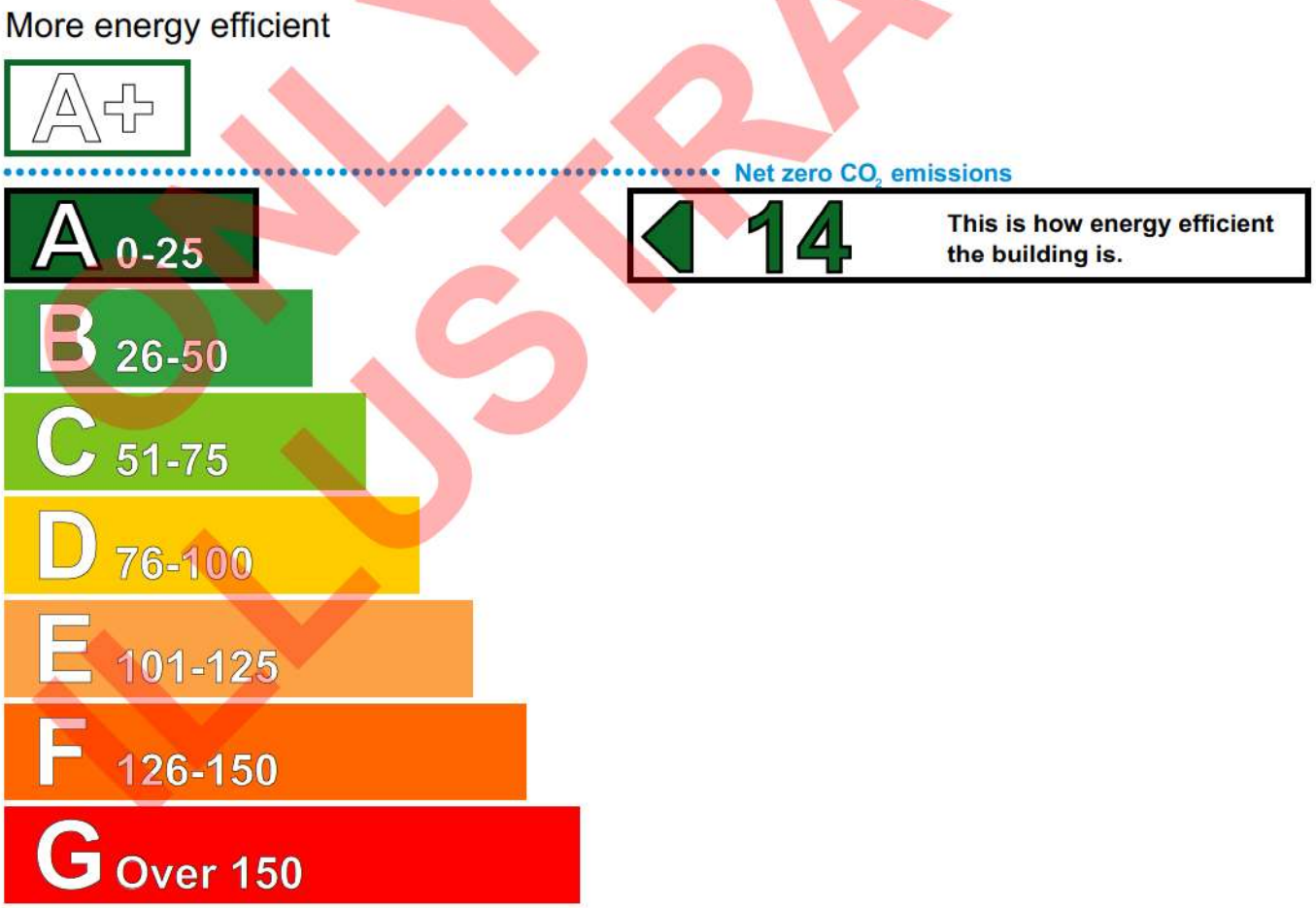
HM Government

151 London Road
Bishop's Stortford,
CM23 3JX

Certificate Reference Number:
6866-5558-4175-0267-0002

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:	Heating and Mechanical Ventilation
Total useful floor area (m^2):	516.458
Building complexity:	Level 5
Building emission rate ($kgCO_2/m^2$ per year):	6.81
Primary energy use (kWh/m^2 per year):	78.22

Benchmarks

Buildings similar to this one could have ratings as follows:

24 If newly built

63 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 v7.0.13 using calculation engine ApacheSim v7.0.13
Property Reference:	UPRN-000000000000
Assessor Name:	Jaejae Dimmock
Assessor Number:	TEST000000
Accreditation Scheme:	Information not available
Assessor Qualifications:	NOS5
Employer/Trading Name:	Green Building Design Consultants
Employer/Trading Address:	Four Rivers House, Fentiman Walk, Hertford, SG14 1DB
Issue Date:	16 May 2022
Valid Until:	15 May 2032 (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: 4061-2515-5110-9327-7538

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 Information not available. You can obtain contact details of the Accreditation Scheme at Information not available.

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.