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SUSTAINABLY.**





BARTON PEVERIL COLLEGE
NEW ART BLOCK
SUSTAINABILITY & ENERGY STATEMENT

Prepared by:

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All information provided here is based on plans and information available at the time of writing. Prior to implementation of the options discussed, further detailed study, design, and costing, based on ground surveys, structural analysis, over shading studies, etc., as relevant to each renewable/low carbon source, is necessary.

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1. EXECUTIVE SUMMARY

The proposal is to construct a two storey standalone building to contain classrooms for Art including textiles, studio's, fine art, photography & graphics.

This report describes the energy and carbon strategy for the proposed new art building at Barton Peveril College.

The College has a target for the site to be net zero by 2050. Therefore it is important any new building strives to achieve net zero to help with the wider site to meet their overall target.

The exact building details for the Art Block are being developed in order to deliver this, which will be achieved through the following measures:

- Energy efficiency through building form
- Fabric u-values significantly better than building regulations & exceeding the values assigned to the notional building
- Heat pump technology for heating and hot water
- Water saving measures
- Mechanical ventilation with heat recovery & low specific fan powers
- Energy efficiency LED lighting
- Photovoltaic panels for on site electricity generation
- Energy monitoring through metering

A lean, clean, green approach to the building from the onset is being adopted and would far exceed the planning & BREEAM energy requirements, demonstrating:

- A greater than 15% improvement in predicted carbon emissions over building regulations
- Achieving BREEAM Excellent standards (New Construction 2018) specifically under the sections relevant to operational energy and carbon emissions i.e. sections ENE01 and ENE04.

The Department of Education (DFE) Output Specifications will be followed as part of the design process.

An initial IES thermal model has been undertaken for the building to show the initial Building Regulations compliance. This shows the measures outlined within report are in compliance with Part L 2021, with the Building CO₂ emission rate being below the target emission rate and the Building primary energy rate being below the target primary energy rate.

Net zero calculations will need to be undertaken following the CIBSE TM54 methodology, which are separate to the Part L compliance, which account for the buildings operational energy that would need to be assessed during the next RIBA workstages.

2. ENERGY STRATEGY

The key drivers for setting out the requirements for the Energy Strategy are detailed within the Eastleigh Borough Council Policy DM2 & within the Department for Education Further Education Output Specifications, Technical Annex 2J: Sustainability, which are set out within the sections below.

2.1 Eastleigh Borough Council

Policy DM2 Environmentally Sustainable Development, states that:

1. The Borough Council required that:
 - b) All development (other than new build residential) that is above 500 sq.m of floorspace measured externally (including extensions and conversions to existing buildings) must achieve BREEAM 'excellent' (or equivalent) or BREEAM 'very good' plus 'passivhaus' certification including a 15% improvement in predicted carbon emissions, compared with the building regulations current at the time, through low or zero carbon energy generation on site or in a Borough location agreed by the Council.
 - c) All other larger developments above 10,000 sq.m of floor space should also seek to fund post occupancy evaluation (POE) in addition to the above.
2. In addition to the above, all development above 500 sq.m of floorspace measured externally (including extensions and conversions to existing buildings) and external spaces within the curtilage serving developments of this size should where practical and viable:
 - a) incorporate energy efficient passive design principles, the best use of natural daylight and natural ventilation systems wherever possible;
 - b) connect to any existing near or adjacent low carbon local energy network unless this is provided unviable;
 - c) use recycled, low embodied carbon, low environmental impact and locally sourced materials in construction where possible;
 - d) be designed with sufficient flexibility to enable the life of the building to be extended by re-use for other purposes where feasible
 - e) aim to deliver at least 1% of all residential units within the whole scheme which achieve full 'passivhaus' certification.

Meanwhile, Policy DM2 Adaption to Climate Change states that:

All development should:

- a) reduce the potential impacts of surface water flooding as part of an integrated SuDS strategy in accordance with policy DM6 (Sustainable surface water management and watercourse management)
- b) have a cooling strategy
- c) be adaptable to water stress and designed to reduce demand on water usage

2.2 Further Education Output Specification Technical Annex 2J: Sustainability

The critical Technical Annex impacting on the Energy Statement is within Annex 2J: Sustainability. This states:

3.6.1.1 All New Buildings shall achieve Net Zero Carbon in Operation as defined by the standards within the Net Zero Carbon Buildings: A Framework Definition UK Green Building Council (UK GBC) Using EN15978. Recognising a development of targets over a timeline.

- a) Net Zero Carbon – Operations (now). The design of New Buildings shall be net zero carbon for operational energy B6 achieved annually, in-use.
- b) Design to be developed to cover stages B1-B7.

3.6.1.2 Net Zero Carbon in Operation Shall be calculated to include regulated and unregulated energy use, following the CIBSE TM54 methodology, projected against 2050 BEIS figures for grid decarbonisation.

3.6.1.3 Off-site setting is not permitted

3.6.1.4 Where a school site meets all of the requirements of the Output Specification, but site specific items or project constraints mean that it is not possible to achieve Net Zero Carbon in Operation using on-site renewables, a clear roadmap towards 2050 should be provided to the Responsible Body as part of the Strategic Brief output in Annex SS6.

3.6.1.5 Zero Carbon in operation reporting shall be part of the development of the Project at each stage of the RIBA Plan of Works 2020, for the whole life of the Project.

2.3 Department for Education

The following FE Output Specification's will be relevant to the mechanical and electrical services:

- Generic Design Brief
- Technical Annex 2E: Daylight & Electric Lighting
- Technical Annex 2F: Mechanical Services and Public Health
- Technical Annex 2G: Electrical Services, Communications, Fire and Security Systems
- Technical Annex 2H: Energy
- Technical Annex 2I: Controls
- Technical Annex 2J: Sustainability
- Technical Annex 2K: Building Performance Evaluation Methodology

These specifications from the Department for Education will be followed through the design process.

3. BUILDING FABRIC

3.1 Fabric First Design Approach

The design of the fabric of the building is extremely important for minimising the energy required for space heating. It is also worth noting that the materials used for the building structure and envelope are likely to have much longer lifespans than building services and other complex technologies.

LETI Climate Emergency Design Guide¹ provides a further specification for a zero carbon target.

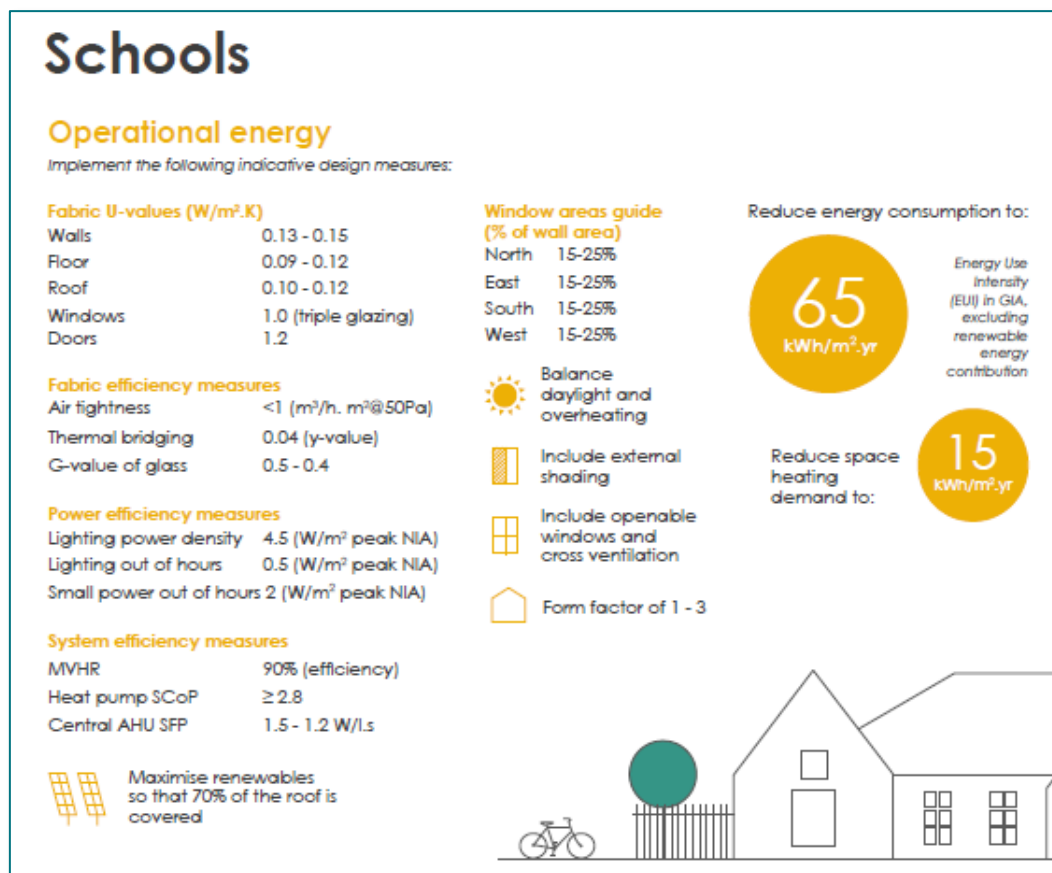


Figure 1 LETI Zero Carbon School Specification

3.1.1 Form Factor

When trying to reduce energy consumption to minimal levels, the massing of the building has a significant impact. Form factor refers to the surface area to volume ratio of the building. As shown in the graphic below there is a huge variation in common building shapes.

¹ LETI Climate Emergency Design Guide, How new buildings can meet UK climate change targets

From a heat loss perspective, the more favourable building forms are shown on the bottom left of this graphic, with more challenging shapes towards the top right.

The LETI guidance targets a form factor of between 1 and 3. Ideally compact multi-storey buildings have favourable form factors.

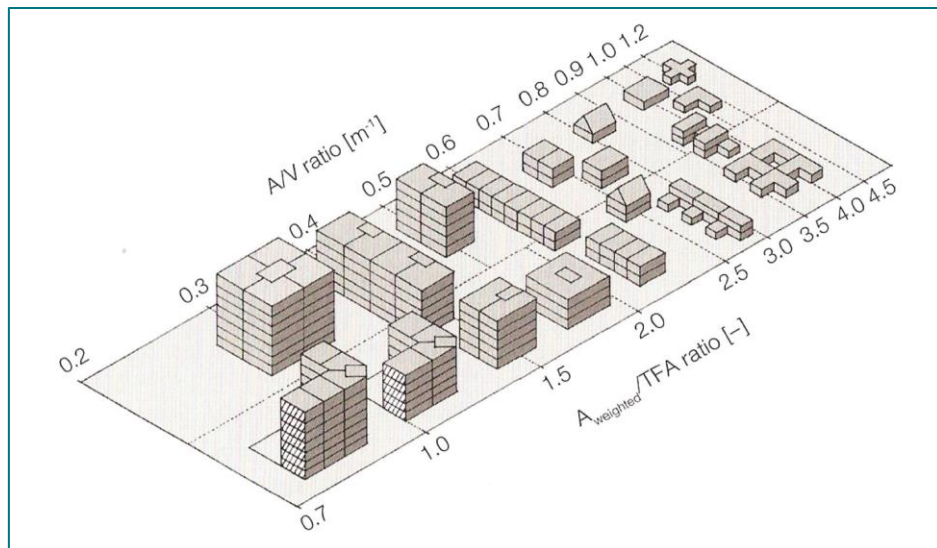


Figure 2 Form Factor (Source: elrondburrell.com/blog/passive-house-design-building-envelope)

In the majority of cases, numerous factors influence the massing of the building. Despite these constraints the proposed design is able to achieve a favourable form factor as illustrated below:



Figure 3 Perspective of the Proposed Design²

² Stride Treglow, Playing Field View

By allocating the accommodation over two floors, the impact of the heat losses through the roof and floor become less significant. The relatively compact nature of the design also helps to reduce the heat losses through walls.

3.1.2 Air Tightness

Maintaining a low air tightness will ensure heat is kept within the building and not lost through the building fabric. This will reduce waste of energy generation reducing the size of the required heating plant.

However, with air tight buildings ventilation becomes critical to maintain good air quality & prevent any condensation build up within the building.

3.1.3 Fabric Performance

The exact detailing of the building fabric will need to be confirmed, which will determine the U-Value. However following the LETI Guidance regarding the U-Values the aim is to be within the bands for each of the building fabric, the mean value is set out within the table below:

Element	Proposed U-Value (W/m ² k)	Building Regulations Limiting U-Value (W/m ² K)	Improvement Over Building Regulations (%)
Wall	0.14	0.26	46.1%
Window	1.0	1.6	37.5%
Roof-lights	1.0	2.2	54.5%
Floor	0.11	0.18	38.8%
Roof	0.11	0.16	31.2%

Table 1 Proposed U-Values in Comparison to the Building Regulations

As shown in the table above these show a significant improvement over the mandatory building regulations. These improvements exceed 31%.

It is important to note that the notional building has improved U-Values assigned from the mandatory minimum values, which any energy efficient building needs to match or improve of. Therefore the table below shows the comparison with the notional building:

Element	Proposed U-Value (W/m ² k)	Notional Building assigned U-Value (W/m ² K)	Improvement Over Building Regulations (%)
Wall	0.14	0.18	22.2%
Window	1.0	1.4	28.5%
Roof-lights	1.0	1.4	28.5%
Floor	0.11	0.15	26.6%
Roof	0.11	0.15	26.6%

Table 2 Proposed U-Values in Comparison to the Notional Building

As shown in the table there is generally an improvement over the notional building, with improvements typically exceeding 22%.

3.1.4 Design Standards

There is a strong intention from the client to pursue a net zero building following the DFE standards and thermal modelling will be carried out at each RIBA Stage to show how the building can achieve this.

Achieving net zero would far exceed the councils target for a 15% improvement in carbon emissions (over building regulations) as well as the BREEAM excellent standards relating to carbon emissions (i.e. credits ENE01 & ENE04).

4. BUILDING SERVICES

There is now a clear movement away from fossil fuels across many different industries including construction. Electricity has emerged as the obvious replacement; however the relatively high fuel cost means that heat pump technology is favoured to manage the running costs.

Another key advantage of using electricity is that there are various means for it to be generated with next to no impact on climate change.

4.1.1 Heating & Hot Water

Heat pump technology is the preferred option for the generation of the heating and hot water. At this early stage a ground source heat pump is the favoured technology. As the building will be adjacent to the sports pitch the use of boreholes is the most likely option for the ground source heat pump array type.

4.1.2 Domestic Water Services

Sanitaryware including WCs, taps, mixers and showers will be of low-flow type to minimise water consumption & energy use. Toilet areas will be fitted with solenoid valves activated by occupancy sensors, which will close when areas are unoccupied to minimise water loss through minor leaks in sanitaryware such as WCs or urinals.

4.1.3 Ventilation

The vast majority of the fresh air requirements will be for the classrooms that occupy a significant portion of the floor area. The preference is to install a ventilation system that will recover the heat either through hybrid ventilation or through mechanical ventilation with heat recover. These types of systems will also be used to help prevent overheating. Low energy systems will need to be designed to keep the specific fan power down for optimum energy efficiency.

Specialist ventilation will also be installed within specific rooms i.e. for the kiln, dust extract etc. These systems will be developed once further information is known.

4.1.4 Lighting

High efficiency LED lighting will be provided. Automatic controls with occupancy and daylight sensing will mitigate unnecessary operation of the lighting.

4.1.5 Photovoltaic Panels

As the intention is to use electricity as a main fuel, using photovoltaic panels to generate electricity would complement this strategy. The layout of the PV would be located on the South facing roof pitches as indicated in Figure 3.

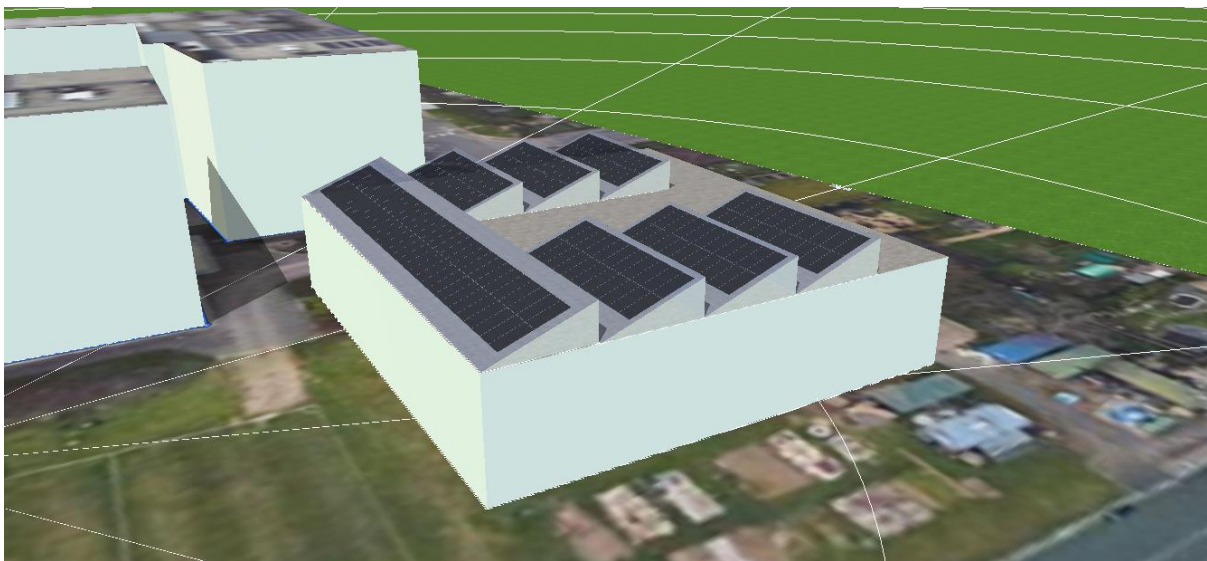


Figure 4 Perspective of the Proposed Design³

Battery Storage will be considered if required to help meet net zero.

4.1.6 System Monitoring

Metering & monitoring of the energy consuming elements will add benefit for the client as they analyse the site buildings to assess their energy efficiency & carbon for their estate.

The following elements would be metered & monitored:

- Heating
- Hot water
- Ventilation
- Lighting
- Small power
- Lifts

³ Stride Treglow, Building Section



- ICT
- Specialist equipment

5. APPROACH TO ENERGY EFFICIENCY

5.1 Fuel Usage

A fundamental decision has been made to avoid using fossil fuels as part of the energy strategy & utilise ground source heat pumps. This heat source uses electricity to generate heat & will have a typical seasonal coefficient of performance (COP) of 1:4. This means that for every 1kW of electrical input it will produce 4kW of heat.

5.2 Energy Hierarchy

The energy hierarchy has been followed to with regards to optimising energy use:

- Be Lean – Use Less Energy
- Be Clean – Efficient Energy Supply
- Be Green – Renewable Energy

This prioritises improvements to the building fabric, which has a much longer life expectancy than renewable technologies.

5.2.1 Be Lean – Use Less Energy

Measures to reduce energy use both actively and passively have been specified for the design. It is important that the services are well designed as to not waste energy. There are a number of measures that would be addressed to ensure plant runs efficiently & is correctly sized.

Passive Measures:

- High levels of insulation- keep heat in
- Low energy glazing- keep heat in
- Draught lobbies between classrooms – reduce heat losses
- Airtight construction- keep warm air inside
- Good daylight- reduce artificial lighting
- Low flow taps- reduce hot water use
- Heat recovery ventilation systems
- Demand controlled ventilation- only supply what is needed
- LED lighting and controls
- BMS Controls
- Energy Monitoring

5.2.2 Be Clean – Efficient Energy Supply

There are no heat networks that would be connected to as part of the scheme.

Using a clean fuel is important to having a clean building. A key benefit of using electricity is that the UK electricity grid is consistently becoming decarbonised by renewable energy sources replacing fossil fuel. Therefore as the grid decarbonises the building will become cleaner.

5.2.3 Be Green – Renewable Energy

As mentioned above, electricity has been identified as the appropriate fuel for heating and hot water. Heat pump technology offers an efficient means of achieving this where “free heat” can be collected from the ground of the sports field adjacent to the building.

A large PV array on the roof is proposed to compliment this all-electric strategy. Battery storage may be considered although may not been considered economically viable, so it is anticipated that clean electricity will be exported during times when it is not required by the school. This will effectively help to decarbonise the UK electricity grid.

In summary, the following measures are recommended:

- Ground Source Heat Pump for space heating and hot water
- Photovoltaic Panels

6. PART L THERMAL MODELLING

An initial IES thermal model has been undertaken for the building to show the Building Regulations compliance; an extract of the compliance document is shown within Figure 5.

This shows the measures outlined within report are in compliance with Part L 2021, with the Building CO₂ emission rate being below the target emission rate and the Building primary energy rate being below the target primary energy rate.

Net zero calculations will need to be undertaken following the CIBSE TM54 methodology, which are separate to the Part L compliance, which account for the buildings operational energy that would need to be assessed during the next RIBA workstages.

BRUKL Output Document

Compliance with England Building Regulations Part L 2021

Project name

BPC Art and Design Centre

As designed

Date: Tue Dec 13 08:05:30 2022

Administrative information

Building Details

Address: Chestnut Avenue, Hampshire, SO50 5ZA

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.16

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.16

BRUKL compliance module version: v6.1.c.0

Certifier details

Name: CBG consultants Ltd

Telephone number: 01865864500

Address: South house 3 Farmoor Court Cumnor Road,
Oxford, OX2 9LU

Foundation area [m²]: 989.96

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	3.48
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	1.83
Target primary energy rate (TPER), kWh/m ² .annum	37
Building primary energy rate (BPER), kWh/m ² .annum	18.53
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _a -Limit	U _a -Calc	U _i -Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	1F000099:Surf[32]
Floors	0.18	0.11	0.11	GF000017:Surf[0]
Pitched roofs	0.16	0.11	0.11	1F000099:Surf[2]
Flat roofs	0.18	0.11	0.11	1F000099:Surf[1]
Windows** and roof windows	1.6	1	1	1F000099:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors ^A	1.6	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No Vehicle access doors in building
High usage entrance doors	3	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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. *** Values for rooflights refer to the horizontal position. A For fire doors, limiting U-value is 1.8 W/m ² K. NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				
Air permeability	Limiting standard	This building		
m ³ /(h.m ²) at 50 Pa	8	1		

Figure 5 Part L Compliance Extract

7. CONCLUSIONS

There is strong client preference to make the proposed building as low carbon as possible with the aim of meeting net zero. The intention at this stage is to achieve the relevant targets using the following measures:

- Energy efficiency building form
- Fabric u-values significantly better than building regulations & exceeding the values assigned to the notional building
- Heat pump technology for heating and hot water
- Mechanical ventilation with heat recovery & low specific fan powers
- Energy efficiency LED lighting
- Photovoltaic panels for on site electricity generation
- Energy monitoring through metering.



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