Ritchie+Daffin

Outdoor Learning Facilities,
The Grange Centre for people with disabilities

Energy Efficiency Statement

Planning, Rev B

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Studio D
Holborn Studios
49-50 Eagle Wharf Road
London N1 7ED
Phone +44 (0)20 7043 3417
info@ritchiedaffin.com
www.ritchiedaffin.com

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1.0 Introduction

This Energy Efficiency Statement has been prepared for the proposed new Outdoor Learning Facilities at The Grange Centre for people with disabilities. The development includes the demolition, refurbishment and construction of buildings in the area north of the existing Walled Garden in order to provide enhanced horticultural, educational, training, support and storage facilities ancillary to the use of The Grange, together with hard and soft landscaping and car and cycle parking.

1.1 Summary of Planning Policy

The project takes place within the context of national and local planning policy that seek to address the challenge of reducing energy use and the implications of climate change. The policies outline how Government and the local authority are endeavouring to improve the way energy and other resources are used in buildings.

National Planning Policy Framework (2021)
Part 14. Meeting the challenge of climate change, flooding and coastal change

152. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

153. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures53. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

154. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable *adaptation measures, including through the planning of green infrastructure; and*

b) *can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.*

155. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) *provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);*
b) *consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*
c) *identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.*

156. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

157. In determining planning applications, local planning authorities should expect new development to:

a) *comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and*
b) *take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.*

158. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) *not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and*
b) *approve the application if its impacts are (or can be made) acceptable54. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.*

Mole Valley District Council Core Strategy lists the following environmental targets:

Policy CS 19

Sustainable Construction, Renewable Energy and Energy Conservation

1. *In order to support the Core Strategy's overarching aim of achieving sustainable development, and to reduce the causes of and effects of climate change, new buildings and the redevelopment and refurbishment of the existing building stock will be required to:*

    a) *minimise energy use through its design, layout and orientation*
    b) *maximise on-site recycling facilities and the re-use and recycling of materials used in construction; and*
    c) *meet at least Level 3 of the Code for Sustainable Homes for housing, or BREEAM 'Very Good' construction standards for all other development, or higher as dictated by future legislation and guidance (Code Level 4 from 2013 and Code 6 by 2016). This must include a 10% reduction in total carbon emissions through the on-site installation and implementation of decentralised and renewable or low-carbon energy sources.*

2. *Applicants will be required to submit evidence to demonstrate how these requirements have been met unless it can be demonstrated that compliance is not technically or financially achievable having regard to the type of development involved and its design.*

The following Sections of this statement outline how the energy demand for the proposed development is minimised through the use of high performance building elements and passive design measures. A high-level renewable energy feasibility study assesses the most applicable low carbon energy sources for the scheme in terms of carbon emissions and costs.

2.0 Energy Demand Reduction

This Section outlines how the energy demand of the buildings is reduced. A 'fabric first' approach is proposed whereby the heating demands are reduced by using thermally insulating build-ups, and retrofitting insulation to existing build-ups.

2.1 Fabric Options

Thermal Insulation

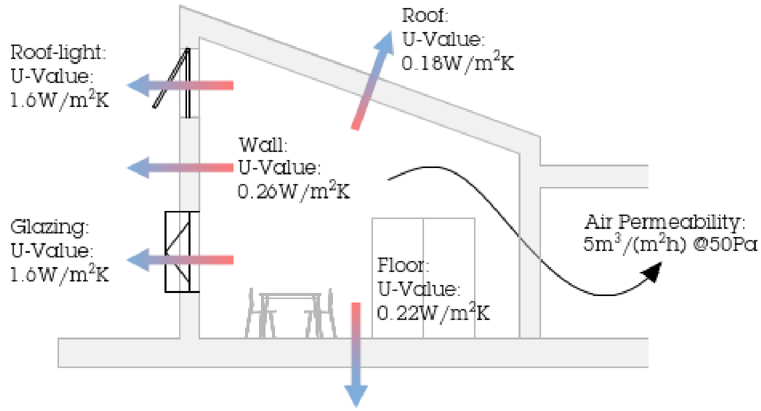
As a minimum, the thermal performance of the new building envelope must be designed to comply with Part L of the Building Regulations shown in the table below:

Construction Element	Notional U-Value defined in Part L
Roof	0.18 W/m^2K
Wall	0.26 W/m^2K
Floor	0.22 W/m^2K
Windows	1.60 W/m^2K

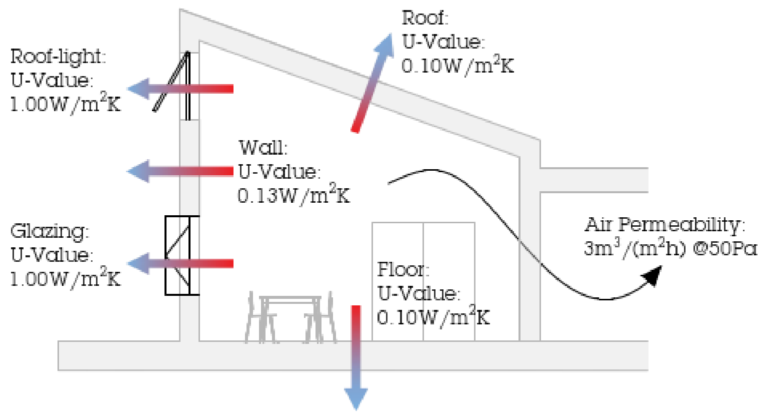
The table below illustrates the proposed thermal performances of the construction elements which are significantly better the notional performances above:

Construction Element	Target U-Value
New Roof	0.10 W/m^2K
New External Wall	0.13 W/m^2K
Existing External Wall (renovated)	0.18 W/m^2K
Existing Roof (renovated)	0.20 W/m^2K
New Floor Slab	0.10 W/m^2K
New Windows	1.00 W/m^2K
New Rooflights	1.00 W/m^2K

These target fabric performance targets have been selected in line with the notional standards outlined by the London Energy Transformation Initiative (LETI) which is an industry initiative for building standards which help put the UK on the path to a zero carbon future.



Building Regulations: Minimum 'Notional' thermal efficiencies



Proposed thermal efficiencies: New Constructions

Airtightness

This refers to limiting the uncontrolled flow of air through unintentional openings in the building's walls and roof. The management of infiltration reduces building energy use by reducing heat lost through this method. A building with high infiltration would be described as draughty or 'leaky'.

The extent of infiltration may be determined by measuring the air permeability of the building envelope which describes the relative 'air-tightness' of a building. The current Building Regulations 2013 requires that the air permeability of the building fabric does not exceed $10m^3/h/m^2$ at an applied pressure difference of 50Pa. This is not a particularly onerous target and the building is being designed to a much better standard of $3m^3/h/m^2$.

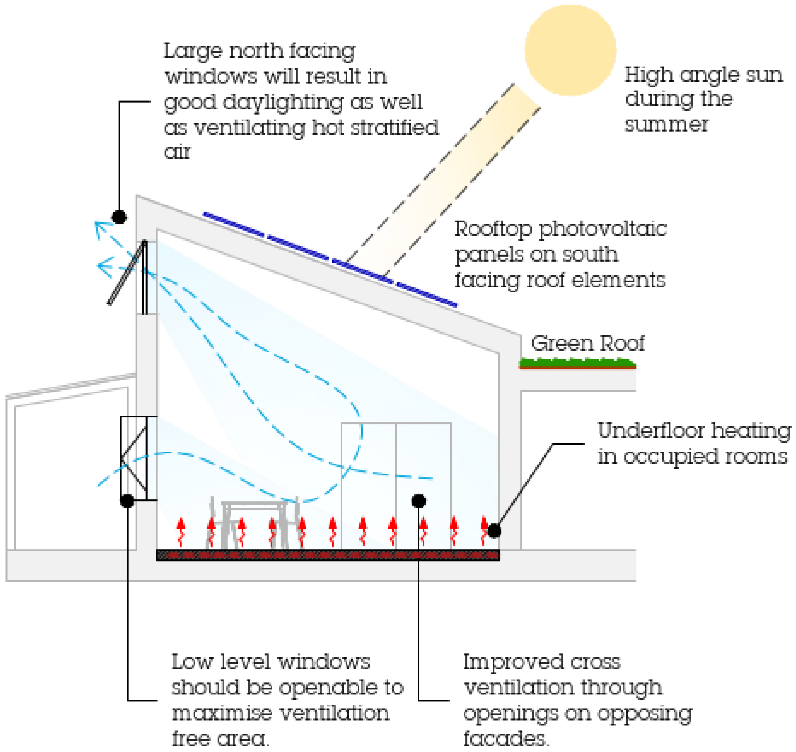
Thermal Bridges

Thermal bridges occur at the junctions between constructions such as sills, jambs and wall to floor joints. Heat is lost at these interfaces due to discontinuities in insulation layer therefore, the amount of heat lost through a thermal bridge depends on the quality of construction and length of a particular junction.

The thermal bridges have not yet been fully defined but it is proposed that a combined y-value of 0.04 W/m^2K is targeted again in line with LETI standards. This applies to the new-build elements only.

Natural Ventilation

The positioning of glazing has been considered carefully and uses northlights and external shading minimise the amount of solar heat entering rooms in summer. Comfort cooling is therefore not proposed.



Auxiliary Power

Auxiliary power represents the energy consumption of fans and pumps. Where rooms are mechanically ventilated, fans and air handling units with low specific fan powers is essential. The table below outlines the performance specification.

Ventilation Application	SFP, W/l/s	Heat Recovery efficiency
Café MVHR units	1.5 W/l/s	85%
Toilet extract fans	0.4 W/l/s	N/A

To minimise the energy demands of ventilation it is proposed that most spaces are naturally ventilated via openable windows and rooflights.

Lighting

The power requirements associated with artificial lighting can vary dramatically depending on lamp type and controls strategy. The lumens per circuit-watt is a measure of a light fitting's efficacy in converting electrical energy into visible light. The table below compares the efficacy of some common types.

Lamp Types	Luminous efficacy, lm/W
Incandescent	11
Halogen	16
Compact Florescent	45
LED	Up to 100

LED lighting is the most efficient form of lighting and has been proposed for all artificial lighting throughout the building. An efficacy of greater than 80 lm/W should be proposed.

3.0 Renewable Energy & Low Carbon Heating Technologies

As noted in Section 1.1 Mole Valley District Council require all new development to achieve a 10% reduction in carbon emissions using renewable energy sources if technically viable.

3.1 Feasibility Study

This Renewable Energy Feasibility Study appraises renewable technologies and their applicability to the proposed new buildings.

The building data below was used to quantify the carbon saving associated each renewable energy technology appraised. This data is based on energy benchmarks for similar building types, and not a specific detailed model.

Building Data				
Total area (heated spaces)	Peak Heating Demand	Annual Space Heating Consumption	Annual Hot Water Consumption	Baseline Emissions
735m^2	66 kW	11025 kWh*	10290 kWh**	10640 kg***

*15kWh/m^{2}yr (LETI target Standard)

**14kWh/m^{2}yr (From assessments on similar building types)

***65 kWh/m^{2}yr (LETI target Standard & SAP 10 carbon factors)

The following renewable energy technologies were considered, and their suitability are as follows:

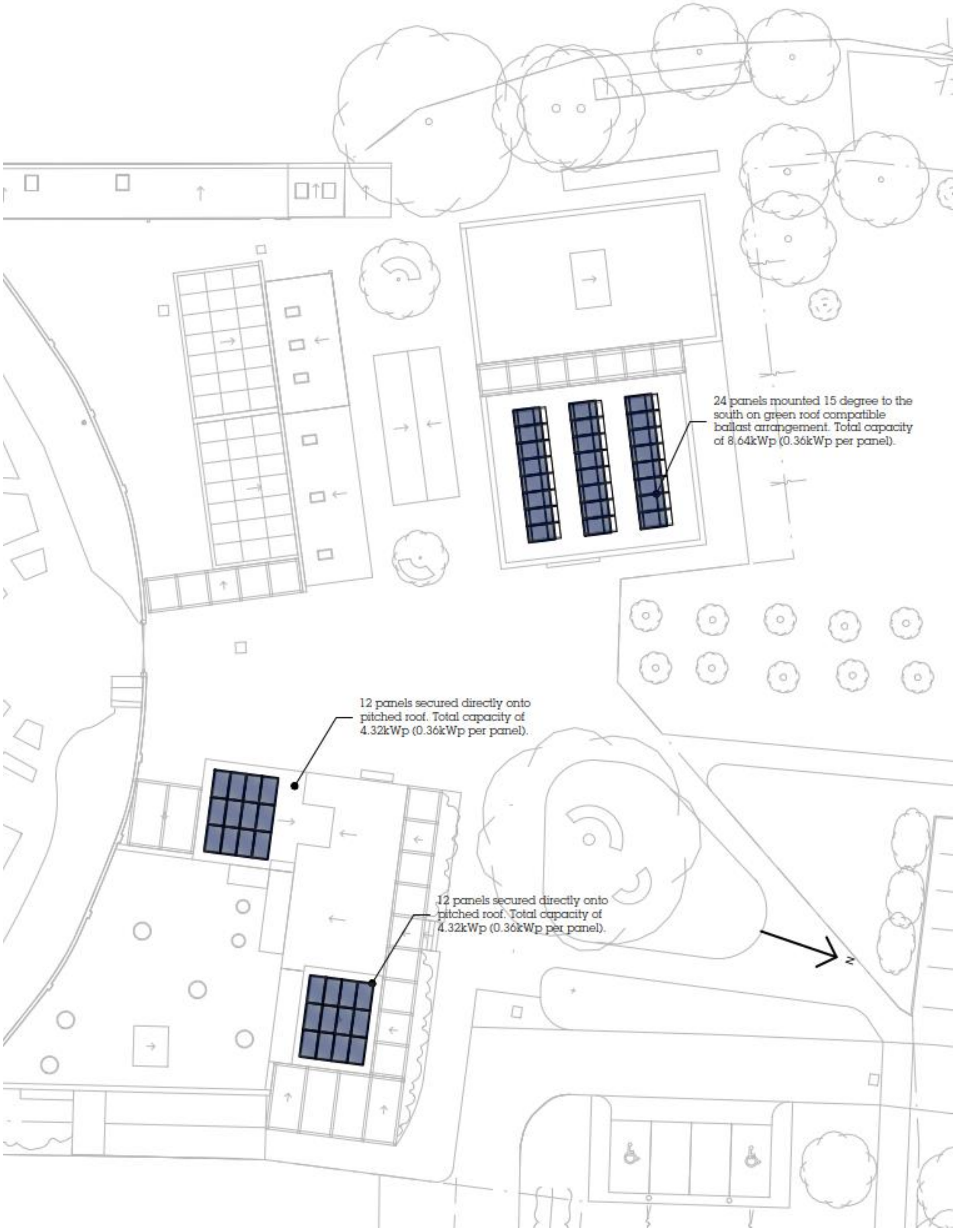
	Technology	Applicability
a	Ground Source heat pumps	**N**
b	Air Source heat pumps	**Y**
c	Biomass heating	**N**
d	Solar Water heating	**N**
e	Photovoltaics	**Y**
f	Wind	**N**

3.2 Suitable Technologies

3.2.1 Photovoltaics

PV arrays require a relatively large initial capital investment however maintenance requirements are minimal, and they are completely silent and static making the risk for planning implications low. These benign qualities make photovoltaics an attractive option.

Having assessed the available roof areas approximately 48 panels equating to 17.3kWp total capacity (assuming 360Wp panels) can be accommodated across the new roofs, see following figure.

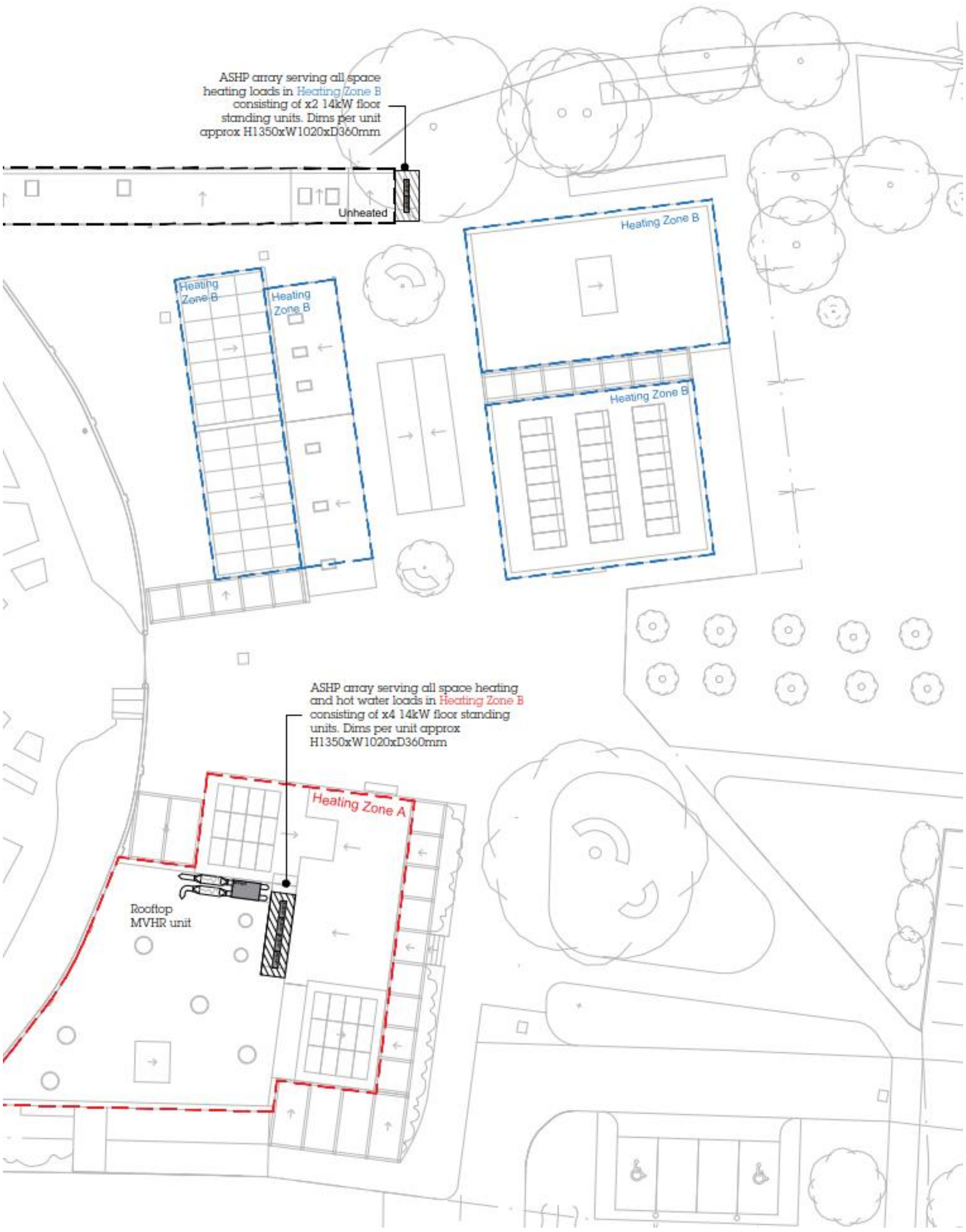


Photovoltaic Solar Panel Arrays

3.2.2 ASHP

An Air Source Heat Pump located on the roofs could provide a renewable source of heat that can be utilised for space heating and potentially hot water production (They are also capable of production DHW although plant efficiencies tend to drop when producing water temps in excess of 50°C).

To meet the total space heating demands for the new buildings as well as the hot water demands for the café requires a total heating capacity of 66kW. This could be achieved via cascading multiple 14kW ASHPs grouped in banks as shown in the figure below. To minimise the extent of buried heating pipework linking the buildings two banks of ASHPs could be installed serving the western and eastern buildings respectively. The external units will be housed in louvred enclosures to minimise breakout noise and provide visual screening.



Heating Heat Pump Locations & Zones

3.3 Unsuitable Technologies

3.3.1 Solar Thermal Heating

Solar thermal hot water heating was discounted primarily due to the complexity of integrating such a system with the general hot water services in the building. It would involve running additional hot water pipework throughout the building which adds cost and increases the risk of overheating. In addition, the relatively low hot water demands for the building in comparison to the space heating means carbon savings in this area are limited compared to other technologies.

3.3.2 Ground Source Heat Pumps

Ground source heat pumps were discounted due to high installation costs, typically from 1,200 to £2,000 per kW of peak heat output. Given the high peak heating/hot water loads this technology would be exceptionally expensive should it be the sole source of heat for the building. These high installation costs (Circa £200k-300k) will likely make the project unviable.

3.3.3 Biomass

Biomass heating was discounted due to concerns regarding the logistics of fuel delivery and handling on the site. A significant amount of space will have to be allocated for fuel storage to minimise the number of fuel deliveries per year.

3.3.4 Wind

Wind power via turbines was discounted due to the negative visual impact.

3.4 Results & Conclusions

The effectiveness of each applicable technology is summarised in the table below:

RES Options		PV	ASHP
End use (demand) met		Electricity 15.5 MWh*	Providing 100% HTG load (COP = 3)
System Size		75m² array	x6 14kW ASHP
Annual Carbon Savings	kg.CO2	2110 kg.CO2***	2821 kg.CO2**
%age CO2 Reduction (from Baseline)		20%	26%
Capital cost Rate (extra)	£/m² panel	300 £/m² panel	670 £/kW
Lifetime		25years	20years
Annual Maintenance Costs		£200	£750
Total Capital Cost	£	£22,500	£44,220

*Based on array with total capacity of 17.3kWp and kK factor of 0.95

** Compared to heat delivered via conventional gas-fired boiler

*** PV Carbon Savings based on grid emission factor of 136 grams CO2e/kWh

Both technologies considered give rise to useful carbon savings that meet the planning policy requirements.

The above analysis shows that photovoltaic panels are also relatively cost effective compared to ASHP heating.

Heating via ASHP is beneficial as the electricity to drive the heat pumps will be met in part by the PV array.

With both ASHPs and PV installed a predicted total of 4931kg CO_2 emissions will be saved per year compared to an equivalent building heated via a gas fired boilers without PV. (equating to approximate 45% reduction in total emissions).