ENERGIST

BEYOND BUILDING

Energy and Environmental Standards Statement

Belle Vue Bingo Hall

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Revision History

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02	24/04/2026	Updated Site Plan	MW	DS

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Calculations contained within this report have been produced based on information supplied to Energist by the Client and the Design Team. Any alterations to the technical specification on which this report is based will invalidate its findings.

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Contents

0. EXECUTIVE SUMMARY 4
1. BUILDING FABRIC AND VENTILATION 7
2. MAXIMISE ENERGY EFFICIENCY 10
3. RENEWABLE ENERGY GENERATION 11
4. LOW CARBON HEATING 13
5. OVERHEATING RISK 14
6. MATERIALS 15
7. OFFSETS 18
8. CONCLUSION 19
APPENDICES 21
APPENDIX 1: LIST OF ABBREVIATIONS 21
APPENDIX 2: LZCT ASSESSMENT 22
APPENDIX 3: SAPS 30

0. EXECUTIVE SUMMARY

0.1 Project Overview

This Energy and Environmental Standards Statement has been produced by Energist UK in support of an application by Kellen Homes and Jigsaw Homes North ('the Applicant') to Manchester City Council. The description of development is as follows:

"Erection of a residential development comprising 152 dwellings (Use Class C3a) together with landscaping, sustainable drainage features, pedestrian footways and highways, parking provision and other associated works"

The site layout, as illustrated in the accompanying drawing below, provides an overview of the proposed arrangement at Belle Bue Bingo Hall.



Figure 1 – The Proposed Site Plan

[Source: Proposed Site Plan, Kellen Homes]

The Applicant has adopted a sustainable design approach, incorporating efficient Low and Zero-Carbon (LZC) technologies to ensure compliance with The Climate Change Act (2008) and the National Planning Policy Framework (NPPF, 2025). The statement also addresses key local planning documents, including:

- The Manchester Core Strategy (Adopted 2012)
- Saved Policies of the Manchester Unitary Development Plan (UDP Adopted 1995, relevant Policies 'Saved in 2012)
- Places for Everyone (Adopted 2024)

The applicant decided to commit to a design approach that aligns with the principles of the energy hierarchy. The development is anticipated to achieve a total reduction in regulated CO_2 emissions of **71%** over the Target Emission Rate (TER) Approved Document Part L (AD L) 2021.

Table 1 - Measures incorporated to deliver the energy standard

Demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double-glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Low-energy lighting throughout the development.
Renewable and low-carbon energy technologies	▪ Heat pump technology to meet the majority of the heat and hot water demand.

The development has optimised every opportunity to reduce on-site emissions by integrating efficient building fabric, innovative design, and advanced heating systems, resulting in substantial CO_2 emission reductions compared to the Baseline.

The effectiveness of the design measures, along with the low-carbon and renewable energy solutions, is demonstrated in Table 2 and Figure 1 below.

Table 2 – CO_2 emissions.

	CO_2 emissions	
	Tonnes CO_2 per annum	*% reduction*
Target Emission Rate: compliant with AD L 2021	132.67	-
Dwelling Emission Rate (DER)	38.13	**71%**
Total cumulative savings	**94.95**	

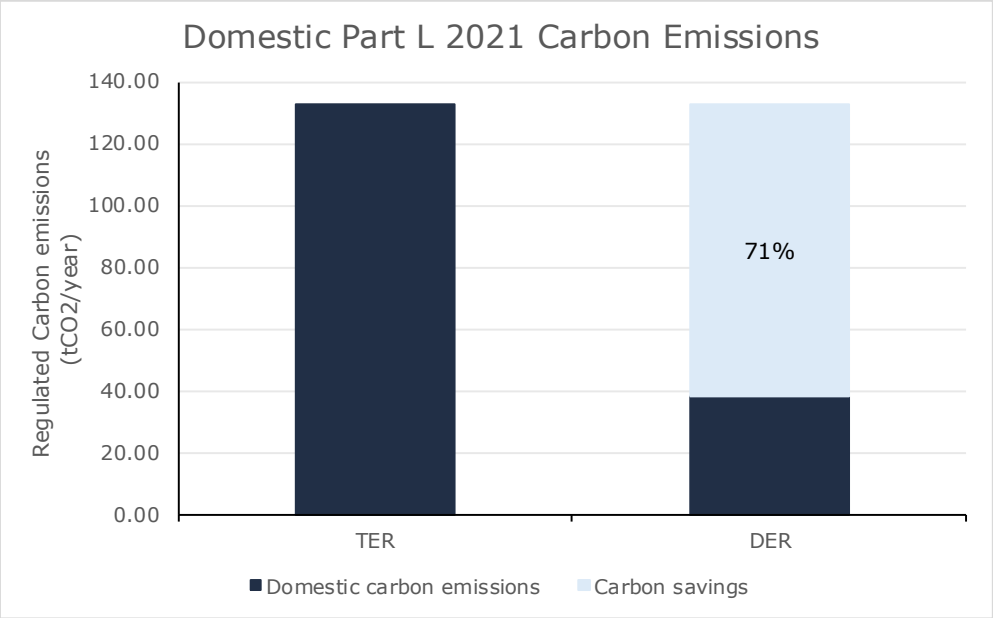


Figure 2 - How the Development delivers the energy standard.

1. BUILDING FABRIC AND VENTILATION

1.1 Introduction

The estimated energy performance of the development has been calculated using the SAP 10.2 methodology to all proposed dwellings. This enables a comprehensive analysis of the carbon emission across the development.

SAP calculates the regulated energy demands associated with hot water, space heating and fixed electrical items. Part L is used for the purposes of the new build energy assessment.

The design specifications for the Baseline (compliant with AD L 2021) are listed in the table below.

Table 3 – Design specification for the Baseline

Element	Design specification for the Baseline
Ground Floor (W/m^2.K)	0.13
External Wall U-Value (W/m^2.K)	0.18
Party Wall U-Value (W/m^2.K)	0 *(fully filled and sealed)*
Roof (Flat) U-Value (W/m^2.K)	0.11
External Door U-Value (W/m^2.K)	1.00
Glazing U-Value (W/m^2.K)	1.20 (double-glazed units)
Glazing G-Value	0.63
Design Air Permeability (m^3/m^{2}hr @50 Pa)	5.0
Thermal Bridging	SAP 10 Appendix R values
Lighting (W/m^2)	100% of 80 lm/W
Ventilation	Natural ventilation with intermittent extract fans

Space Heating	92.3% efficient gas boiler
Space Heating Controls	Standard controls *(time and temperature zone control, thermostatic radiator valves)*
Domestic Hot Water Heating	From main heating system

1.2 Development's Baseline

The resulting TER, representing the total maximum CO_2 emissions permitted for the development has been calculated as **132.43 Tonnes CO_2 per annum**. To ensure compliance with AD L 2021, CO_2 emissions should not exceed this figure.

Table 4 - Development's Target Emission Rate

	CO_2 emissions	
	Tonnes CO_2 per annum	*% reduction*
Target Emission Rate: Compliant with AD L 2021	132.67	-

1.3 Fabric First

The development achieves a high quality, sustainable design by integrating the following passive and active design measures to reduce energy demand:

- Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs
- High-efficiency double-glazed windows throughout
- Quality of build will be confirmed by achieving good air-tightness results throughout
- Efficient-building services including high-efficiency heating systems
- Low-energy lighting throughout the dwellings

Designing an efficient thermal envelope significantly reduces the need for space heating by minimising heat transmittance through the building's thermal elements. Additionally, achieving low air permeability further lowers heating demand by limiting the amount of air that can infiltrate the building, effectively reducing heat loss during winter and minimising heat gain in summer.

As part of a 'Fabric First' approach, the building fabric has been carefully considered and specified to meet or exceed current Building Regulations minimum requirements, along with the specification of an energy efficient plant.

Table 5 – 'Fabric First' design specification

Element	**Proposed design specification**
Ground Floor ($W/m^2.K$)	0.11-0.12
External Wall U-Value ($W/m^2.K$)	0.19
Party Wall U-Value ($W/m^2.K$)	N/A
Roof (Pitched) U-Value ($W/m^2.K$)	0.08-0.15
External Door U-Value ($W/m^2.K$)	1.30
Glazing U-Value ($W/m^2.K$)	1.20-1.30
Glazing G-Value	0.63
Design Air Permeability (m^3/m^2hr @50 Pa)	3.0
Thermal Bridging	Bespoke Thermal Bridging Calculations
Lighting	150 lm/W
Ventilation	Decentralised Continuous Mechanical Extract MVHR/Purge Fans where required due to acoustic constraints

2. MAXIMISE ENERGY EFFICIENCY

ENERGY HIERARCHY

This Energy Statement is assessed against, and presented, to align with the following steps (please refer to the figure below):

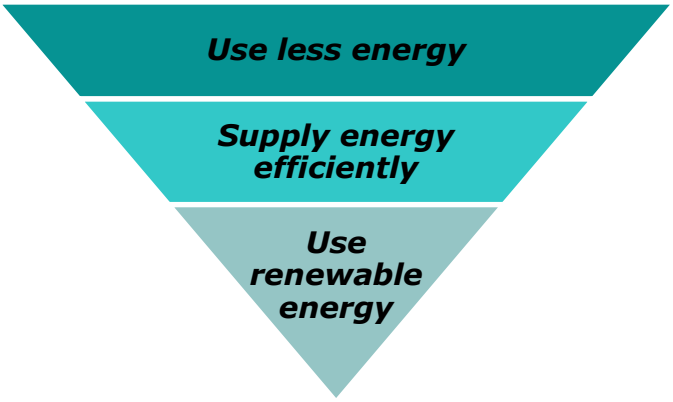


Figure 3 - Three-tier energy hierarchy

This three-tier energy hierarchy is based on widely recognised sustainable energy planning principles, consistent with UK national policy frameworks such as the NPPF and the guidance from the Department for Energy Security and Net Zero (DESNZ). This approach prioritises energy demand reduction ('use less energy'), followed by efficient energy supply ('supply energy efficiently'), and the integration of renewable energy technologies ('use renewable energy').

SAP

Energist UK employed the SAP 10.2 methodology to calculate the energy demand for all the proposed homes included in the development application. The assessment was conducted using the available architectural drawings of the dwelling types provided by Kellen Homes, ensuring that the energy performance predictions are tailored to the specific design characteristics of the development. This approach allows for a comprehensive analysis of the development's energy efficiency, ensuring compliance with current regulatory standards and providing a robust foundation for future energy strategy decisions.

3. RENEWABLE ENERGY GENERATION

3.1 Renewable and low—carbon energy technologies

The applicant has also committed to maximising the integration of Low and Zero-Carbon (LZC) technologies within their energy statement for the development.

Viability of the following low-carbon and renewable energy technologies have been considered:

- Wind
- Solar
- Aerothermal
- Geothermal
- Biomass

The above LZC technologies have been assessed for their viability as a component of a complementary heating strategy for the development. A detailed review of the LZC technologies is provided in Appendix 2, including wind, solar thermal, biomass, and other heat pump technologies. The Applicant's adopted strategy for LZC technologies is compatible with the 'Fabric First' design specification.

The following low-carbon and renewable energy technologies, summarised here in Table 6, are considered potentially viable options for the Development.

Table 6 - Summary of Feasibility

✓	*Solar Thermal* *Solar PV* *Air Source Heat Pumps*
✗	*Wind Turbines* *Biomass Boilers* *Ground Source Heat Pumps*

AIR SOURCE HEAT PUMPS

Following the implementation of 'Fabric first' design measures to reduce energy demand, the assumed strategy for the purpose of calculating carbon emissions currently is individual ASHPs for the houses, and heat pump hot water cylinders for the apartments. This solution will ensure efficient, low-carbon space heating and hot water provision for all units.

As the design development, other types of heat pump based heating will be considered to ensure the most efficient and appropriate technology is implemented on site.

SOLAR THERMAL / SOLAR PV

Whilst technically feasible, the applicant has opted not to pursue the incorporation of solar thermal or PV. The decision was made to incorporate ASHP technology as the low zero carbon energy source in combination with significant improvements to the fabric specification above Part L notional design. Significant investment was made to a fabric first approach to make the dwellings more comfortable for occupants, as well as ensuring that the risk of fuel poverty is reduced, rather than the reliance on bolt-on technologies such as solar PV. The dwellings onsite achieve significant reductions over Part L regulations via the use of the prescribed fabric and ASHP technology.

4. LOW CARBON HEATING

The development as proposed is fossil fuel free, utilising mains grid electricity to meet all heating and cooling requirements. This will ensure the development is future proofed as the nation grid continues to decarbonise and will reduce the impact on the local environment. The below table summarise the current assumptions for heating and cooling:

Table 7 – Heating and Cooling Specification

Element	**Proposed design specification**
Space Heating	Houses - Ideal ASHP monoblock 5kwh Apartments - Dimplex electric panel
Hot water Heating	Houses – From ASHP Apartments - Mixergy 150 litre tank (Heat Pump hot water cylinder)

As a result of applying these standards, the following reductions against Part L 2021. The estimated site-wide CO_2 emissions are **38.13 Tonnes CO_2 per annum**, which is a reduction of **94.55 Tonnes CO_2 per annum**, or **71%** over the Baseline.

Table 8 – SAP Results

	CO_2 emissions	
	Tonnes CO_2 per annum	*% reduction*
Target Emission Rate: compliant with AD L 2021	132.67	-
Dwelling Emission Rate (DER)	38.13	**71%**
Total cumulative savings	**94.55**	

5. OVERHEATING RISK

Approved Document O

Since June 15th, 2022, an additional volume of Building Regulations has been applied to new building works in England. Approved Document O (2021) considers the overheating risk of new dwellings, and other buildings which are used in a domestic manner.

AD O considers solar gains, the incorporation of shading into the design, and the free area of air movement within buildings. It also includes guidance to protect against external noise and air pollution, security and to ensure changes to the design for overheating purposes do not increase the risk of falling from height.

The Developer will complete AD O calculations for the Development at the detailed design stage. All properties will be designed to comply with the requirements of Approved Document O (2021).

Mitigating the Risk of Overheating

The design follows the cooling hierarchy by prioritising passive measures before introducing active interventions to effectively mitigate overheating risks. The potential measures include:

- Enhanced Building Fabric: High-performance materials improve insulation, minimising heat transfer and contributing to a more stable indoor environment.
- Natural Ventilation: Openable windows will be incorporated into the design, allowing natural airflow to cool the interior spaces effectively. If acoustic restraints limit the opening of windows then purge fans will be adopted.
- Enhanced mechanical ventilation: If required enhanced supply and extract ventilation will be provided to provide additional summer comfort.
- Shading from Overhangs: Overhangs will be strategically positioned to provide shading and reduce direct sunlight, particularly during peak hours.

These strategies ensure compliance with best practices for mitigating overheating risks, creating a thermally comfortable and energy-efficient environment. This will be evidenced by the completion of both Simplified and Dynamic Overheating assessments to ensure compliance with Part O.

6. MATERIALS

Sustainable Waste Management

The Applicant is committed to prioritising steps of the waste hierarchy and implements the following Strategy to ensure a sustainable and environmentally responsible approach is taken to the management of domestic waste and waste during the design and construction of the development.

This will be managed through the effective implementation of an on-site plan that will focus on steps in the waste hierarchy:

- Prevention
- Minimisation
- Reuse
- Recycling
- Energy recovery
- Disposal

Domestic Waste

In line with local guidance on the provision of household recycling and refuse waste collection services the applicant will encourage recycling by making suitable space for off-street storage space for wheeled bins and storge for recycling.

Construction Waste

The Applicant will implement guidance on sustainable waste management. As a primary objective, and in accordance with the waste hierarchy, the Applicant will seek to prevent waste in the first instance. This will be achieved through a site waste management plan.

This is key with around a third of the UK's waste coming from the construction and demolition sector.

The Applicant will work with a principal contractor in order to deliver the objective of reducing the proportion of waste diverted to landfill. The Applicant will monitor and review this commitment by defining the following:

- Waste minimisation actions to be undertaken.
- Procedures for minimising hazardous waste.

- Procedures for sorting, reusing, and recycling construction waste into defined waste groups, either on-site or through a licensed external contractor. The delivery of this target will be managed through the effective implementation of an on-site plan that will focus on steps in the waste hierarchy.

These approaches will ensure that waste from the site is minimised, and environmental impact is reduced. This well be set out in a Construction Management Plan, which will be provided as the project progresses.

Sustainable Materials

The impact of materials selection is an important consideration when designing a new development. The energy and natural resources consumed over the course of extraction or procurement, processing and manufacturing can be significant.

The Applicant will implement an environmentally responsible approach to the procurement of construction materials and supply chain management for the development where possible.

Good-practice principles for the responsible sourcing of sustainable materials will be applied across the Development. The life cycle impact of materials will be considered.

The Development will be designed to incorporate sustainably sourced materials and where possible, these will have:

- Materials will be environmentally sustainable

  The selection of construction and insulation materials will be considered for their potential impact on the internal and external environment and specified, where feasible, to ensure they do not contain gases that have an Ozone Depleting Potential (ODP) or Global Warming Potential (GWP). Materials here possible will be sourced with a high recycled content. Materials will be picked that have a sustainable source with appropriate certification. For example, Forestry Stewardship Council (FSC), Environmental Management Systems (EMS), PEFC, ISO 14001 (International Organisation for Standardisation) where possible.

- Materials will be durable and robust

  The Application Proposals will be constructed to incorporate, where possible, robust materials which have low embodied impact, high recycled content where possible (for example, PFA in concrete) and high durability.

- Materials will be 'healthy'

  The Applicant will avoid the use of materials which have the potential to impact on human health. Building materials and products that produce VOC (Volatile Organic Compounds and Formaldehyde) will be avoided whilst non-toxic and environmentally sensitive materials will take precedence.

7. OFFSETS

The current modelling demonstrated residual carbon emissions of **38.13 Tonnes CO_2 per annum.** The adopted Places For Everyone Joint Development Plan Document states that a Zero Carbon development should offset any residual carbon. It also acknowledges that no current mechanise is in place to enable this. Therefore, at this stage no offsetting measures are proposed.

8. CONCLUSION

The applicant has committed to delivering an energy-efficient, policy-compliant application. The statement follows the three-stage energy hierarchy — 'use less energy', 'supply energy efficiently', and 'use renewable / low-carbon energy' — and aligns with the Climate Change Act (2008), the NPPF (2024), Approved Document L 2021 and the Manchester's Local Development Framework Core Strategy Development Plan Document (July 2012), as well as the adopted Places For Everyone Joint Development Plan Document For Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford And Wigan. All units have been modelled individually in SAP 10.2, rather than by sampling, so the results reflect every unit's exact envelope and servicing specification.

Reductions achieved

- Against the Part L 2021 notional benchmark the design delivers a **71% reduction in regulated CO_2 emissions**.
- The development has ensured the provision of renewable energy via the use of heat pump technology for heating hot water.

Energy hierarchy in practice

- *Fabric first* measures cut losses through an insulated envelope.
- *Supply efficiently* is met through high-efficiency split units and LED lighting with advanced controls.
- *Use renewables / low carbon* is satisfied by those same heat pump systems.

A summary of these measures is listed in the table below.

Table 9 - Measures incorporated to deliver the energy standard

Demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double-glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Electric instantaneous water heaters will serve the hot water demand. ▪ Low-energy lighting throughout the development.

Renewable and low-carbon energy technologies	▪ Heat pump technology to meet the majority of the heat and hot water demand.

Overall the Development has been shown to represent a future proofed fossil free design, aligned with national and local energy policy.

APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

AD L 2021	*Approved Document Part L of Buildings Regulations 2021*
ASHP	*Air Source Heat Pump*
BRE	*Building Research Establishment*
CIBSE	*Chartered Institution of Building Services Engineers*
COP	*Coefficient of Performance*
DER	*Dwelling Emission Rate*
DHN	*District Heat Network*
DHW	*Domestic Hot Water*
EAHP	*Exhaust Air Heat Pump*
EER	*Energy Efficiency Ratio*
EUI	*Energy Use Intensity*
FEES	*Fabric Energy Efficiency Standard*
FHS	*Future Homes Standard*
LZC	*Low and Zero-Carbon technologies*
NCM	*National Calculation Methodology*
PV	*Photovoltaics*
PUE	*Power Usage Effectiveness*
SAP	*Standard Assessment Procedure*
SCOP	*Seasonal Coefficient of Performance*
SEER	*Seasonal Energy Efficiency Ratio*
TER	*Target Emission Rate*
TFEE	*Target Fabric Energy Efficiency*
TPER	*Target Primary Energy Rate*
VRF	*Variable Refrigerant Flow*

APPENDIX 2: LZCT ASSESSMENT

Please refer to the following page for Viability of the following low-carbon and renewable energy technologies:

i) wind,
ii) solar,
iii) aerothermal,
iv) geothermal,
v) water source heat pumps,
vi) biomass.

i) Wind

Wind	*The ability to generate electricity via a turbine or similar device which harnesses natural wind energy. This could be considered as an onsite solution to reducing carbon emissions (turbines included within the development), or offsite (investing financially into a nearby wind farm).*
Installation considerations	▪ *Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available.* ▪ *A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier)* ▪ *Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required.* ▪ *Noise considerations can be an issue dependent on density and build-up of the surrounding area.* ▪ *Buildings in the immediate area can disrupt wind speed and reduce performance of the system.* ▪ *Planning permission will be required along with suitable space to site the turbine, whether ground installed, or roof mounted.*
Advantages	▪ *Generation of clean electricity which can be exported to the grid or used onsite.* ▪ *Can benefit from the Feed in Tariff, reducing payback costs.*
Disadvantages	▪ *Planning restrictions and local climate often limit installation opportunities.* ▪ *Annual maintenance required.* ▪ *High initial capital cost. It is usual for an investor to consider a series of turbines to make the investment financially sound.*
Development feasibility ✗	▪ *Installing a large turbine in an area such as this is not considered to be appropriate due to its appearance and physical impact on the built-up environment. Residents' and neighbours' concerns may include the look of the turbine, the hum of the generator and the possibility of stroboscopic shadowing from the blades on homes.* ▪ *Wind speed has been checked for the development scheme using the NOABL wind map:* ▪ *http://www.rensmart.com/Weather/BERR. The wind speed at ten metres for the development scheme is 4.6 metres per second (m/s) which is below the minimum of 5 m/s and threshold for technical viability.* ▪ *Typical payback times for a single turbine are expected to be greater than 15 years which means that the cost of installing and maintaining a single wind turbine is not considered a commercially viable option.*

ii) Solar PV and/or Solar Thermal

Solar PV ***Solar Thermal***	*The ability to generate energy (either electricity, hot water or a combination of the two) through harnessing natural solar energy. This could include the use of solar thermal panels, photovoltaic (PV) panels, or a combined solution. PV panels, similarly, to turbines, can be considered both on and offsite.* *Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid.* *Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well-designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months and overheating of the system.*
Installation considerations	– *Operate most efficiently on a south-facing sloping roof (between 30- and 45-degree pitch.)* – *Shading must be minimal (one shaded panel can impact the output of the rest of the array.)* – *Panels must not be laid horizontally on a flat roof as they will not self-clean. Panels will therefore need to be installed at an angle and with appropriate space between them, to avoid over-shading.* – *Large arrays may require upgrades to substations if exporting electricity to the grid.* – *Local planning requirements may restrict installation of panels on certain elevations.* – *Installation must take into account pitch and fall of the roof, along with any additional plant on the roof to ensure there is sufficient room.* – *The average domestic solar PV system is 4kWp and costs £5,000 - £8,000 (including VAT at 5 per cent) - (taken from the Energy Saving Trust).*
Advantages	– *Relatively straightforward installation, connection to landlord's supply and metering.* – *Linear improvement in performance as more panels are installed.* – *Installation costs are continually reducing.* – *Can benefit from the Feed in Tariff to improve financial payback.*
Disadvantages	– *Less appropriate for high-rise developments, due to lack of roof space in relation to total floor area.* – *With Solar Thermal, performance is limited by the hot water demand of the building – system oversizing will lead to overheating.*



Development feasibility ✓	– *The suitability of Solar panels has been considered for this Development and are concluded as a technically-viable option.* – *There are potential areas of roof space suitable for the positioning of unshaded Solar PV arrays.* – *The Development is not on land, which is protected or listed, so it is considered that Solar panels would not have a negative impact on the local historical environment or the aesthetics of the area.*

iii) Aerothermal

Aerothermal	*The transfer of latent heat in the atmosphere to a compressed refrigerant gas to warm the water in a heating system. This includes air to water heat pumps and air conditioning systems.* *Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water.* *They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.*
Installation considerations	– *ASHPs operate effectively in buildings with a low energy demand, as they emit low levels of energy suitable for maintaining rather than dramatically increasing internal temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability.* – *Underfloor heating will give the best performance, but oversized radiators can also be used.* – *Immersion heater back-up required to ensure appropriate Domestic Hot Water (DHW) temperature in winter months.* – *Noise from the external unit can limit areas for installation.* – *£7,000-£11,000 per dwelling (taken from the Energy Saving Trust).*
Advantages	– *Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings.* – *Running costs between heat pumps and modern gas boilers are comparable especially when Gas boilers require PV to achieve building regulation compliance.*

Disadvantages	– *Heat pumps are generally quiet to run, however if a collection of pumps were used, this could generate a noticeable hum while in operation.* – *Residents need to be made aware of the most efficient way of using a heat pump as the low flow rates used by such a system means that room temperature cannot be changed as reactively as a conventional gas or oil boiler system.* – *Will not perform well in homes that are left unoccupied and unheated for a long period of time.* – *Back-up immersion heating can drastically increase running costs.* – *Noise and aesthetic considerations limit installation opportunities.*
Development feasibility ✓	– *ASHPs are considered a viable option for this development scheme and shall be utilised as part of an individual heat pump strategy for dwellings. This works well with the reduced energy demand, as achieved through passive design principles.* – *This presents a zero carbon ready energy strategy for the development, as the national grid continues to decarbonise.*

iv) Geothermal

Geothermal	*The transfer of latent heat from the ground to a compressed refrigerant gas to warm the water in a heating system. This includes ground source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.* *Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10 ℃ at 4 metres depth). This leads to a reliable source of heat for the building.* *Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.*

Installation considerations	– *Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.)* – *Decision between coils or piles can lead to significant extra cost.* – *Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators.* – *Similar to ASHPs, perform best in well-insulated buildings with a low heating demand.* – *Electric immersion heater required for winter use.* – *£11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust).*
Advantages	– *Perform well in well-insulated buildings, with limited heating demand.* – *More efficient than ASHPs.*
Disadvantages	– *The coils can be damaged by natural earthworks and by intensive gardening practices – occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit.* – *Will not perform well in buildings that are left unoccupied and unheated for a long period of time.* – *Back up immersion heating can drastically increase running costs.* – *Large area of ground needed for coil installation.*
Development feasibility ✗	– *GSHPs are not considered a viable option for this development scheme as they conflict with the preferred option of ASHP electric heating which works well with the reduced energy demand, as achieved through passive design principles.*

v) Water Source Heat Pumps

Water Source Heat Pumps	*The transfer of latent heat from a local water source to a compressed refrigerant gas to warm the water in a heating system. This includes water source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.* *Water Source Heat Pumps (WSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the water) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the water source, circulating a mix of water and antifreeze to extract energy from the water, where the year-round temperature is relatively consistent (approx. 10 ℃ below surface). This leads to a reliable source of heat for the building.* *Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for WSHPs tend to be higher than those of ASHPs.*

Installation considerations	– *Require a reliable water source near to the site.* – *Need to consider affect on the water course.* – *Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators.* – *Similar to ASHPs, perform best in well-insulated buildings with a low heating demand.* – *Electric immersion heater required for winter use.* – *£11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust).*
Advantages	– *Perform well in well-insulated buildings, with limited heating demand.* – *More efficient than ASHPs.*
Disadvantages	– *The coils can be damaged by high water flow or low water levels– occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit.* – *Will not perform well in buildings that are left unoccupied and unheated for a long period of time.* – *Back up immersion heating can drastically increase running costs.* – *Large area of water needed for coil installation.*
Development feasibility ✗	– *WSHPs are not considered a viable option for this development scheme as they conflict with the preferred option of ASHP electric heating which works well with the reduced energy demand, as achieved through passive design principles.*

vi) Biomass

Biomass	*Providing a heating system fuelled by plant based materials such as wood, crops, or food waste.* *Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.*

Installation considerations	– *Biomass boilers are larger than conventional gas-fired boilers and also require what can be significant storage space for the fuel source. This needs to be considered at planning stage to ensure an appropriate plant room can be provided.* – *Flue required to expel exhaust gases – design needs to be in line with the requirements of the Building Regulations.* – *Need to consider whether fuel deliveries will be reliable and consistent to the location of the site (especially relevant in rural areas) and whether the plant room can be easily accessed by the delivery vehicle.* – *£9,000-£21,000 per dwelling dependent on size (taken from Energy Saving Trust).*
Advantages	– *Considerable reduction in CO_2 emissions.*
Disadvantages	– *Limited reduction in running costs compared to A-rated gas boilers, but at a substantially higher up-front cost.* – *Plant room space required for boiler and storage.* – *Dependent on consistent delivery of fuel.* – *Ongoing maintenance costs (need to be cleaned regularly to remove ash.)*
Development feasibility ✗	– *Biomass combustion is not compatible with Wakefield's air-quality objectives. The district still has several Air Quality Management Areas (AQMAs) for NO_2 and PM_{10}, and the 'West Yorkshire Low-Emissions Strategy: Air-Quality & Emissions, Technical Planning Guidance (2023 update)' discourages new plant that emits higher NO_x and particulates than gas or electric alternatives. Installing a biomass boiler would therefore conflict with Local-Plan Policies LP 33 and LP 36 and the guidance the Council uses when screening applications for air-quality impact.* – *A reliable local fuel supply cannot be guaranteed: there are no accredited biomass depots within a practical haulage distance, and regular HGV deliveries would undermine the project's carbon and traffic objectives.* – *Capital and running costs are significantly higher than for the proposed air-source heat-pump solution, and the closure of the Renewable Heat Incentive means there is now no subsidy to offset those costs. Biomass would not be a commercially viable option for this development scheme.* – *The heat-pump/split system already achieves ≈ 37% on-site renewable contribution, easily surpassing the 10% requirement of Policy LP 32, so biomass is unnecessary to meet planning policy, Condition 22, or BREEAM targets.*

APPENDIX 3: SAPs

Provided Separately.