



Gerrards Lane

Energy and Sustainability Statement

For Four Architects

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Gerrards Lane

This document addresses the energy and sustainability objectives required by National and Knowsley planning policy in relation to the Gerrards Lane proposal.

1. INTRODUCTION

Hydrock Consultants has been appointed by Four Architects to provide planning stage advisory services in relation to the proposed development on Gerrards Lane in Halewood, within the metropolitan borough of Knowsley, Merseyside.

This document forms part of the planning application and will inform Knowsley Borough Council (KBC) Planning Department of the energy and sustainability strategy for the application site.

1.1 Purpose of Report

This energy and sustainability assessment follows the guidance set out in the Knowsley Local Plan. Throughout this report carbon emissions are split into two categories:

- Regulated: Emissions associated with heating, cooling, hot water, lighting and any other fixed building services equipment (those that are covered under Building Regulations Part L); and
- Unregulated: Emissions that are associated with small power and plug-in items and any other process or plant equipment (these are not covered by Building Regulations Part L).

1.2 Development Details

The site is located to the north of the town of Halewood which is located to the south east of Liverpool City Centre in the Knowsley Metropolitan Borough Council Area.

The site is currently a brownfield site which is run down and overgrown. The east of the site is bound by a single-track road called North End Lane

The development is for 9 no. 4 bedroom houses across the site, with two different house types.



Figure 1 - Aerial view of site location looking north



Figure 2 - Proposed site plan

Regulations, Policy and Guidance

This section sets out the National and Local planning policy and regulations that the site must abide by to achieve planning permission.

1. NATIONAL PLANNING POLICY

1.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) was first published on 27 March 2012 to set out government planning policy for England, removing all regional level planning policy at this time in favour of ‘a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.’

All Local and Neighbourhood Plans must therefore align with the policies of the NPPF.

The NPPF states clearly that the purpose of planning is to help deliver sustainable development and defines three mutually dependent pillars that must be equally considered in order to achieve this:

- Economic
- Social
- Environmental

A revised NPPF was published in July 2018, focusing on the following key areas:

- Promoting high-quality design for new homes and places.
- Offering stronger protection for the environment.
- Constructing the right number of homes in the right places.
- Focusing on greater responsibility and accountability of councils and developers for housing delivery.

In terms of the environment, the revised NPPF seeks to further protect biodiversity by aligning the planning system with Defra's 25-year Environment Plan. Not only does this protect habitats, it also emphasises air quality protection in relation to development proposals.

1.2 Building Regulations (Part L)

The revised NPPF was updated again on 19 February 2019 but this update included only minor changes to the text to provide additional clarity in some areas.

All areas of the proposed development will need to meet Energy Performance standards are set for non-dwellings by Building Regulations Approved Document Part L1A and L2A, Conservation of Fuel and Power in New Dwellings, and Conservation of Fuel and Power in New Developments in Buildings other than Dwellings.

It is the role of Part L of the Building Regulations to include a minimum level for regulated carbon emissions defined by the Target Emission Rate (TER) which relates to a ‘Notional Building’, automatically generated as part of the and Simplified Building Energy Model (SBEM) toolkits.

The resulting Building Emission Rate (BER) and Dwelling Emission Rate (DER), must be less than the TER in order to comply. A benchmark Energy Performance Certificate (EPC), rated A (most efficient) through G (least efficient) will also be calculated as part of this assessment via comparison of each building assessed to a ‘Reference Building’, also automatically generated as part of the SAP and SBEM toolkits.

These changing national regulations will drive energy efficiency and carbon reduction improvements in new buildings. It was the intention via progressive changes to Part L to require zero carbon homes by 2016. However, in July 2015 the Government Productivity Plan (“Fixing the Foundations”) announced that it would not proceed with the zero-carbon allowable solutions carbon offsetting scheme, or the proposed 2016 increase in on-site energy efficiency standards, committing instead to keeping standards ‘under review’.

Recently, consultation on a 2020 update to Part L was held alongside a proposed national ‘Future Homes Standard’ to come into effect in

2025. No government response to the consultation has yet been published but on this basis, an update to Part L for new homes is imminent.

A consultation to make similar updates to Part L 2A for new non-domestic buildings is also expected in early 2021 and developments should be aware of proposed changes and any transitional arrangements that may come into effect before works have started on site.

Also important is the changes to the carbon emissions within the new SAP10 which will replace the existing figures in SAP 2012. The emissions emission factors demonstrate the significant decarbonisation of the national grid and confirm that natural gas will have a higher carbon factor than electricity going forward.

A draft version of the 2020 update to Part L1 was published in January 2021 with the view to be adopted in Autumn 2021.

2. LOCAL PLANNING POLICY

2.1 Knowsley Local Plan

The following current policies for the Knowsley Local Plan are of relevance.

2.1.1 Policy SD1 – Sustainable development

- 1) When considering development proposals, a positive approach will be taken, which reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework. Work will be undertaken pro- actively with applicants jointly to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social and environmental conditions in the area.
- 2) Planning applications that accord with the policies in this Local Plan (and any relevant policies in Neighbourhood Plans) will be approved without delay, unless material considerations indicate otherwise.
- 3) Where there are no policies relevant to the application or relevant policies are out of date

at the time of making the decision then permission will be granted unless material considerations indicate otherwise – taking into account whether:

- a) Any adverse impacts of granting permission would significantly and demonstrably outweigh the benefits, when assessed against the policies in the National Planning Policy Framework taken as a whole; or
- b) Specific policies in that Framework indicate that development should be restricted.

2.1.2 Policy CS2 - Development Principles

New development in Knowsley and the preparation of subsequent stages of the Local Plan will be expected to support the following development principles:

Principle 1: Promote sustainable economic development, tackle the causes of deprivation and disadvantage and narrow the gap between the richest and poorest neighbourhoods by:

- a) Meeting needs for new housing, employment, retail and other service provision;
- b) Improving business productivity and employment levels in Knowsley;
- c) Reducing economic, environmental, education, health and other social inequalities between Knowsley and other parts of the UK; and
- d) Providing opportunities for positive lifestyle choices and health improvement for people of all ages.

Principle 2: Reduce carbon emissions and adapt to the effects of climate change by:

- a) Contributing to reductions in carbon dioxide emissions from all sources, in line with national targets;
- b) Ensuring an ability to adapt to future changes to national targets for carbon
- c) dioxide and other greenhouse gas emissions, including recognising the role

- d) of new technology;
- e) Identifying and applying measures offering effective mitigation and
- f) adaptation to likely environmental, social and economic impacts of climate
- g) change; and
- h) Meeting appropriate minimum standards for sustainability.

Principle 3: Reduce the need to travel and increase accessibility by:

- a) Selecting locations that reduce the need to travel, especially by car, and enable people as far as possible to meet their needs locally;
- b) Assisting the Council in achieving a shift towards more sustainable modes of transport for people, goods and freight;
- c) Encouraging safe and sustainable access for all, particularly by promoting the use of public transport, walking and cycling between homes and employment; and
- d) Supporting the provision and retention of shared space, community facilities and other local services (such as local shops, health facilities, education provision, meeting places, sports venues, cultural buildings, public houses and places of worship).

Principle 4: Recognise environmental limits, protect and enhance environmental assets, enhance local character and promote quality of place by:

- a) Understanding and respecting the character and distinctiveness of places and landscapes;
- b) Protecting and enhancing the historic environment;
- c) Promoting good quality design and ensuring that development respects its setting taking into account relevant design requirements, and best practice;
- d) Maximising opportunities for the regeneration of previously developed land, including derelict or unsightly areas to

improve the image of Knowsley and use land resources efficiently;

- e) Mitigating potential negative impacts of traffic growth and road traffic on highway safety, air quality, noise and health;
- f) Supporting policies relating to Green Infrastructure and the greening of towns and cities;
- g) Maintaining or enhancing the tranquillity of open countryside and rural areas;
- h) Maintaining or enhancing the quantity and quality of biodiversity and habitats, including potential impacts on nationally and internationally important sites for biodiversity;
- i) Addressing any issues of unstable land, resulting from Knowsley's legacy of minerals extraction; and
- j) Minimising negative impact upon flood risk, air quality, water quality, land quality, soil quality, and noise or vibration levels and ensuring any negative impacts are appropriately mitigated.

Development that will have an unacceptable impact upon any of the above will only be permitted where the benefits of the proposal clearly outweigh the harm.

Principle 5: Make the most efficient use of available resources and infrastructure by prioritising locations consistent with the spatial strategy, which:

- a) Do not require major investment in new infrastructure, including transport, water supply and sewerage, or where this is unavoidable, incorporate appropriate development phasing and delivery assistance;
- b) Ensure environmental protection is enhanced through the phasing of new development and delivery of supporting infrastructure, including working with neighbouring authorities and key partner agencies where appropriate;
- c) Support prudent and efficient management of natural and man-made resources; and

- d) Promote sustainable construction and efficiency in resource use (including reuse and recycling of materials).

2.1.3 Policy CS8 Green Infrastructure

Maintenance and Enhancement of Knowsley's Existing Green Infrastructure

Knowsley's existing Green Infrastructure and its beneficial functions will be protected, managed and/or enhanced, primarily to:

- a) Ensure more attractive and cleaner residential neighbourhoods;
- b) Sustain and promote biodiversity (including designated sites, priority habitats and protected and endangered species) in accordance with importance and contribution to ecological networks;
- c) Preserve the character and function of historic environments and valued landscapes;
- d) Mitigate the effects of climate change and flood risk;
- e) Mitigate air, water and noise pollution;
- f) Provide local opportunities for sport, recreation and allotments; and
- g) Provide sustainable transport linkages between residential neighbourhoods and easy access to employment and services.

2.1.4 Policy CS22 Sustainable and Low Carbon Development

New development will be required to meet high standards of sustainable design and construction and minimise carbon emissions. This should be achieved by:

- a) Designing new buildings for flexible uses throughout their lifetime;
- b) Avoiding the creation of adverse local climate conditions by using natural systems to avoid internal overheating and excessive heat generation;

- c) Ensuring developments are comfortable and safe for users;
 - d) Making the most effective and sustainable use of water, aggregates and other resources;
 - e) Limiting energy use by incorporating high standards of insulation, heat retention, natural ventilation and passive solar techniques;
 - f) Landscaping (including measures such as green walls or roofs) to create shelter and reduce any heat island effect;
 - g) Using sustainable materials from local suppliers where possible;
 - h) Supplying energy efficiently and incorporating decentralised energy systems, using renewable and low carbon energy where feasible;
 - i) Managing flood risk, including through the use of Sustainable Drainage Systems (SuDS) and flood resilient design for infrastructure and property; and
 - j) Promoting sustainable waste practices in new and existing developments.
- mitigated by appropriate measures agreed by the Council.

2.1.5 *Policy CS23 Renewable and Low Carbon Infrastructure*

The Council will support proposals that will produce and distribute decentralised, low carbon and renewable energy, provided that they do not cause significant harm (in terms of their number, scale, siting or cumulative impacts) to:

- a) Natural resources, biodiversity, geodiversity, water and air quality and, landscape character;
- b) Aviation and transport safety;
- c) Historical and cultural assets;
- d) Public amenity and living conditions; or
- e) Openness and amenity of the Green Belt, except in very special circumstances.

Proposals must be accompanied by information that shows how the local environment will be protected, and how the site will be restored when energy production ends. Proposals resulting in an unacceptable impact must be

Sustainability

This section of the report gives an overview of the sustainable design principles incorporated into the development, in response to Knowsley Core Strategy requirements.

2.1 Sustainable Design and Construction

Passive design measures, including daylight access and natural ventilation, and active design measures including building services, district or communal heating infrastructure and renewables are covered under the energy strategy sections of this report.

2.1.1 Design & Access

The site is situated in an area which is characterised primarily by residential uses, with local amenities and transport links within a short walk from the application site. The site is located to the North of Halewood which is roughly a 15-minute walk.

The site will be designed to allow safe and easy access for all potential users, including pedestrians and cyclists.

2.1.2 Material Selection

The BRE 'Green Guide to Specification' is proposed to be used when selecting the construction materials, to encourage the use of materials which have been produced with minimal impact to the environment in line with good-practice methodology. The Guide promotes the use of sustainable materials with low embodied energy, ecotoxicity and long-life span.

Additionally, the materials selected will be responsibly sourced and where practicable meet the following guidelines:

- ISO14001;
- BES6001;
- PEFC / FSC;
- Chain of Custody.

As aforementioned the material will be mainly brickwork which suits the locality and context of the surroundings.

2.1.3 Security

The development has been designed in a manner which minimises the risk of crime. The

site will be designed securely and seeks to ensure a safe living environment and ensure that the building is safe and accessible.

2.2 Ecology

Due to the nature and location of the proposed development, there is no requirement for a habitat survey for this site. In the absence of this all national and local legislation concerning ecology will be adhered to.

2.3 Flooding & Drainage

The site is located in Flood Risk Zone 1 denoting a low risk of flooding.

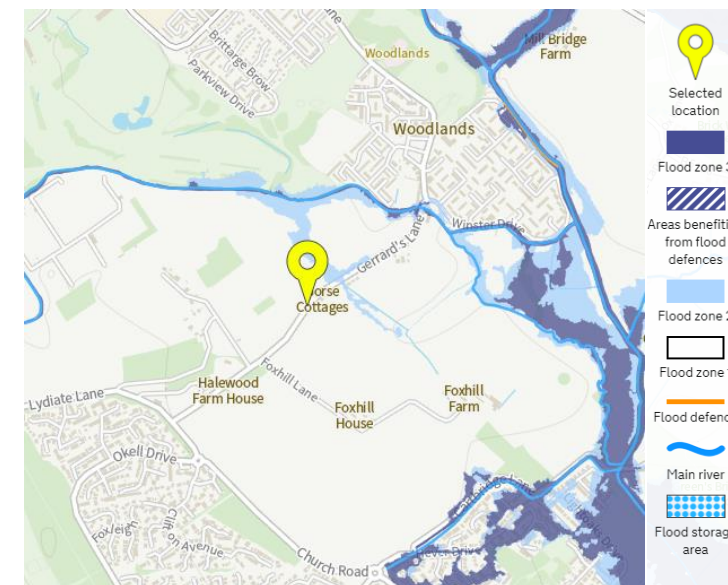


Figure 3 - flood map for the site

2.4 Water (Supply)

To reduce the consumption of potable water, efficient sanitary ware and water-saving features will be specified.

This will include limiting flow rates and reducing flush levels of sanitary ware fittings. The development aims to reduce water usage and improvement in water efficiency over a notional baseline established by the BRE in line with best practice guidelines.

At present, and where applicable, this will include:

- Low and dual flush WCs - Dual flush cisterns with low effective flush volume will be specified;
- Taps – Wash hand basins and sinks will be water efficient.
- Showers – Aerated or low flow showerheads will be included to help reduce water consumption; and
- Kitchen appliances – Low water consuming equipment to be considered.

All external planting will rely on manual watering, or precipitation only.

Plumbed rainwater harvesting has not currently been included for the scheme, due to the practicality and cost of installing the system, in lieu of targeting other energy and water saving measures.

2.5 Waste

The new development aims to minimise waste throughout construction and also to reduce waste throughout operations by providing appropriate facilities, in accordance with good-practice principles. Throughout construction, the appointed contractor will make effort to minimise waste and, where possible, divert waste from landfill through reuse or recycling.

Waste will be minimised throughout the demolition and construction phase through the implementation of the waste hierarchy. The principles of the waste hierarchy are shown below.

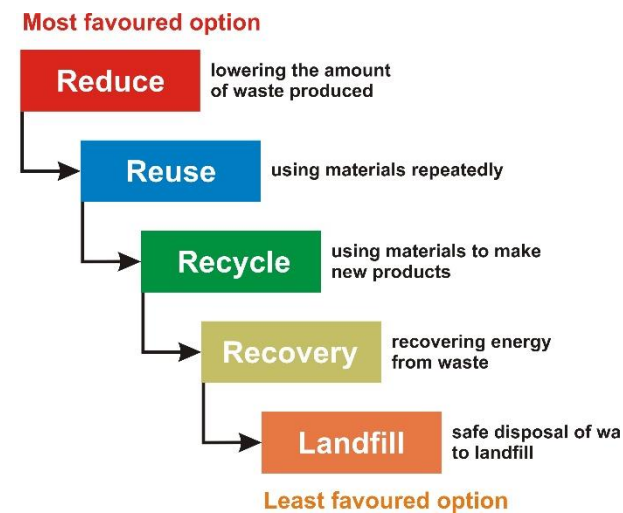


Figure 4: Waste Hierarchy.

Throughout the operation of the development waste storage facilities will be provided for recyclable and non-recyclable waste. The design and size of these facilities will meet the requirements of KBC waste guidelines. The waste strategy has been designed to reduce walking distances to storage points and kept close to the road side for waste transport vehicles.

Waste will be segregated on-site into the main waste streams for recycling and collection purposes.

2.6 Transport

The site is approximately a 15-minute walk to the town of Halewood which has many bus routes and a train station which has a 26-minute direct route into Liverpool Lime Street Station.

2.7 Pollution

Pollution can harm both the natural environment and the human environment and consequently can negatively influence the wellbeing of wildlife and humans.

Best practice pollution prevention measures will be implemented throughout construction to reduce the potential negative impacts on water, and air, to minimise disturbance to the surrounding areas. In addition, the design of

the site has been undertaken in a way which negates or reduces the impact of pollution.

2.7.1 Air

The development will aim to reduce exposure to poor air quality, as well as reduce emissions from development, including during the demolition and construction phases.

The development will be designed to be 'air quality neutral' where practicable and minimise the generation of air pollution during the following stages:

- Construction – Minimise impacts using necessary mitigation measures relating to demolition, earthworks, construction, trackout, and non-road mobile machinery (NRMM), as appropriate; and
- (If boilers) Locally-generated emissions from the gas-fired boilers that are installed will be specified as low NOX in line with CIBSE guidelines.

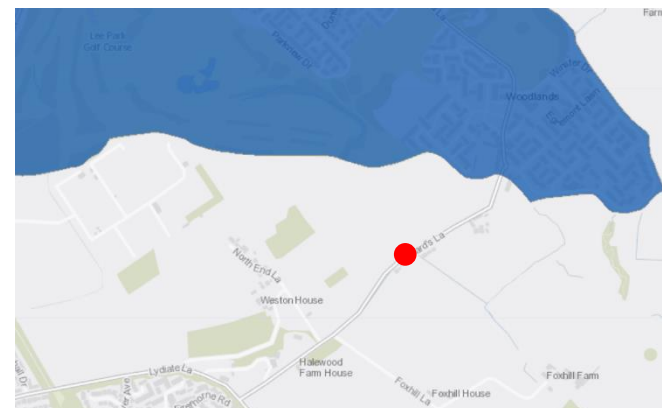


Figure 5 - AMQA map for site

2.7.2 Land

Any existing land contamination will be remediated prior to the commencement of construction activities on site

2.7.3 Water (Foul)

All areas of the development will connect to the public foul sewer network.

2.7.4 Noise

Internal noise will be controlled to provide a comfortable environment for the desired use and if required, attenuation measures will be specified.

2.7.5 Light

Light pollution can result from any adverse effect of artificial lighting and includes the following:

- Glare – the uncomfortable brightness of a light source when viewed against a dark sky;
- 'Light trespass' – the spread of light spillage the boundary of the property on which a light is located; and
- 'Sky glow' – the orange glow seen around urban areas caused by a scattering of artificial light by dust particles and water droplets in the sky.

All external lighting for the site will be designed in line with current British Standards and ILP Guidelines.

2.8 Broadband Connectivity

A review of broadband connectivity options has been carried out for the site to determine providers and expected bandwidths. High speed broadband is available from a number of different suppliers; standard broadband up to 17 Mb and fibre optic up to 67 Mb. Suppliers serving the area include Vodafone, TalkTalk and BT.

Energy & Carbon

This section of the report provides background information regarding the various forms, definitions and metrics of carbon emissions.

Through calculating a baseline energy demand for the site, this section goes on to demonstrate the potential to reduce site-generated carbon emissions through the employment of the ‘Energy Hierarchy’.

3. BACKGROUND

3.1 The Energy Hierarchy

The energy hierarchy is a classification of energy strategies, prioritised to assist progress towards a more sustainable energy system. It is represented in the figure below and highlights the priority of each step within the hierarchy as you progress downwards through the strata.

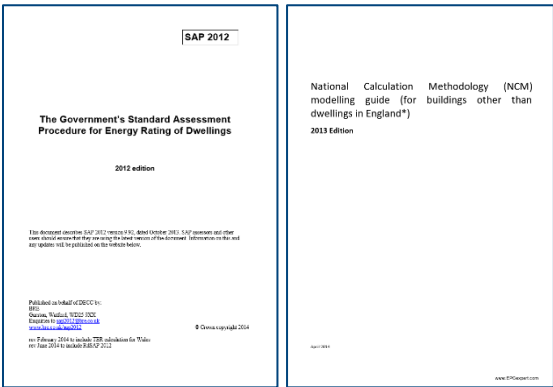
Energy demand reduction provides the greatest opportunity for minimising a building’s potential CO₂ emissions. Design strategies typically include building form and fabric measures (passive design) and energy efficient building services (active design). Focusing on form and fabric in particular at an early stage in the build process is often the most cost-effective way to reduce energy consumption and CO₂ emissions.

Following demand reduction measures, the residual CO₂ emissions can be reduced through low or zero carbon technologies.

4. BASELINE CARBON EMISSIONS

This section establishes the baseline energy consumption and associated CO₂ emissions for the scheme. The baseline carbon dioxide emissions refer to a Building Regulations 2013 Part L compliant development.

Under Part L, residential areas of the development are to be assessed under the Standard Assessment Procedure (SAP).



4.1 Standard Assessment Procedure (SAP) Energy Modelling

The dwellings on site have been assessed under Part L 2013 using the Government’s Standard Assessment Procedure (SAP). The CO₂ reduction requirements have been assessed on an aggregate approach across the site, taking into account the orientation, number, size and type of dwelling. Both house types have been assessed.

4.1.1 Baseline Internal Gains

Weather data is based on the UK average climatic data provided by SAP for the dwellings.

Solar gains are calculated automatically by the modelling software and are based on the orientation of the building, the transmission coefficients of the glazing and the solar angles. SAP also takes into account shading devices.

Gains from lighting, appliances, cooking and from the occupants are estimated from the floor area.

4.1.2 Baseline Building Fabric

All fabric attributes for the baseline case are as per the notional building (SAP Appendix R). below shows the baseline U-values for a Part L Compliant Development.

Table 1 - Reference Fabric Values (Building Regulations Part L1A).

Building Element	Part L1A 2013 Notional Building U-value
Roof	0.13 W/m ² k
Wall	0.18 W/m ² k
Floor	0.13 W/m ² k
Glazing	1.40 W/m ² k

The air permeability target for the residential scheme is 5 m³/m²/hr at 50 Pa. The thermal mass is medium (250 kJ/m²K).

4.1.3 Baseline Regulated and Unregulated Carbon Emissions

Two energy strategy options are being considered for the development:

- Low NOx emission gas boilers;
- Air source heat pumps.

Throughout this report carbon emissions will be reported for both options.

Table 2 - Baseline energy summary

Energy Hierarchy Stage	Regulated Carbon Emissions kgCO ₂ /yr	Unregulated Carbon Emissions kgCO ₂ /yr
Baseline Carbon Emissions using boilers	54,200	59,500
Baseline Carbon Emissions using heat pumps	80,600	88,500

5. REDUCING DEMAND

This section looks at measures to reduce the energy consumption of the new development against the notional building baseline through passive design options. These options are those which utilise building form, massing and glazing ratios to exploit the natural surroundings of the site to help reduce energy demand.

5.1.1 Building Fabric

The proposed building fabric is shown in Table 3. The proposed fabric goes beyond Part L requirements to reduce heat losses. The proposed air permeability is 4 m³/m²/hr at 50 Pa.

Table 3: Proposed building fabric.

Building Element	Proposed Building Fabric
Roof	0.11 W/m²k
External Wall	0.15 W/m²k
External Floor	0.11 W/m²k
Glazing	1.20 W/m²k

A low g-value (solar heat gain co-efficient) of 0.6 is proposed for south facing windows to reduce direct solar gains in summer.

Overhangs / Window reveals have been used to reduce the risk of overheating and cooling demand in the summer, while allowing solar gain from the lower winter sun to help reduce heating demand.

The glazing ratio has been designed to increase daylight access and sunlight availability to provide beneficial solar gains in winter and reduce reliance on artificial lighting.

Thermal mass via exposed concrete has been included to regulate internal room temperature.

5.1.2 Building Form

100% of units will provide at least one main living space window within 90° due south in

order to maximise opportunity for sunlight availability.

Increased dual aspect units have been designed to provide natural ventilation via cross ventilation through windows and openings in the façade.

An openable window strategy has been developed to reduce the risk of overheating in summer in line with CIBSE TM59 methodology requirements.

Further passive cooling strategies include night cooling and curtains/blinds to meet comfort criteria for current and future weather scenarios.

6. IMPROVING EFFICIENCY

Active design relates to energy efficiency measures that can be included within the building services specification to reduce energy consumption. All services will be designed to meet at least the minimum recommended performance requirements contained in the UK Government Domestic Building Services Compliance Guide (2013, incorporating 2018 amendments).

6.1 Off-site Low Carbon Installation

Where heat demand is of suitable density, heat networks can be an efficient and cost-effective mechanism by which to decarbonise heat. Heat (and cooling) infrastructure consists of systems of insulated pipes, which transport hot (or cold) water from energy centres to end-users.

As with other networks, heat networks can operate with a range of heat sources including large scale heat pumps, boilers, combined heat and power (CHP), and water heat from commercial or industrial processes.

6.1.1 Knowsley Heat Network

Knowsley is installing a city-wide heat network as part of its commitment to become carbon neutral by 2030. In addition to reducing carbon emissions, the heat network’s aim is to increase

resilience and supply security to connected buildings that would otherwise be reliant on a single fossil fuel for heat generation, such as mains gas. Whilst mains gas is currently a low-cost fuel, this will change as the UK government incentivises a transition to low and ultimately zero carbon fuels.

Due to the small scale of the development, it is not considered viable for the Gerrards Lane development to connect to this network once it becomes available.

6.2 Regulated Energy

6.2.1 Heating and Domestic Hot Water

Heating and hot water will be provided by an energy efficient system in order to reduce the amount of waste energy produced by the dwellings.

The two options currently being pursued for the development are:

- Low NOx emission gas boilers;
- Air source heat pumps.

6.2.2 Ventilation

Natural ventilation is proposed for the scheme.

Wet areas within dwellings will be provided with local or centralised extract ventilation that has a low specific fan power (SFP) to reduce energy consumption.

Generally, all equipment will be specified to achieve a high efficiency and low distribution losses (low fan and pump power, insulation in accordance with relevant standards).

6.2.3 Electrical Systems

All spaces will be provided with energy efficient light fittings including LEDs.

A home energy display device may also be installed to provide residents with real time energy consumption information.

6.3 Unregulated Energy

Where white goods are specified, these will be chosen to be A/A+ rated under the EU Energy Labelling Scheme.

7. POTENTIAL RENEWABLE TECHONOLGIES

An initial desktop study of a wide variety of technologies has been carried out and for clarity, a summary of potential renewable technologies is shown table 5 in the Appendix A.

However, as carbon savings can already be achieved through utilising efficient building fabric and an efficient heating and hot water system, additional renewable technologies are not proposed for the site.

Conclusion

This report has provided a detailed assessment of the sustainability principles and reduction of CO₂ emissions for the development in Halewood, Knowsley. The scheme has been designed to respond positively to all national regional and local sustainability policy. The scheme will minimise any negative environmental impacts associated with energy, resource consumption, water, noise, air and light pollution.

After analysis of anticipated CO₂ emissions under Building Regulations Part L1A using SAP, and having undergone a lean design process to reduce the demand for energy, it is proposed that the development will utilise energy efficient building fabric along with an efficient boiler or ASHP.

Table 4: Energy strategy summary as required by BCS14.

	Baseline Emissions	After Energy Efficient Measures	Percentage Reduction
ASHP	80,600	54,100	32.9%
Proposed after energy efficiency	54,200	49,500	8.6%

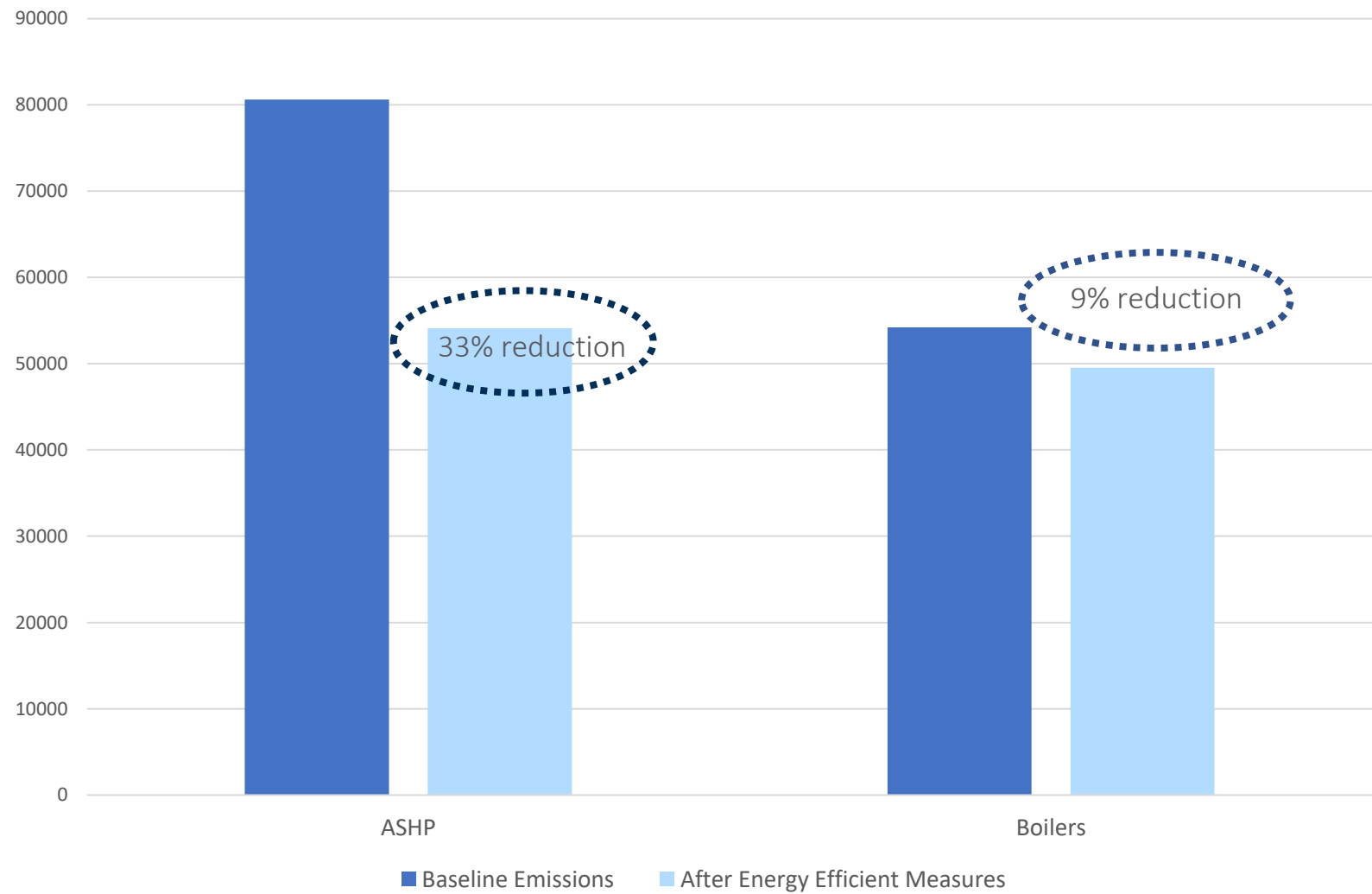


Figure 6 -Summary of Regulated Energy with Boilers and ASHP

Appendix A - Renewable Technologies

Table 5: Summary of low or zero carbon technology options (taken from the Bristol Sustainability and Climate Change Practice Note).

Technology	Building Characteristics	Uses	Scale	Considerations	Viability
Photovoltaic Panels	Roof facing east to west (through south) and not overshadowed, flat roof or pitched around 30°.	All uses. Especially suitable for where extensive IT use and/or lighting e.g. offices, schools.	All scales.	To maximise potential need to consider orientation.	Viable
Solar Thermal	Roof faces east to west (through south), how water tank needed (not compatible with combi boilers).	All uses.	All scales. Can be used with other fuel source to pre-heat water and so reduce fuel consumption.	Needs a demand for hot water – domestic or canteens, showers, washrooms.	Not Viable
Air Source Heat Pumps	Sited on external walls.	Any.	Any, but more likely to be appropriate at small scale.	Careful siting needed to reduce aesthetic impact. Potential noise impact. Powered by electricity, so lower carbon reduction than other technologies. Can also be used to provide cooling, especially in building with no openable windows.	Viable
Biomass	Space needed for plant, fuel storage and deliveries.	Mixed use, schools, offices, commercial, residential- especially multi-residential – best where constant energy demand.	Medium to large, viable where heat demand is above 15 kW, can be combined with gas for summer / backup use.	Air quality impact. Impact of deliveries on residents. Fuel source (is supply secured?) Distance transported.	Not Viable
Ground Source Heat Pumps	External space for horizontal trench or vertical borehole.	Any.	Medium to large.	Archaeology. Usually combined with underfloor heating, so slow to respond. Can combine with landscaping.	Not Viable
Combined Heat and Power (CHP)	Single energy centre providing heat and power – needs space for access and servicing.	Hospitals, leisure centres, educational buildings, large scale residential and mixed use.	Large.	Need substantial heat demand to be viable.	Not viable.
District Heating	One or more energy centres with heat distribution network.	Residential / mixed use.	Very large.	Needs substantial heat demand to be viable, can be combined with gas boilers to respond to demand variations.	Not Viable

Photovoltaic Panels

Solar PV works by converting light into electricity using a semi-conductor material. PV panels don't need direct sunlight to work; electricity can still be generated on a cloudy day.

Solar irradiance, which is the power per unit area (W/m²) received from the sun is measured annually. Monthly irradiation figures are shown in the following figures.

Monthly energy output from fix-angle PV system:

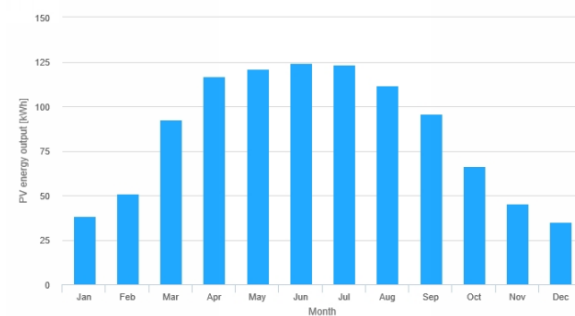


Figure 7: Monthly energy output from solar PV.

Monthly in-plane irradiation for fixed-angle:

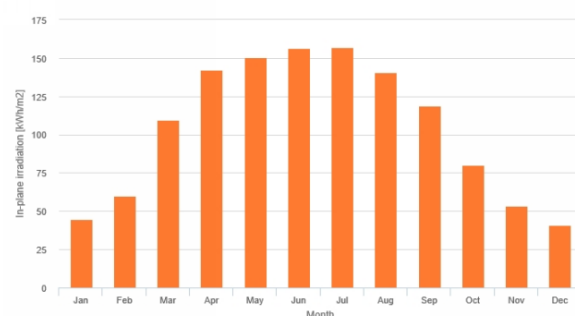


Figure 8: Monthly irradiation for solar PV.

It is anticipated that the site will receive approximately 1,200 kWh/m²/yr based on the UK irradiance chart, which makes a great case for installing solar.

PV panels themselves vary in efficiency from 15-18% (average) to 21% (most efficient). Panels should face between SE and SW, at an elevation of about 30° – 40° for maximum output. The spacing of rows of panels should minimise over-shading of each other and also account for maintenance space required.

Taking into account over-shading, maintenance space and the frames, the area allocated should be approximately 2.5 times the active panel area required.

In terms of location and orientation, there should be no overshadowing of the panels, as this reduces their overall efficiency. Even shading a small part of a PV panel could significantly reduce its efficiency and the efficiency of other PV panels connected in the string. Overshadowing can be caused by trees, other buildings, roofs of adjacent buildings, dormer windows, roof furniture, etc.

Heat Pumps

Heat pumps work by extracting thermal energy from a low-grade source (air, soil or water) to a heating element with a higher temperature. Heat pumps use a liquid refrigerant that is pumped into pipes which absorbs heat, that later is passed through a compressor where its further heated and moved to heating and hot water circuits.

Heat pumps operate with a typical Seasonal Coefficient of Performance (SCoP) of 2.5:1 to 5:1 (depending on heat source/sink); meaning that for every 1kW of electric in, 2.5kW of heat is generated (for ASHP) and up to 5kW (for some ground or water source heat pumps). This efficiency of a heat pump is governed by both the temperatures of the heat source and the heat emitter as shown below.

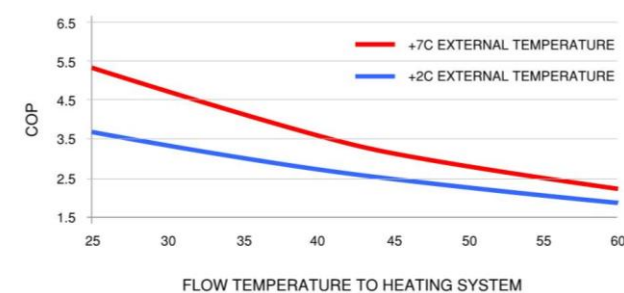


Figure 9: COP as a function of flow temperature for typical ASHP

Heat pumps are, therefore, best suited to low temperature systems such as underfloor heating. If radiators are used with heat pumps

it is likely that they would be twice the as large as those used with conventional radiators.

Heat pumps are suited to individual buildings as well as within an energy centre to form part of a wider strategy. Heat pumps are powered by electricity, so are considered low-carbon rather than zero-carbon/renewable, however, they can be powered by electricity from renewable sources – PV, wind etc.

Heat pumps also have the added benefit of being able to provide cooling in the summer months, as well as heat in winter.

Air Source Heat Pumps (ASHPs)

ASHPs work by using ambient air as their heat source. The heat pump system is sited externally; either on external walls, in external compounds or within a ventilated plant room allowing air to be drawn over the evaporator part of the unit.



Figure 10: ASHP external unit

Additional Considerations

ASHP units would need to sit in either an acoustically treated external plant enclosure or within a well-ventilated internal plantroom.

Battery storage

Installing batteries can help balance the development's electricity demand with electricity produced via the PV panels. This can reduce the demand for energy through storing energy collected during daylight hours to be

used in the evening. In addition, battery storage also enables cost savings to be achieved via peak shaving and Triad avoidance (reducing grid use in 'peak' times).