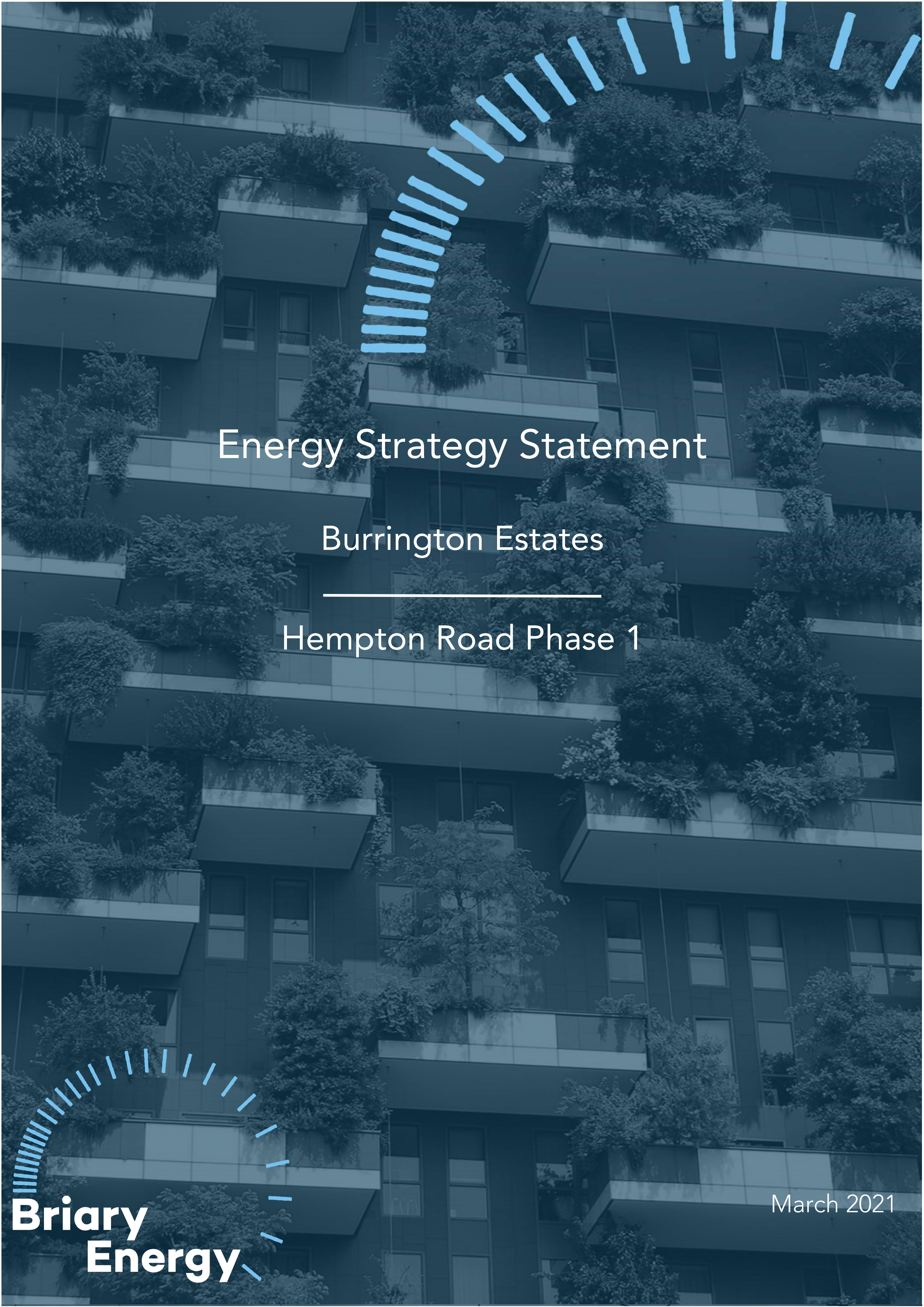


Energy Strategy Statement

Burrington Estates

Hempton Road Phase 1

March 2021

Briary Energy

1. Executive Summary

Burrington Estates has instructed Briary Energy to prepare this document, which examines the feasibility of suitable Low to Zero Carbon (LZC) sources, high-efficiency alternative systems, and low carbon energy efficiency measures.

The Hempton Road Phase 1 development will comprise of 21 dwellings. The developer will first ensure a Building Regulation compliant carbon reduction across all dwellings through fabric measures, before assessing LZC technologies where appropriate.

The energy consumption figures for the development will be based on benchmark figures for each building type from SAP 2012, and include regulated and non-regulated emissions.

1.1. Local Policy

Cherwell District Council Local Plan 2011-2031, Policy ESD 3 - Sustainable Construction states -

All development proposals will be encouraged to reflect high quality design and high environmental standards, demonstrating sustainable construction methods including but not limited to:

• Minimising both energy demands and energy loss
• Maximising passive solar lighting and natural ventilation
• Maximising resource efficiency
• Incorporating the use of recycled and energy efficient materials
• Incorporating the use of locally sourced building materials
• Reducing waste and pollution and making adequate provision for the recycling of waste
• Making use of sustainable drainage methods
• Reducing the impact on the external environment and maximising opportunities for cooling and shading (by the provision of open space andwater, planting, and green roofs, for example); and
• Making use of the embodied energy within buildings wherever possible and re-using materials where proposals involve demolition or redevelopment.

1.2 Planning Conditions

Condition 13 of the planning permission states that -

"13. Prior to the commencement of any works associated with the construction of a dwelling, details of the means by which all dwellings will be designed and constructed to achieve an energy performance standard equivalent to a 19% improvement in carbon reductions on 2013 Part L of the Building Regulations (unless a different standard is agreed with the local planning authority) shall be submitted to and approved in writing by the local planning authority. The development shall thereafter be carried out in accordance with the approved details and no dwelling shall be occupied until it has been constructed in accordance with the approved energy performance measures."

1.2. Policy Response

The strategy calculates the total energy demand and associated CO_2 emisisions arising from the development and demonstrates that a 19% carbon reduction can be achieved through Flue Gas Heat Recovery Systems (FGHRS), Showersave Waste Water Heat Recovery and improved fabric efficiency measures.

2. National Planning Policy Framework (NPPF)

The latest National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of planning for climate change as noted in the following relevant clause numbers.

Achieving a sustainable development

7. The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Planning for climate change

150. 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.

151. 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 collocating potential heat customers and suppliers.

152. 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.

Paragraph 154 sets out what is expected from local authorities when considering strategies to mitigate and adapt to climate change:

154. 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) acceptable. 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.

3. Energy hierarchy through design

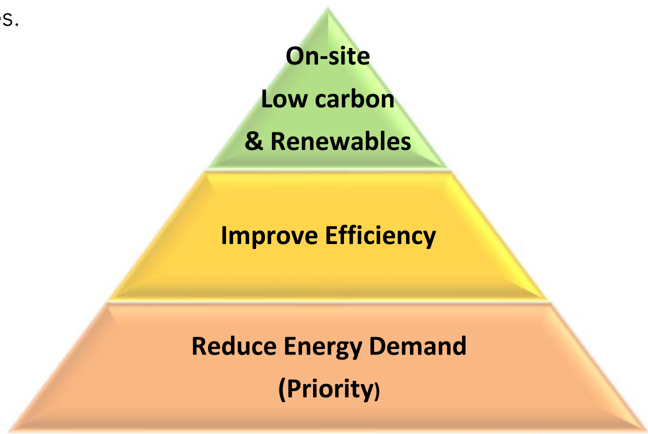
The Hempton Road Phase 1 development will be developed with the aim of reducing annual energy consumption, whilst providing energy in the most environmentally friendly way to reduce the annual CO_2 footprint.

This strategy has been developed using established methodology (as recommended by Cibse and the London Plan). It has three stages of priority, seeking to reduce energy use through the cleanest possible solutions.

Be Lean - Reducing energy needs through improved design and construction.
Be Clean - Supply energy efficiently through the use of decentralised energy where feasible.
Be Green - Further reduce CO_2 emissions through the use of on-site renewable sources, where practical.

As this hierarchy demonstrates, designing out energy use is weighted more than the generation of low-carbon or renewable energy to offset unnecessary demand. Applied to the development of new housing, this approach is referred to as 'fabric first' and concentrates finance and efforts on improving U-values, reducing thermal bridging, improving airtightness and installing energy efficient ventilation and heating services.

This approach has been widely supported by industry and government for some time, with previous reports from Zero Carbon Hub [1] and Energy Saving Trust [2] having both stressed the importance of prioritising energy demand as a key factor in delivering resilient, low energy homes.



Further to the above methodology, we have also looked at other steps towards achieving a low carbon solution, including:

- The incorporation of passive design solutions by considering the dwellings orientation and layout solutions;
- The incorporation of energy efficiency measures through the design of services and improved fabric performance;
- Calculation of the predicted design energy consumption rates and associated annual CO_2 emissions in comparison with a 'baseline' building (using Part L Regulations compliance standards) to include both regulated and un-regulated energy use;
- Assessment of the viability of incorporating low and zero carbon energy sources.

Benefits of the Fabric First Approach	Fabric Energy Efficiency Measures	Bolt on renewable energy technologies
Energy/CO2/fuel bill savings applied to all dwellings	✓	X
Savings built-in for life of dwelling	✓	X
Highly cost-effective	✓	X
Increases thermal comfort	✓	X
Potential to promote energy conservation	✓	✓
Minimal ongoing maintenance / replacement costs	✓	X
Minimal disruption to retrofit post occupation	✓	X

[1]1Zero Carbon Hub, Zero Carbon Strategies for tomorrow's new homes, Feb 2013.
[2] Energy Saving Trust, Fabric first: Focus on fabric and services improvements to increase energy performance in new homes, 2010

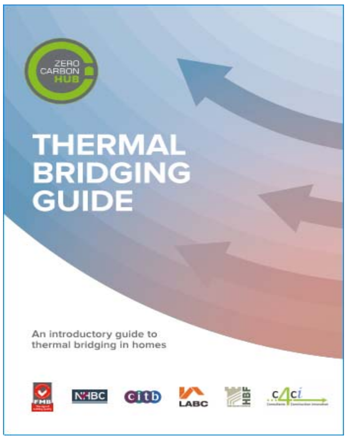
4. Be Lean - Energy efficient design measures

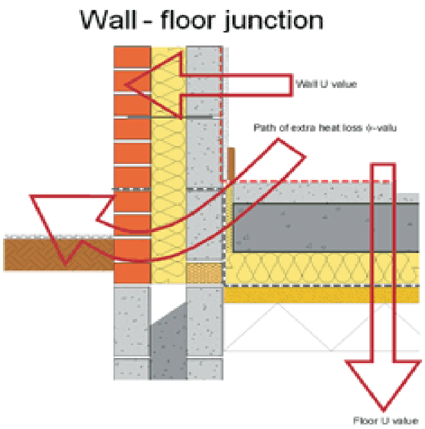
Enhancing the thermal performance of the building is usually more cost effective than providing renewable energy, with more reliable CO_2 savings for the long-term life cycle of the building, without the cost of replacing mechanical or electrical components on a continual basis. Adding renewable technology will then maximise these carbon reductions, reducing the quantity required.

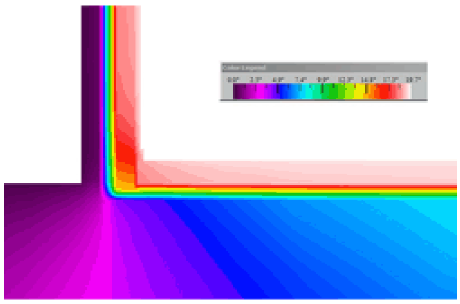
This development will achieve compliance with Part L1A of the Building Regulations (2013) without relying upon the contribution of renewable energy.

Element	Building Regulations	Proposed
Ground Floor	0.25 W/m^{2}k	0.11 W/m^{2}k
External Wall	0.30 W/m^{2}k	0.24 W/m^{2}k
Insulation at Joists	0.20 W/m^{2}k	0.09 W/m^{2}k
Insulation at Rafters	0.20 W/m^{2}k	0.16 W/m^{2}k
Windows	2.00 W/m^{2}k	1.30 W/m^{2}k
Doors	2.00 W/m^{2}k	1.09 W/m^{2}k
Air Permeability	10.00 m^3/hm^2 (@50 Pa)	5.01 / 4.00 m^3/hm^2 (@50 Pa)
Thermal Bridges	0.15 ≤ Y	Calculated Constructive Details

Improving the thermal bridge constructive details can have a great impact on the heat loss of the development, in some cases using enhanced details can make as much as a 27% improvement on fabric alone.



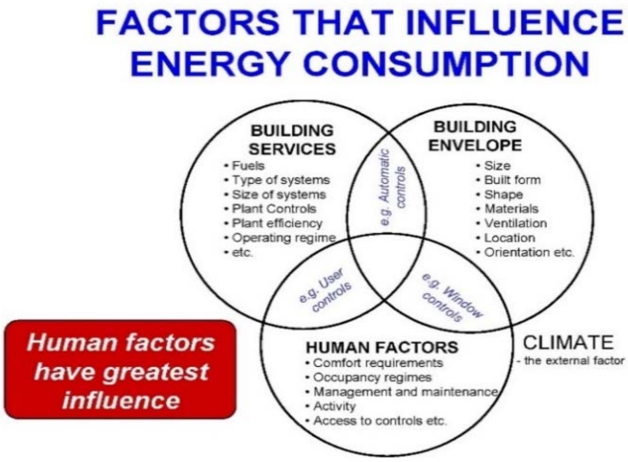




Additional improvements to thermal performance can be achieved by ensuring good practice airtightness targets are achieved. Simple measures like sealing around services (e.g. water, gas and cables), using proprietary seals and collars, ensuring blockwork is sealed and parging layer/plaster finish is applied to external walls before erecting studwork for internal partitions will all improve air tightness results.

5. Be Clean - Energy efficient M & E systems

Having reduced energy demand through the fabric first approach, we now look to specify mechanical and electrical systems with efficiencies that surpass the requirements of the Domestic and Non-domestic Building Services Compliance Guide (2013).



The following energy efficient systems are proposed. This covers the clean mechanical and electrical systems, HVAC (heating, ventilation, air conditioning), hot water, lighting and efficient controls. Some renewable factors may be considered and included at this stage, i.e.: heat recovery, air source heat pumps or ground source heat pumps. The suitability of such technologies will be explored further within this report.

Element	Compliance	Proposed
Low energy lighting (efficacy ≥ 45lm/W)	75%	100%
Ideal ESP1	88%	89.6%
Shower Save (WWHRS)	N/A	Yes
Hot Water Cylinder - 210L	2.3 kWh/day	1.76 kWh/day
Heating controls	Programmer, TRV's & room stats	Time & Temp Zone controls (over 150m2)
Advanced controls	N/A	delayed start
System 1 - Natural Ventilation / System 3 - Continuous Mechanical Extract	0.5 l/W/s (SFP) / 0.7 l/W/s (SFP)	0.5 l/W/s (SFP)

6. District Heating

As part of planning, any major development proposal should evaluate feasibility of energy systems in accordance with the following hierarchy: -

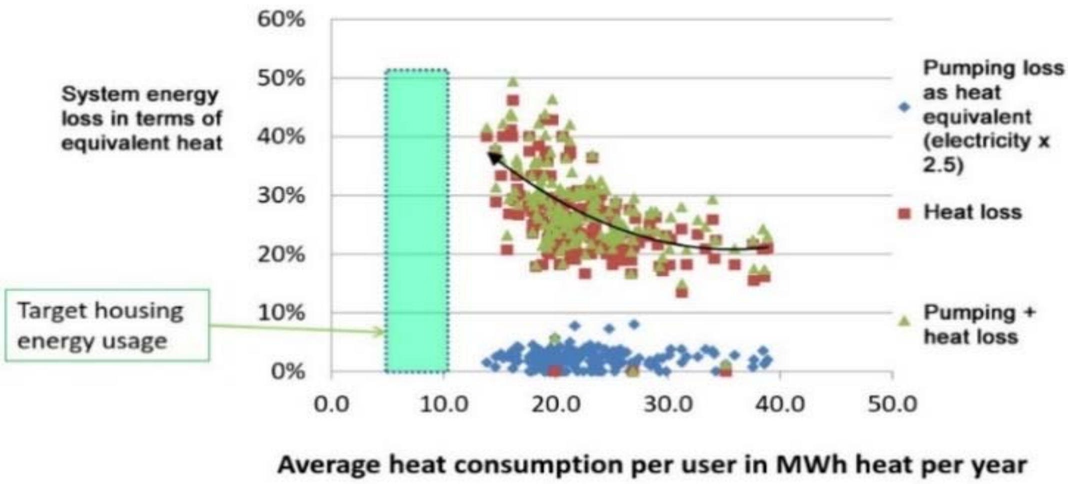
- Connection to existing heating and cooling networks;
- Site wide combined heat and power (CHP) network;
- Communal heating and cooling.

Over several years, building service engineers Max Fordham have studied the benefits and drawbacks of providing heat to buildings via hot water heat networks supplied from community scale heat sources, in particular combined heat and power (CHP). Government scenario planning includes predictions that by 2050 heat networks may supply about 20% of the UK's building heat demand [*D. o. E. &. C. Change, "National Energy Efficiency Data-Framework (NEED) report: Summary of analysis 2013 Part 1," DECC, 2013*.]. It is clear that government policy is vigorously pursuing gas fired CHP with heat networks, but to what effect?

The issues are varied and complex, and include: consideration of the heat sources that may be in use in the future; the future strategy for national electricity generation; the difference between "as predicted" and "as measured"; the relationship to the intensity of heat demand; and the costs to the end users.

The most important aspect that Max Fordham concluded is that the heat network system heat losses are very large. They are much larger than the assumed values used in regulatory and system planning calculation methods (such as SAP).
An unfortunate feature of this (district heating) debate is that good quality data from a wide range of UK installations is not available or not publishable due to its commercially sensitive nature. Clearly this situation is not helping the UK develop a low carbon heat strategy.

However, data from the Danish District Heating Association shows that from analysis of about 100 installations the heat losses in the municipal distribution pipes ranged from 15% to 45% of the heat supplied. This is only the loss up to the building site boundaries. There will be additional losses inside the buildings too. The current UK average domestic heat demand is 14MWhr/dwelling/yr. [*D. o. E. a. C. Change, "National Energy Efficiency Data-Framework (NEED) Summary consumption statistics," DECC, 2011*.]. At this scale the Danish data shows that a heat loss of around 35%. If the heat demand from buildings is reduced to less than 10 MWh/yr. (which is desirable) then the heat losses might represent 50% of the heat supplied.



Danish data of heat and pumping losses in district heating systems. *Source: Birger Lauersen, International chef / Manager International Affairs, Dansk Fjernvarme / Danish District Heating Association*

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District Heating - Continued

High system heat losses (and pumping demands) mean that in many cases, gas fired CHP with heat networks will not reduce, but increase carbon emissions. This is particularly true when compared to using individual gas boilers and electricity from the current national grid. It is clear that heat networks need to be reassessed (by the UK Government) taking into account the true extent of heat losses and/or the mitigation measures required to reduce them. If this is done, we may well see quite a change in national and local policies for heat networks, with or without CHP.

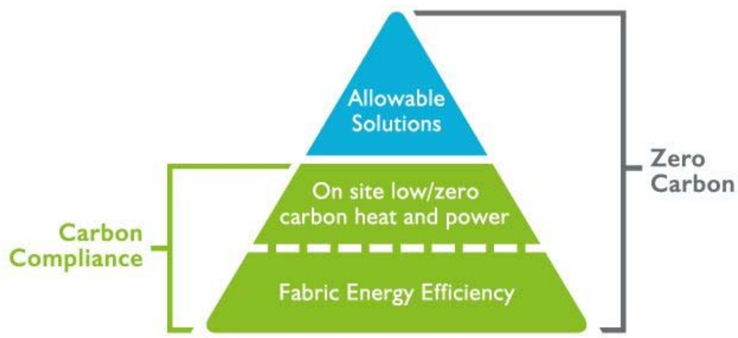
Our preference has always been a much more vigorous pursuit of heat demand reduction, principally by insulating and draught proofing existing buildings. From our observations of district heating systems we believe that the very high losses can be reduced with improved components, improved design and improved care during installation. However, it is highly unlikely that the system losses could be reduced to the levels that have informed current government policy anytime soon.

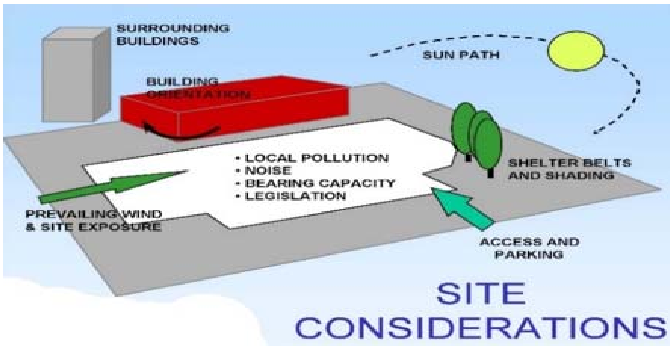
The development will not connect to any existing district heating system, nor will a new system be considered, for the following reasons:

- the site is mainly residential, with units dispersed over a large area. This will mean that a large distribution network would be required, and it is anticipated that distribution losses would be high.
- the carbon reduction and energy efficiency requirements can be achieved at a lower cost, and at a greater benefit to the homeowner the 'fabric first' approach is proposed.
- the site is too far away from existing District Heat networks.
- the home owners would be tied to the same supplier, removing choice.
- The statement on the previous page outlines why CHP and district heating systems are generally more expensive to run, consume more energy and issue more CO2 than an equivalent "conventional" systems.

7. Low to Zero Carbon Technology Reductions

In order to satisfy local planning requirements, a detailed assessment of Low to zero carbon technologies will be carried out. Each energy efficiency measure has been considered to give a greater understanding of which solutions could be implemented at the development to provide energy and CO_2 savings beyond current building regulations. Feasibility is based on location, cost, payback for both initial payment and ongoing maintenance and suitability





Technologies Not Considered within following feasibility study -

- Fuel Cells : These are not yet fully commercially available
- Hydro : Small scale hydro would be inappropriate for integration into the proposed development due to the geographical location of the proposed site
- CHP, Biomass and Biogas District heating: These have been discounted under the District Heating Scheme section

Low to Zero Carbon Technology Reductions - cont.

7.1. Solar Hot Water

Solar water heating systems use heat from the sun to work alongside conventional primary water heaters. The technology is well developed with a large choice of equipment to suit many applications. There are three main components.

Solar collectors - fitted to the roof and collect heat from the sun's radiation. There are 2 main types of collector:

- Flat plate systems: comprised of an absorber plate with a transparent cover to collect the sun's heat
- Evacuated tube systems: comprised of a row of glass tubes that each contain an absorber plate feeding into a manifold which transports the heated fluid.

Heat transfer system - uses the collected heat to heat water

Hot water cylinder - stores the hot water that is heated during the day and supplies it for use later.

All savings are approximate and are based on the hot water heating requirements of a 3 bed semi detached home. Solar water heating can be used in the home or for larger applications. A domestic system would typically require 3-4 square metres of southeast to southwest facing roof receiving direct sunlight for the main part of the day and space to locate an additional water cylinder.

installation and maintenance costs - The typical installation cost for a domestic system is £3,000- £5,000. Evacuated tube systems are more advanced in design than flat plate, and so tend to be more expensive. Solar water heating systems generally come with a 5-10 year warranty. A yearly check by the householder and a more detailed check by a professional installer every 3-5 years should provide sufficient maintenance.

Proposed for this development?

No

Solar Thermal Calculation	
Number of plots with panels	0
Size of Panel	4.5
Number of Panels per plot	0
Total m^2	0
Average kWh/m^2	294
Energy produced by panels	N/A
Energy% Saved From Panels	N/A
CO_2% Saved From Panels	N/A

Not Proposed for this development because…

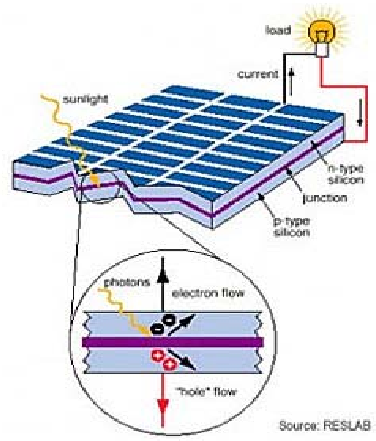
- Solar Thermal relies on energy from the sun, therefore producing hot water only during daylight hours
- Poor servicing and badly programmed controls can make this technology operate less efficiently than a standard boiler
- Hot water storage has a heat loss linked to it, which can contribute to summer overheating and reduced efficiency
- This is not a 'fit and forget' technology, it requires regular servicing, replacement parts and optimizing of controls
- This is not suitable for poorly orientated dwellings
- Solar thermal is predominantly not feasible for dwellings with combination boilers

7.2. Photovoltaic Collectors (PV)

Proposed for this development?

No

Solal PV panels create electricity to run appliances and lighting from natural daylight (direct sunlight is not required) to generate electricity.



How it works

Photovoltaic cells convert solar radiation into electricity. The PV cell consists of one or two layers of a semi conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers, causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity. PV systems generate no greenhouse gases, saving approximately 325kg of carbon dioxide emissions per year- adding up to about 8 tonnes over a system's lifetime for each kilowatt peak (kWp). PV cells are referred to in terms of the amount of energy they generate in full sun light.

PV arrays come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles, to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. As well as enabling you to generate free electricity they can provide an interesting alternative to conventional roof tiles.

PV performs optimally with a roof or wall that faces within 90 degrees of south, as long as no other buildings or large trees overshadow it. If the roof surface is in shadow for parts of the day, the output of the system will decreases. The additional weight of PV will require the roof to be designed accordingly to carry the load. Solar PV installations should always be carried out by a trained and experienced installer. The area of PV required to provide 1kWp is around 6.5m2.

Cost and maintenance

Prices for PV systems vary, depending on the size of the system to be installed, type of PV cell used and the nature of the building on which the PV is mounted. The size of the system is dictated by the amount of electricity required. For the average domestic system, costs can be around £1250-£2000 per kWp installed (energy saving trust 2017), with most domestic systems usually between 1.5 and 2 kWp. Solar tiles cost more than conventional panels, and panels that are integrated into a roof are more expensive than those that sit on top. Grid connected systems require very little maintenance, generally limited to ensuring that the panels are kept relatively clean and that shade from trees has not become a problem.

The wiring and components of the system should however be checked regularly by a qualified technician. Stand-alone systems, i.e. those not connected to the grid, need maintenance on other system components such as batteries.

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Photovoltaic Collectors (PV) - continued

Proposed for this development?

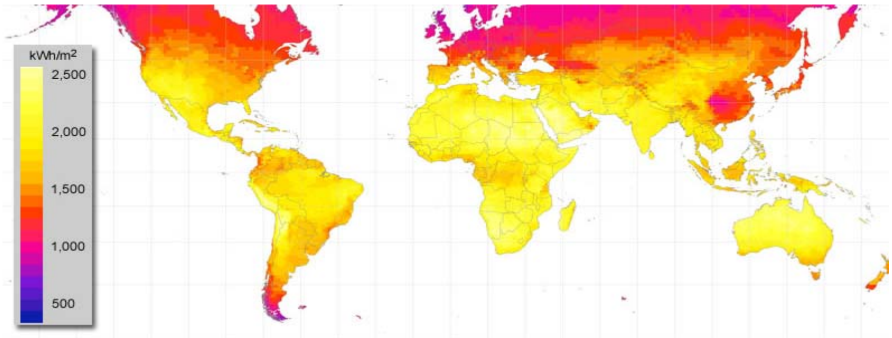
No

In determining the feasibility of Solar PV, energy output will be calculated through the equation - E = A x r x H x PR, detailed below.

Loss details (dependent on site, technology, and sizing of the system)

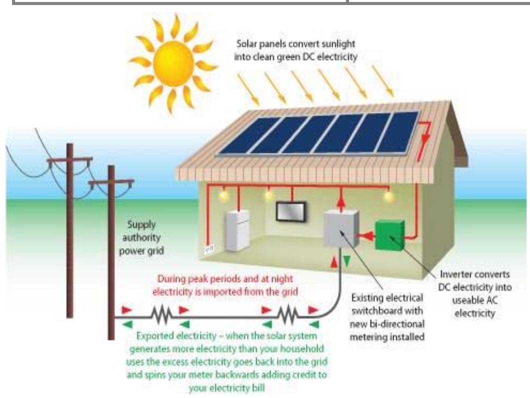
Inverter losses	4%
Temperature losses	3%
DC cables losses	1%
AC cables losses	1%
Shadings	0%
Losses weak irradiation	1%
Losses due to dust, snow	1%
Other Losses	0%

Yearly sum of global irradiance



	Total site kWp	PR = Perf Ratio	H = Annual irradiation	r=panel yield(%)	A=Panel Area(m²)	E=Energy (kWh)
South	0	0.89	1054	20%	0	0
SE/SW	0	0.89	997	20%	0	0
East/West	0	0.89	854	20%	0	0.00
NE/NW	0	0.89	686	20%	0	0.00
North	0	0.89	640	20%	0	0.00
	0				Total Energy kWh	0

PV Panels required to meet 0kWp output	
240W Panels	0 Panels Required
250W Panels	0 Panels Required
270W Panels	0 Panels Required
300W Panels	0 Panels Required



Not Proposed for this development because…

PV panels are considered technically feasible for all buildings with suitable roof orientations. However, for the following reasons, PV is not considered to be viable for this site -

- Poor design and installation can lead to lower than expected yields (e.g. from shaded locations)
- Installation is restricted to favourable orientations
- Feed in Tariff scheme no longer offered by government
- Safe access must be considered for maintenance and service checks
- Inverters require replacing on average every seven years
- Visual impact may be a concern in special landscape designations (e.g. AONB) and reflected light may be a concern in some locations

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7.3. Micro wind turbine

Proposed for this development?

No

Wind turbines use the wind's lift forces to rotate aerodynamic blades that turn a rotor which creates electricity. In the UK we have 40% of Europe's total wind energy.

Most small wind turbines generate direct current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity to AC (alternating current- mains electricity). Wind systems can also be connected to the national grid. An inverter and controller convert DC electricity to AC at a quality and standard acceptable to the grid. No battery storage is required. Any unused or excess electricity may be able to be exported to the grid and sold to the local electricity supply company.

There are two types of wind turbines -

• Mast mounted - free standing and located near the building(s) that will be using the electricity.

• Roof mounted- can be installed on house roofs and other buildings

Potential Benefits

Wind power is a clean, renewable source of energy which produces no carbon dioxide emissions or waste products. Individual turbines vary in size and power output from a few hundred watts to two or three megawatts (as a guide, a typical domestic system would be 1- 6 kilowatts). Uses range from very small turbines supplying energy for battery charging systems (e.g. on boats or in homes), to turbines on wind farms supplying electricity to the grid.

Not Proposed for this development because…

The Government wind speed database predicts local wind speeds at Hempton Road Phase 1 to be 4.9 m/s at 10m above ground level, 5.7 m/s at 25m above ground level and 6.1 m/s at 45m above ground level. This is below the level generally required for commercial investment in large wind turbines.

- Large potential land take, noise pollution and and signal interference make a large wind turbine unsuitable for this development
- Horizontal axis micro-wind turbines only reduce carbon emissions by a small amount. High winds can cause the turbine to be stationary
- Health and safety is a factor, with high speed moving parts mechanical failure can be catastrophic to human life, birds and wildlife
- The turbine flicker effect means that the turbine needs to be at least 400 metres from the nearest dwelling and computer controlled to take into account the position of the sun

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Proposed for this development?

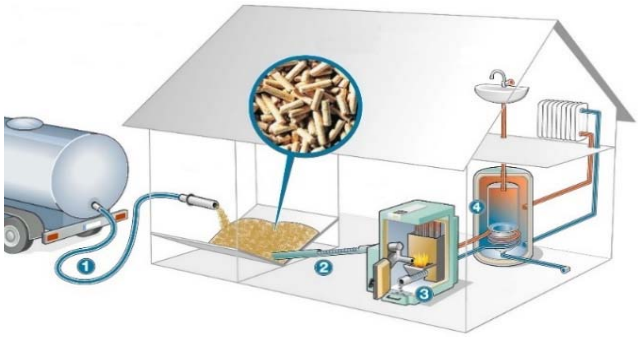
No

7.4. Biomass

Biomass is produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products. It is often called 'bio energy' or 'bio fuels'. It does not include fossil fuels, which have taken millions of years to be created.

Biomass falls into two main categories -

- Woody biomass: includes forest products, untreated wood products, energy crops and short rotation coppice (SRC), which are quick-growing trees like willow.
- Non-woody biomass: includes animal waste, industrial and biodegradable municipal products from food processing and high energy crops. Examples are rape, sugar cane, maize.



Planning

If the building is listed or in an area of outstanding natural beauty (AONB), then you will need to check with your Local Authority Planning Department before a flue is fitted.

Costs and savings

Stand alone room heaters generally cost £2,000 to £4,000, installed. Savings will depend on how much they are used and which fuel is being replaced. A biomass stove which provides a detached home with 10% of annual space heating requirements could save around 840kg of carbon dioxide when installed in an electrically heated home. Due to the higher cost of biomass pellets compared with other traditional heating fuels, and the relatively low efficiency of the stove compared to a central heating system it will cost more to run. The cost for boilers varies depending on the system choice; a typical 15kW (average size required for a three bedroom semi detached house) pellet boiler would cost around £5,000-£14,000, installed, including the cost of the flue and commissioning. A manual log feed system of the same size would be slightly cheaper. A wood pellet boiler could save around £750 a year in energy bills and around 6 tonnes of CO2 per year when installed in an electrically heated home.

Not Proposed for this development because…

Biomass boilers and and CHP engines create a large amount of pollution and carbon emissions. Although it is considered that Biomass is a carbon neutral technology thanks to the CO_2 being absorbed by growing new trees, it is not viable at the Hempton Road Phase 1 development.

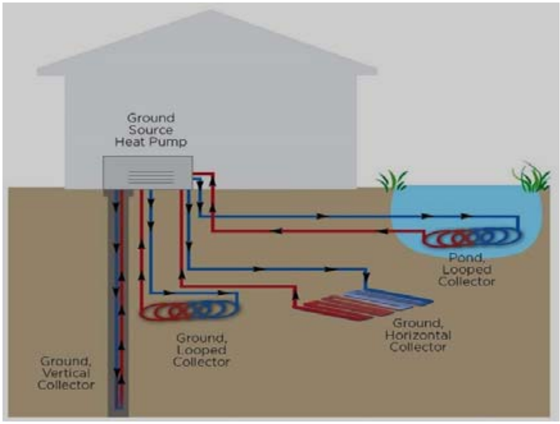
- With pollution levels consistently increasing, particulate levels in burning biomass means that it is not a clean technology
- Wood is a major source of biomass energy. Producing biomass fuel on a large scale can lead to deforestation
- Delivering the fuel can lead to additional traffic, causing pollution and delays. Supply needs to be within a 40 mile radius
- By developing crops to produce fuel for biomass energy, we are utilising land that may have been used for food sources

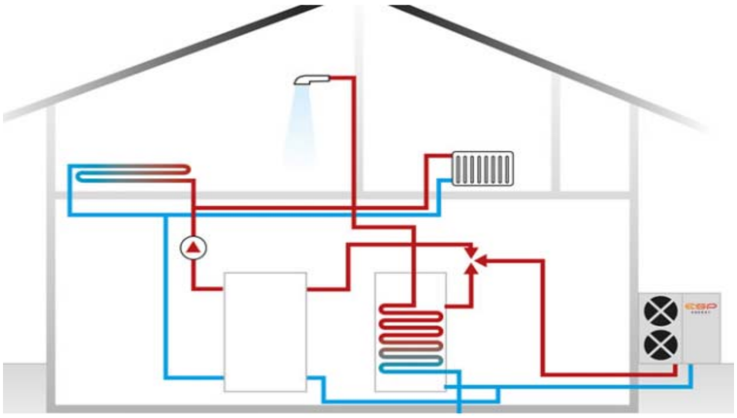
7.5. Heat Pumps (ASHP & GSHP)

Proposed for this development?

No

There are two types of heat pumps, ground source and air source. Heat pumps work in a similar way to fridges and air conditioners and absorb heat from the ground or from the air. Ground Source Heat Pumps (GSHP) and Air Source Heat Pumps (ASHP) are mainly designed to work with under floor heating systems because of the lower design temperatures of under floor systems. The Coefficient of Performance (CoP) of ground source heat pumps can range between 3.5-5.5 and air source between 2.5-4.5.





GSHPs require significantly more space to install heating coils, either in trenches or bore holes. This is often not viable within the boundary conditions of a development, nor the space constraints of an urban or suburban dwelling. ASHPs have fewer space constraints, can be more easily installed and offer a shorter payback period.

Commercial buildings and some dwellings can benefit from variable refrigerant flow systems (VRF), which are large-scale ductless HVAC systems that can perform at a high capacity. VRF systems can either be heat pump or heat recovery systems, which provide simultaneous heating and cooling. These systems function in a similar way to an ASHP and when designed correctly they can produce efficiencies in some circumstances outperforming GSHP.

A VRF HVAC system can heat and cool different zones or rooms within a building simultaneously. If the appropriate VRF system is selected, building occupants have the ability to customize the temperature settings to their personal preferences. These systems are advantageous in buildings with plenty of glass on several orientations, helping to reduce the risk of over heating and producing adequate heat whilst maintaining a lower energy demand.

Not Proposed for this development because…

- Each GSHP would require up to 400m2 of trench to accommodate the heating coils. The alternate of bore holes would require extensive survey work to determine if there are any existing service networks that may be disrupted. The extensive cost of bore hole drilling and associated works would not be commercially viable for this development.

- Meeting hot water demand solely from an ASHP can be an issue as they are a low temperature system, if the end user uses immersion heating to top up the hot water it can create a high energy demand and increase running costs.
- As there is a lower heat supply compared to oil and gas boilers, heat pumps will perform better with underfloor heating or warm air heating, or when coupled with larger radiators.
- Heat pumps need to run constantly during the winter, with similar noise to an air conditioning unit and a constant energy demand
- ASHPs can lose efficiency in areas where the temperature in winter regularly drops below -1.5°C. The CoP can drop below that of a gas boiler increasing running costs significantly.

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7.6. Flue Gas Heat Recovery Systems (FGHRS)

Proposed for this development?

Yes

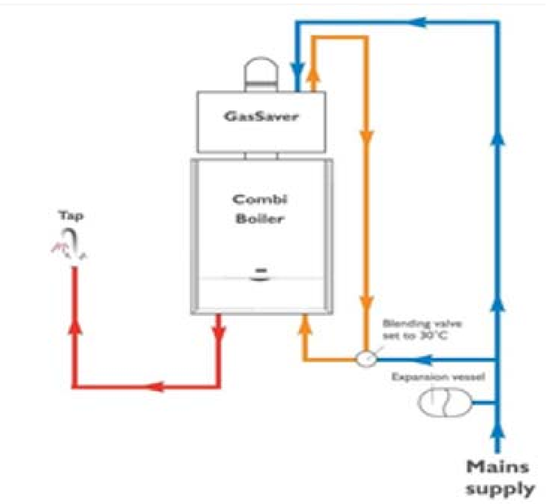
FGHRS can provide a reduction in CO_2 emissions compared to some technologies that are classified and listed as LZC technologies yet produce emissions in excess of a Natural Gas energy model.

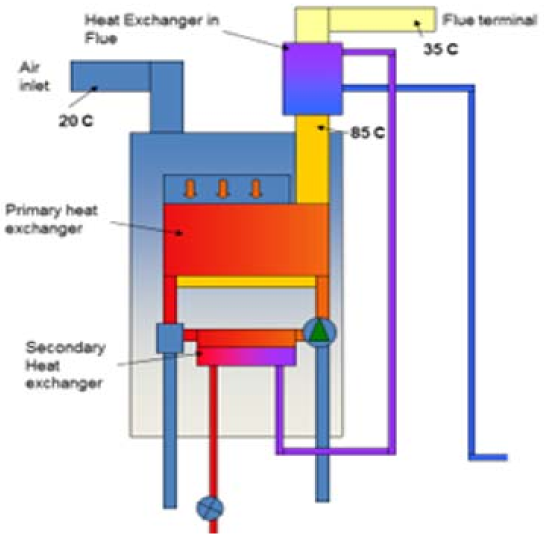
FGHRS take advantage of the heat within the waste flue gasses resulting from the combustion of gas in the boiler. This recovered heat is used to preheat the cold water entering the boiler, thereby lowering the amount of energy needed to warm the water up to the required temperature. This principle can be applied to mains gas, LPG or oil condensing boilers.

The system requires very little maintenance, with no need for mains electricity. These systems should be planned in early as there are additional space requirements for the FGHRS. Some boilers have the system built in, and in others it takes the form of a "top box". It is important that the specific boiler and FGHRS are compatible so check this with the manufacturer or seek further advice.

FGHRS has no specific land use requirements or additional planning requirements.

FGRS can be either a "wet" or "dry" configuration





Proposed for this development because...

In order to meet energy demand improvements using Flue Gas Heat Recovery Systems, this site will incorporate Ideal Logic Code Combi ESP1 38 boilers (or similar) installed to 7 dwellings, site wide. Carbon emissions will be reduced by 2.31% compared with Part L 2013 Target Emission Rate, and energy demand reduced by a further 2.47%. Calculated emissions will be incorporated in to the overall carbon and energy reduction, but not included in any calculations specific to renewable energy.

- Can be linked to weather compensation control to further improve efficiency
- Zero maintenance with no auxiliary energy requirements (e.g. mains electricity) for operation
- PFGHRS' has a direct benefit to water efficiency, less time running taps to bring water up to heat can save as much as 6% water usage

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7.7. Waste Water Heat Recovery Systems

Proposed for this development?

Yes

Following Directive (EU) 2018/2001 of the European Parliament and of the Council, 11 December 2018, Waste Water Heat Recovery (WWHR) is defined as a source of renewable energy, stating -

(1) 'energy from renewable sources' or 'renewable energy' means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas;

(2) 'ambient energy' means naturally occurring thermal energy and energy accumulated in the environment with constrained boundaries, which can be stored in the ambient air, excluding in exhaust air, or in surface or sewage water;

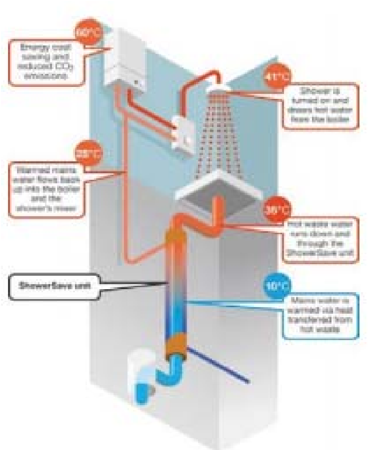
Shower Save (Figures 1 & 2) Waste Water Heat Recovery Systems (WWHRS) is a Dutch technology, where in The Netherlands, they are fitted to 20% of new dwellings. Although generically classified as a WWHRS, the Shower-Save device is primarily applicable to heat recovery from warm shower waste water.

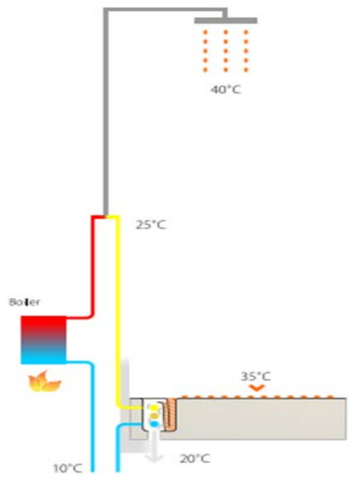
The most common configuration known as QB-21, is applicable to upstairs showers, whilst the Linear Drain can be used in apartments, bungalows or other single storey properties. The principle of heat recovery is the same in both cases -

• Warm shower water passes through the 'grey' water side of a copper counter-flow heat exchanger

• Mains pressure water simultaneously passes through the fresh water side of the heat exchanger, where it is pre-heated before passing into both the 'cold' inlet of the mixer shower and the 'cold' inlet to the hot water cylinder, combi boiler or other water heater.

• The use of pre-heated water (orange line below) reduces the total volume of hot water required per shower, whilst also pre-heating the cold feed to the hot water heater which increases potential flow rates for combi or shortens the re-heat time of cylinders. The energy saving applies to whichever fuel is used for water heating, which is therefore not limited solely to gas boilers. Whilst technically applicable to instantaneous electric showers, these ARE NOT currently modelled by SAP, so it is not possible to apply in Appendix Q either. WWHRS does not save energy from baths, in which hot water use is in advance of grey water disposal, but it is applicable to the shower over a bath.





Proposed for this development because…

WWHRS will be applied to 21 dwellings site wide, resulting in a carbon reduction of 6.53% compared with part L 2013, and an energy demand reduction of 8.26%. We recommend WWHRS on shower/bath drains because -

- Shower recuperation of heat is the most efficient source of heat recovery
- The use coincides well with the flow of hot water
- In best case scenario the hot water demand can be reduced by as much as 8%

8. Baseline Energy Calculations

A baseline total energy demand has been established for the development. Reductions in demand due to energy conservation measures are considered and form the basis of the renewable energy strategy which follows.

Total floor areas for the Hempton Road Phase 1 development have been used in conjunction with the building specification to determine total energy demand and associated carbon emissions using the methodology as set out in Part L1A 2013, calculated using approved SAP 2012 software.

Savings are measured in terms of a reduction in CO_2 emissions and kWh, which are calculated from their association with a particular fuel source. CO_2 conversion factors have been taken from the approved DEFRA Carbon Factors 2017 DECC conversion (cF)1.

Activity	Fuel	Unit	Energy - Gross CV	
Electricity Generated	Electricity	kWh	0.35156	kg CO_2e
Gaseous Fuels	Natural Gas	kWh	0.18416	kg CO_2e
Biomass	Wood Pellets	kWh	0.01270	kg CO_2e

Predicted Carbon Emissions: Part L1A (2013) TER, Before Fabric Improvements						
	Space Heating Demand	Hot Water Demand	Energy From Pumps and Fans	Energy from Lighting		Totals
Part L1A Plots (kWh/a)	113,484	52,087	1,575	9,870		177,015
CO_2 Associated with total Energy Demand (kg/a)	20,899	9,592	554	3,470		34,515

Predicted Carbon Emissions: Part L1A (2013) DER, with improved fabric, controls and heating system						
	Space Heating Demand	Hot Water Demand	Energy From Pumps and Fans	Energy from Lighting		Totals
Part L1A Plots (kWh/a)	95,301	41,415	1,648	9,870		148,234
CO_2 Associated with total Energy Demand (kg/a)	17,551	7,627	579	3,470		29,227

Baseline Emissions - Reduction through fabric and building efficiency

The carbon emissions for the development at Hempton Road Phase 1 is calculated to be 29227 kgCO_2 per annum. This represents an initial saving of 15.32% over the Part L1A 2013 compliant figure of 34515 kg per annum.

The total energy demand for the development at Hempton Road Phase 1 is calculated to be 148234 kWh per annum. This represents an initial saving of 16.26% over the Part L1A 2013 compliant figure of 177015 kWh per annum.

9. Renewable energy technology summary

The below table summarises the proposed Low/Zero carbon technologies that will be applied to the site, following the assessment of viability of each technology.

Potentially viable energy strategies considered	Number of Dwellings Applied to	Energy Saved %	Carbon Saved %	Proposed?
Solar hot water	0	0	0	No
Solar Photovoltaic (Approx.)	0	0	0	No
Wind Turbines	0	0	0	No
ASHP	0	0	0	No
GSHP	0	0	0	No
Flue Gas Heat Recovery	7	2.5	2.3	Yes
Waste Water Heat Recovery	21	8.3	6.5	Yes
Fabric Approach	21	16.3	15.3	Yes

10. Energy and Carbon Reduction Summary

This energy statement has been prepared in support of the development at Hempton Road Phase 1. Local Planning Policy for the development requires that demand reduction measures are implemented to achieve an improvement of 19% carbon, over Part L1A 2013 standards.

Provisional SAP assessment of the house types proposed demonstrates that baseline Part L compliant emissions for the development will be 34515 kgCO_2 per annum, with an energy demand of 177015 kWh per annum.

From this baseline, further energy demand reduction has been prioritised as part of the widely supported 'fabric first' approach. The benefits to the resident of this approach have been discussed in detail, which include an improvement in thermal comfort, lower energy bills, reducing the risk of fuel poverty and minimal maintenance requirements. These benefits are realised alongside the crucial aspect of the long-term reduction in energy demand that is built into the lifetime of the dwellings.

Applying this approach through a combination of the fabric specification proposed, detailing to avoid thermal bridging, reducing air leakage and employing passive and active design measures, the dwellings will secure a saving in CO_2 emissions of 5288 kgCO_2/year, equating to an energy demand reduction of 28781 kWh/year.

In order to meet the 19% carbon requirement, a further 1270 kg CO_2 will need to be offset, which is achieved through the strategy set out in this statement.

The energy statement determines the feasiblity of a range of LZC technologies. The development will apply Showersave Waste Water Heat Recovery in order to meet local authority planning policy, providing a 12243kWh energy and 2255 kgCO_2 carbon reduction.

The proposed strategy will provide a 21.85% carbon reduction over a development built to comply with the CO_2 targets under the latest revision of the Building Regulations, Part L1A 2013. This also represents a 24.52% energy demand reduction.