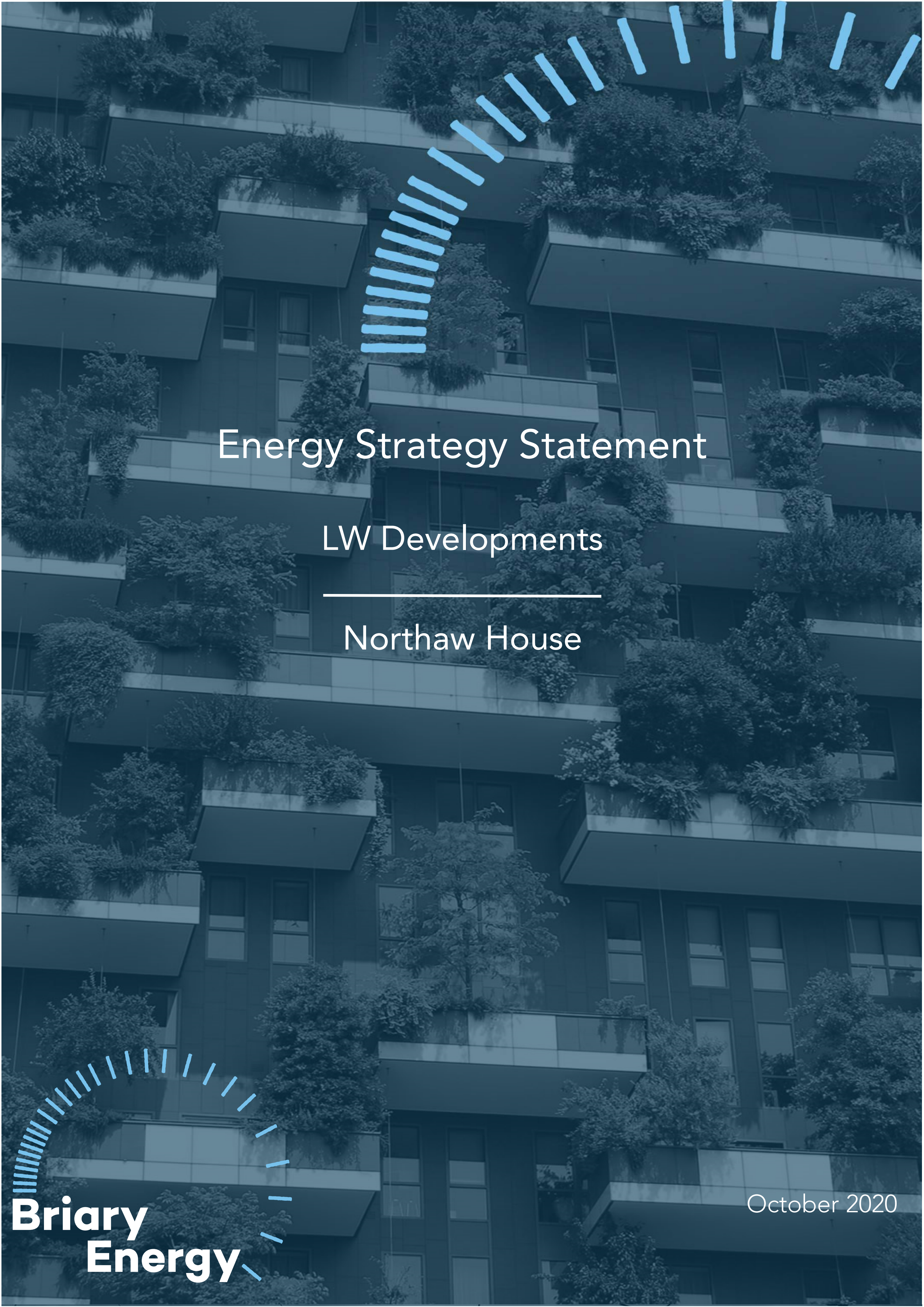


Energy Strategy Statement

LW Developments

Northaw House

October 2020

Briary Energy

Executive Summary

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

The Northaw House development will comprise of the conversion of a listed building into 11 apartments, the conversion of a wing of the listed building into 2 houses, the conversion of 2 buildings into detached houses, 7 new build homes in a traditional style and 3 new build semi-basement homes in a contemporary style.

Condition 10 of the development states that -

Prior to above ground development an Energy & Sustainability Statement must be submitted to and approved in writing by the Local Planning Authority. The development shall be constructed in accordance with the agreed and shall thereafter be maintained in the approved form.

REASON: To ensure that the development contributes towards Sustainable Development and Energy efficiency in accordance with Policy R3 of the Welwyn Hatfield District Plan 2005 and the National Planning Policy Framework 2019.

Welwyn Hatfield Borough Council, District Plan 2005 Policy R3 - Energy Efficiency states -

The Council will expect all development to:

Include measures to maximise energy conservation through the design of buildings, site layout and provision of landscaping; and

Incorporate the best practical environmental option (BPEO) for energy supply.

The new build dwellings will be designed to maximise solar gain, minimise thermal bridging, exceed fabric standards set out in part L1a of the building regulations, and take advantage of efficient heating sources. Units 16-18 will be heated through Air Source Heat Pumps, which are highly efficient and a renewable technology.

The converted dwellings will fully comply with fabric measures stated in part L1b of the building regulations, and use efficient gas heating to exceed the required carbon reduction targets set out in the building regulations.

The strategy calculates the total CO_2 arising from the dwellings and demonstrates a carbon reduction of 13.26% over building regulation standards. This equates to a 10.79% reduction in energy demand.

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.

Local Policy and/or Planning Conditions

Condition 10 of the development states that -

Prior to above ground development an Energy & Sustainability Statement must be submitted to and approved in writing by the Local Planning Authority. The development shall be constructed in accordance with the agreed and shall thereafter be maintained in the approved form.

REASON: To ensure that the development contributes towards Sustainable Development and Energy efficiency in accordance with Policy R3 of the Welwyn Hatfield District Plan 2005 and the National Planning Policy Framework
2019.

Changes to National Policy

Significant changes to both Building Regulations standards and national policy have occurred, since 2010.
Reductions in CO2 emissions from new development have been mandated through changes to Part L England and Wales. Updates in 2010 and 2013 required CO2 reductions from residential development cumulatively equating to approximately 30% better than Part L 2006, when the minimum standards for CO2 emissions were first introduced.
Further changes to national policy impact on the application of local planning policy, as expressed by the guiding principle within the latest National Planning Policy Framework which states that local policy should, "when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy."
With respect to 'zero carbon', the implementation timescale and meaning of 'zero carbon' buildings has been under review and consultation in recent years. 'Zero carbon homes' was originally planned for introduction in 2016, with non-residential development to follow in 2019, however a policy announcement presented by HMTreasury as part of the July 2015 productivity plan "Fixing the Foundations" advised that the government is not intending to proceed with zero carbon policy at this time, commenting that energy efficiency standards introduced through the 2013 amendment to Part L 'need time to become established' and will therefore persist until further notice

Energy Standards

The March 2015 ministerial statement additionally stated:
"For the specific issue of energy performance, local authorities will continue to be able to set and apply policies in their Local Plans which require compliance with energy performance standards that exceed the energy requirements of Building Regulations until commencement of amendments to the Planning and Energy Act 2008… Until the amendment is commenced, we would expect local planning authorities to take the government's intention into account in applying existing policies and not set conditions with requirements above a Code Level 4 equivalent".

Proposed LPA Policy Response

The new build dwellings will be designed to maximise solar gain, minimise thermal bridging, exceed fabric standards set out in part L1a of the building regulations, and take advantage of efficient heating sources. Units 16-18 will be heated through Air Source Heat Pumps, which are highly efficient and a renewable technology.
The strategy calculates the total CO2 arising from the dwellings and demonstrates a carbon reduction of 13.26% over building regulation standards. This equates to a 10.79% reduction in energy demand.

Energy hierarchy through design

The Northaw House 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.

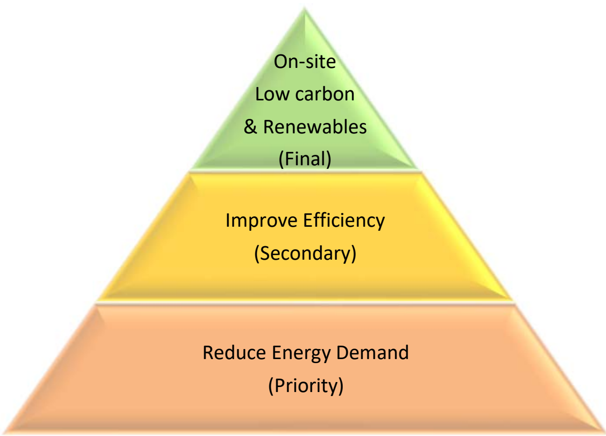
This outline strategy has been developed using established methodology (as recommended by Cibse and the London Plan). It has three stages of priority, seeking to reduce energy use through the cleanest possible solutions.

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; and
- 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	✓	0
Savings built-in for life of dwelling	✓	0
Highly cost-effective	✓	0
Increases thermal comfort	✓	0
Potential to promote energy conservation	✓	✓
Minimal ongoing maintenance / replacement costs	✓	0
Minimal disruption to retrofit post occupation	✓	0

[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



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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 and L1B of the Building Regulations (2013) without relying upon the contribution of renewable energy.

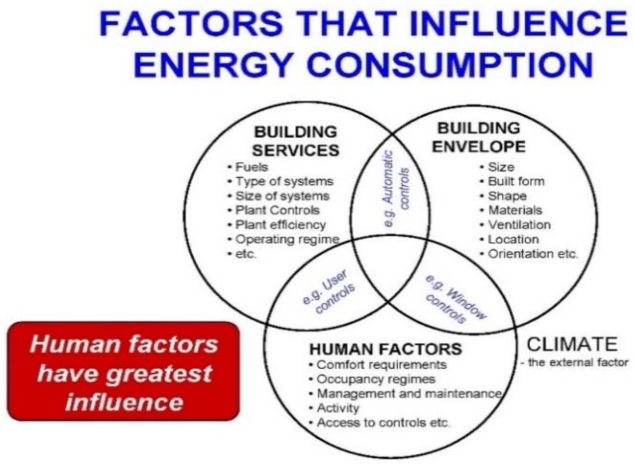
Element	Building Regulations (L1A)	Proposed
Ground Floor	0.25 W/m^{2}k	0.16 W/m^{2}k
External Wall	0.30 W/m^{2}k	0.24 W/m^{2}k
Insulation at Joists	0.20 W/m^{2}k	0.11 W/m^{2}k
Insulation at Rafters	0.20 W/m^{2}k	0.18 W/m^{2}k
Windows	2.00 W/m^{2}k	1.4 W/m^{2}k
Doors	2.00 W/m^{2}k	1.4 W/m^{2}k
Air Perm	10.00 m^3/hm^2 (@50 Pa)	5.01 m^3/hm^2 (@50 Pa)
Thermal Bridges	0.15 ≤ Y	Calculated Constructive Details

Element	Building Regulations (L1B)	Proposed
Ground Floor	0.25 W/m^{2}k	0.25 W/m^{2}k
External Wall (upgraded)	0.30 W/m^{2}k	0.3 W/m^{2}k
Insulation at Joists	0.16 W/m^{2}k	0.16 W/m^{2}k
Insulation at Rafters	0.18 W/m^{2}k	0.18 W/m^{2}k
Windows	1.60 W/m^{2}k	1.6 W/m^{2}k
Doors	1.80 W/m^{2}k	1.8 W/m^{2}k
Air Perm	n/a m^3/hm^2 (@50 Pa)	n/a
Thermal Bridges	n/a ≤ Y	n/a

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 can all improve air tightness results.

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.

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 Logic ESP1 / Air Source Heat Pump	88% / 170%	89% / < 210%
Shower Save (WWHRS)	N/A	N/A
Hot Water Cylinder	2.86 kWh/day	2.03 / 2.04 / 2.1 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	0.3 l/W/s (SFP)	0.2 l/W/s (SFP)

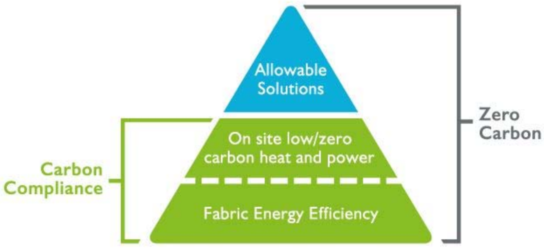
Be Green - Decentralised/Low to Zero Carbon sources

Feasibility is based on location, cost, payback for both initial payment and ongoing maintenance and suitability. The following pages show each Low to Zero Carbon energy solution that has been considered. Further feasibility has been calculated and demonstrated for each, with a list below of all the technologies considered with in-depth information about each technology, regardless of whether it is proposed or not: -

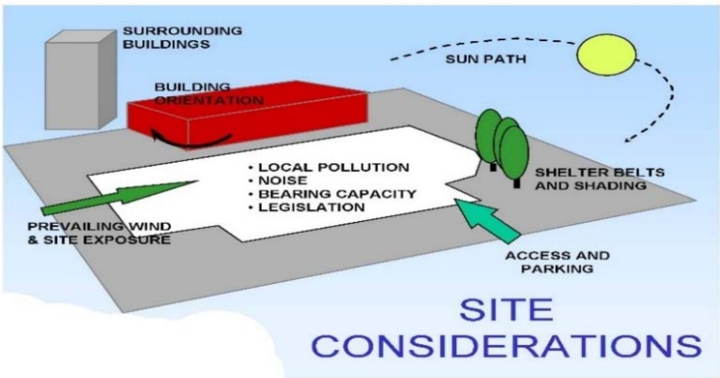
Zero carbon technologies
- Solar Hot Water;
- Solar Photovoltaic;
- Perovskite Photovoltaic;
- Wind Turbines; and
- Small Scale Hydro Power.

Low carbon technologies
- Biomass;
- District Heating and Combined Heat and Power (CHP);
- Heat pumps: Ground Source Heat Pumps, Geothermic Heating Systems, Air Source Heat Pump;
- Flue Gas Heat Recovery Systems (FGHRS); and
- Showersave / Waste Water Heat Recovery System (WWHRS).

Be Green - Continued



In order to satisfy the local planning requirements, a more detailed assessment of each of the following solutions will be explored. 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.



Considered technologies	
Solar hot water	No
Solar Photovoltaic	No
Wind Turbines	No
ASHP	Yes
GSHP	No
Flue Gas Heat Recovery	No
WWHR	No
Fabric Approach	Yes

District Heating

As part of planning, any major development proposal should evaluate 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?

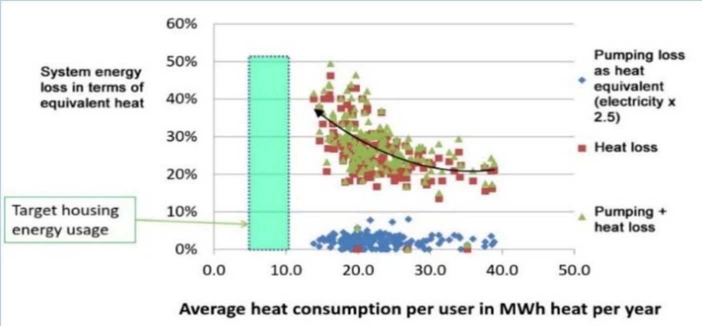
The issues are varied and complex, and include: consideration of the heat sources that may be in use in the future; the future strategy for national electricity generation; the difference between "as predicted" and "as measured"; the relationship to the intensity of heat demand; and the costs to the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

District Heating - Continued



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

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.

Low to Zero Carbon Technology Reductions

A detailed assessment, which will include the practical implications of installing each technology and quantity to achieve the required mandatory improvement in DER over 2013 Building Regulations, will be discussed in more detail later in this report, should any of these technologies be considered economically viable for the Northaw House development.

Technologies Not Considered
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 schemes have been discounted under the District Heating Scheme section

Low to Zero Carbon Technology Reductions - continued

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	3	1.5	2.5	Yes
GSHP	0	0	0	No
Flue Gas Heat Recovery	0	0	0	No
Waste Water Heat Recovery	0	0	0	No
Fabric Approach	13	9.3	10.7	Yes

Solar Hot Water

Proposed for this development?

No

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. For domestic hot water there are three main components Solar panels or collectors- are fitted to the roof. They collect heat from the sun's radiation. There are 2 main types of collector:
- Flat plate systems- which are comprised of an absorber plate with a transparent cover to collect the sun's heat, or
- Evacuated tube systems- which are comprised of a row of glass tubes that each contains an absorber plate feeding into a manifold which transports the heated fluid.

A 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, such as swimming pools. For a domestic system you will need 3-4 square metres of southeast to southwest facing roof receiving direct sunlight for the main part of the day, a space to locate an additional water cylinder if required. Solar water heating systems tend to require little maintenance 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 and require little maintenance. A yearly check by the householder and a more detailed check by a professional installer every 3-5 years should be sufficient.

Solar Thermal Calculation	
Number of plots with panels	0
Size of Panel	4.5
Number of Panels per plot	1
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 contibute to summer over heating 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.

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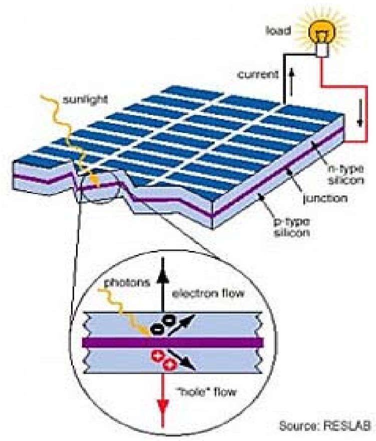
Photovoltaic Collectors (PV)

Proposed for this development?

No



Solar PV (photovoltaic) creates electricity to run appliances and lighting from natural daylight (direct sunlight is not required) to generate electricity.

How it works

Photovoltaic systems use cells to 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 now 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 systems for a building 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 decreases. Solar panels are not light and the roof must be strong enough to take their weight, especially if the panel is placed on top of existing tiles. Solar PV installations should always be carried out by a trained and experienced installer. The area of PV required to generate 1kw hour peak varies but is generally 6-8m² for M6n crystalline.

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 actual 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.

Not Proposed for this development because…

On the face of it, PV panels would be 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 need replacing an average of every seven years;
- Visual impact may be a concern in special landscape designations (e.g. AONB), reflected light may be a concern in some locations.

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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. But it is still largely untapped and only 0.5% of our electricity requirements are currently generated by wind power.
How does it work? 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 electricity grid. A special 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- which are free standing and located near the building(s) that will be using the electricity.
•Roof mounted- which 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 Northaw House to be 5.2 m/s at 10m above ground level, 5.9 m/s at 25m above ground level and
6.4 m/s at 45m above ground level. This is below the level generally required for commercial investment in large wind turbines and in addition the land take, potential for noise 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. In high winds they need to be static due to fundamental design issues.
- Health and safety is also a factor, with high speed moving parts mechanical failure can be castastrophic to human life, birds and wildlife.
- Flicker means that the turbine needs to be at least 400 mtrs from the nearest dwelling and computer controlled to take into account the position of the sun.

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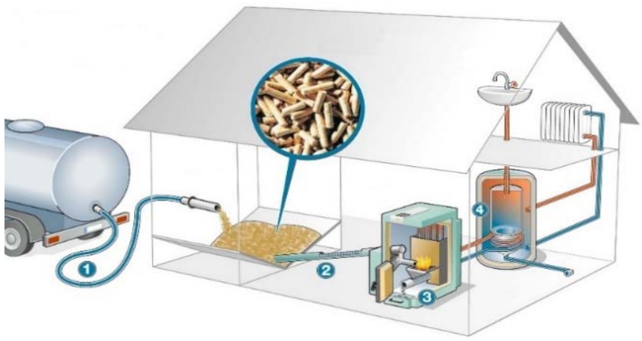
Bio Mass



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 you are replacing. 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 typical15kW (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 C02 per year when installed in an electrically heated home.

Not Proposed for this development because…

Biomass boilers, wood burning stoves and CHP engines all 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 Northaw House development.
- With pollution levels consistantly increasing, particulate levels in burning biomass mean 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 more 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 utilizing land that may have been used for food sources.

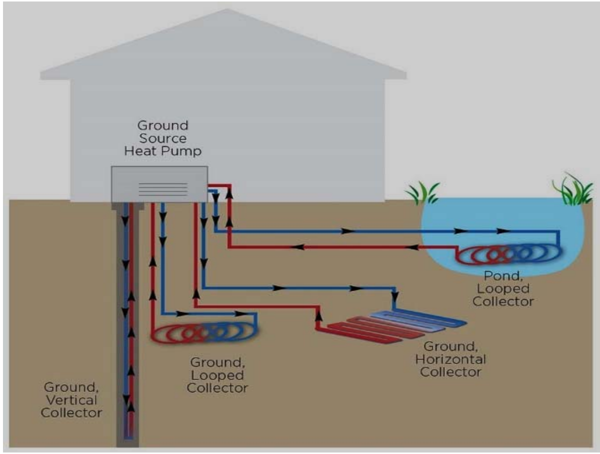
Heat Pumps (ASHP & GSHP)

Proposed for this development?

Yes

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 or air source heat pumps are mainly designed to work with under floor heating systems because of the lower design temperatures of under floor systems. Efficiencies of ground source heat pumps are between 350%-550% and air source between 250%-450%. Heat pumps are a viable alternative to electric, LPG and oil fuel boilers, but are not considered as an alternative to natural gas.

Generally speaking, the ground source heat pump is considered the best for use in cold weather as the ground has a natural supply of warmth. Typically, the piping is buried far enough down that the frost and cold weather will not be able to reach it, and so is prevented from freezing by the natural warmth that surrounds it. This also means that it does not lose efficiency at any point in the year. This is in contrast to the air source heat pump, which is installed outside.



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 provides simultaneous heating and cooling. These systems function in a similar way to ASHP, when designed correctly they can produce far greater 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.

Proposed for this development because…

Heat pump systems reduce your carbon emissions and have an efficient conversion rate from energy to heat. Water source heat pumps can reach high efficiencies, with Coefficient of Performance (CoP) as high as 600%, so for every 100% of electricity used the pump can produce 6 times the heat. Coupled with low temperature radiators or under floor heating makes them more efficient.
- As heat pumps are electric, they represent a perfect fit for solar applications. This makes for an effective carbon free model. Coupled with Solar PV, heat pumps can lead to a zero net energy.
- Heat pumps require less maintenance than a combustion heating system. Depending on the size of the units they only require inspection by a professional every 3-5 years;
- With a skilled M&E designer this low carbon technology will have a huge impact on Northaw House development;
- Government incentives are available for most types of heat pumps.

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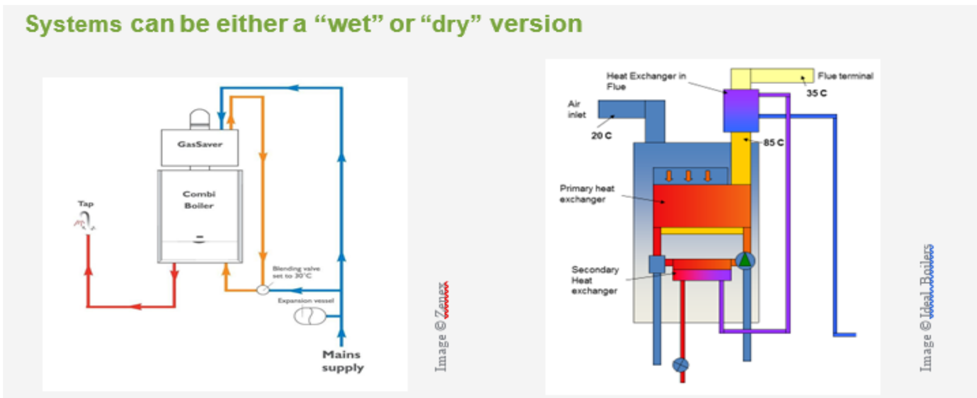
Flue Gas Heat Recovery Systems

Proposed for this development?

No

FGHRS provides a good reduction in C02 emissions compared to some technologies that are classified and listed as LZC technologies yet do not provide a reduction in C02 emissions when compared to a Natural Gas energy model.

Flue Gas Heat Recovery Systems takes 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. It can be applied to mains gas, LPG or oil condensing boilers.
The flue gas heat recovery 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



Land use
FGHRS requires no specific land use requirements.
Planning
FGHRS require no additional planning requirements.

Not Proposed for this development because…

Flue Gas Heat Recovery Systems are not the most efficient carbon reducing technology for the Northaw House development. They are better suited to small dwellings with no more than five occupants and two bathrooms, although there are some devices that are capable of providing hot water or central heating to larger dwellings and even non-domestic buildings. These types are less efficient and can often require continual servicing and calibration.

Waste Water Heat Recovery Systems

Proposed for this development?

No

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 (Figure 1), is applicable to upstairs showers, whilst the Linear Drain (Figure 2) 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 in Figures 1and 2) 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.

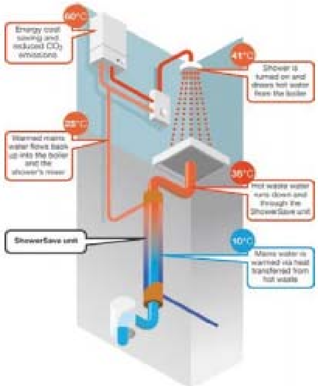


Figure 1

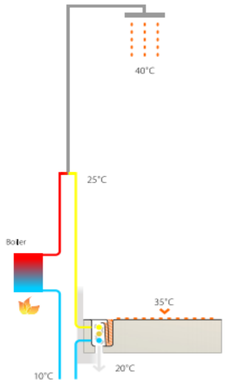


Figure 2

DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 11 December 2018
on the promotion of the use of energy from renewable sources
states: " ‘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"
WWHR is therefore now classed as renewable.

System A set ups are now feasible for apartment projects, yielding efficiencies as high as 65.2% when installed effectively, using a shared soil stack for every apartment above 1st floor height. The solution being the to use an in-line tray system for the ground floor apartment.

Not Proposed for this development because…

It is not viable due to construction constraints to install WWHRS to this development, for the following reasons: -
- There would only be a carbon emissions reduction of 0.45% and an energy demand reduction of 0.51%.
- Although WWHR can be installed on ground floor-single floor dwellings, the devices are less efficient;
- Multiple shower locations may require multiple WWHRS devices;

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.
Floor areas for the Northaw House development have been used in conjunction with building specifications to prepare preliminary SAP Calculations. SAP calculations have been carried out to Part L1A 2013.

Total Energy Demand is used in the final analysis to determine the contribution that renewable energy technology makes to total energy requirements for the development once energy conservation measures have been considered.

Energy 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

Baseline Energy Calculations- Continued

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)	97,740	33,270	975	6,942		383,240
CO_2 Associated with total Energy Demand (kg/a)	18,000	6,127	343	2,441		73,040

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)	202,809	35,458	930	6,942		350,650
CO_2 Associated with total Energy Demand (kg/a)	37,349	6,530	327	2,441		65,200

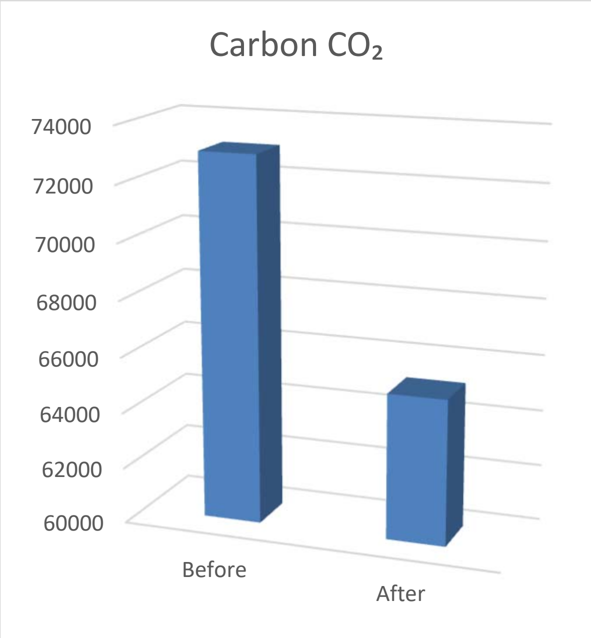
Fabric Results

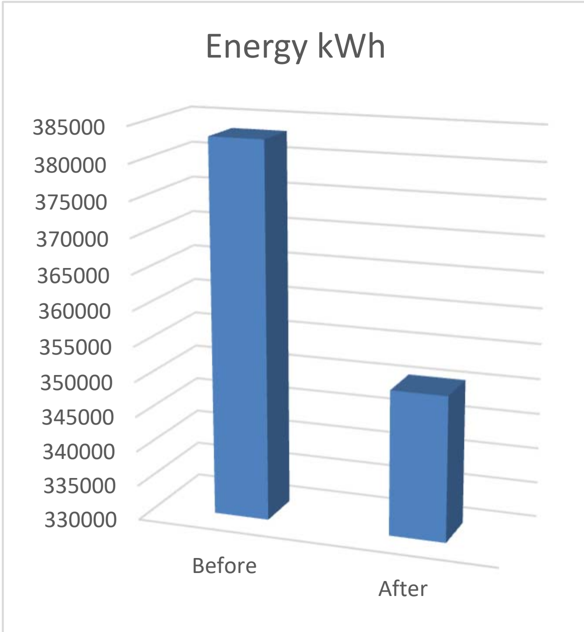
When compared against Part L1A 2013 Building Regulations: -

Total CO_2 demand for the residential units at Northaw House is calculated to be 65200 kg per annum. This represents a saving of 11% over the Part L1A 2013 compliant figure of 73040 kg per annum

Total energy demand for the residential units at Northaw House is calculated to be 350650 kWh per annum. This represents a saving of 9% over the Part L1A 2013 compliant figure of 383240 kWh per annum

Baseline Energy Calculations - Continued





Energy and Carbon Reduction Summary

This Energy statement has been prepared in support of the development of the site at Northaw House. Local Planning Policy for the development requires that demand reduction measures are implemented to achieve an improvement of Building Regulation standards or better, over Part L 2013 standards. Analysis based on a provisional SAP assessment of the house types proposed demonstrates that Part L compliant emissions equate to a site-wide calculated 73040 kg CO_2/year and energy demand of 383240 kWh/year

The dwellings are to be constructed to meet the requirements of Part L 2013, which requires CO_2 emissions to be reduced by approximately 30% beyond Part L 2006 standards. 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.

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 7840 kgCO_2/year, equating to an energy demand reduction of 32590 kWh/year.

The final calculations demonstrate that the overall CO_2 reductions would equate to a 13.26% 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 10.79% reduction in the energy requirements of the site.

Sustainable Design Considerations

Energy efficient design is only a part of a sustainable design strategy for modern homes. This section of the statement outlines the considerations that have been made to ensure that the proposed development will be designed and constructed to the highest standard of sustainable living.

Energy Conservation

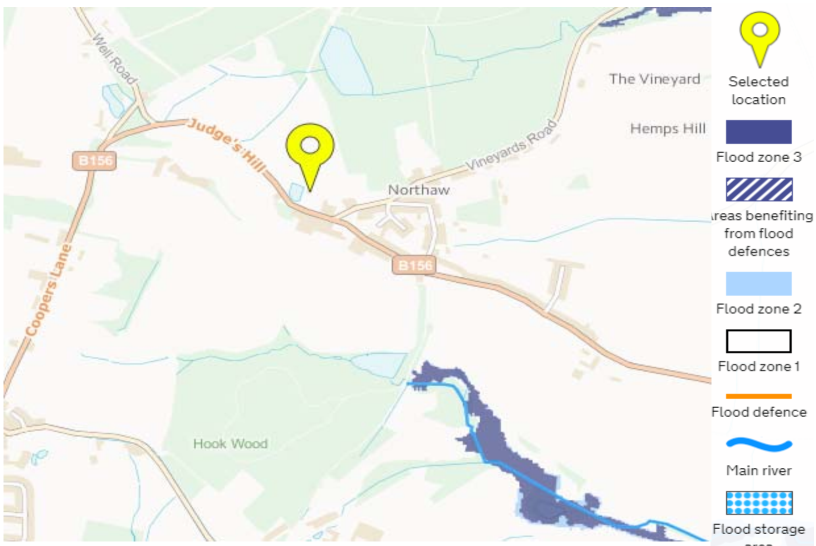
Further energy consumption reductions are achieved through the provision of energy efficient white goods (where applicable) ensuring that all appliances have a minimum energy rating of A+. Energy display monitoring devices & smart meters are designed to show the energy consumption within the home. This will help the occupants to develop an understanding of the energy they use and therefore enable them to improve their habits to reduce energy consumption.

Sustainable Urban Drainage Systems (SuDS)

SuDS are designed to manage excess rainwater where it falls rather than the traditional approach of channelling it through drains. Examples include ponds, reed beds, drainage channels and porous driveways.

Local planning policies and decisions on planning applications relation to major developments (those of 10 dwellings or more; or equivalent non-residential or mixed development) to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate.
The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event, a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.
For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event. This development falls into Flood Risk Zone 1, having a low probability of flooding (Land shown in light blue on the Flood Map below).

For developments in Flood Zone 2 the Government's NPPF and the accompanying online Planning Practice Guidance (PPG) on Flood Risk and Coastal Change provide tests and thresholds to protect property from flooding which all local planning authorities (LPAs) are expected to follow. Where these tests/thresholds are not met, new development should not be allowed. Together, the NPPF and the PPG provide for what is known as a "sequential test" designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim is to keep development out of medium and high flood risk areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible. A sequential approach should be used in areas known to be at risk from any form of flooding. Where there are no reasonably available sites in Flood Zone 1, local planning authorities can then consider reasonably available sites in Flood Zone 2, applying what is known as "the exception test".
Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the exception test if required. The exception test is set out in the NPPF as follows: -
• it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
• a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
Both elements of the test will have to be passed for development to be allocated or permitted.



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Water Conservation

Performance target: 125 ltrs pp/d

Installation type	Unit of measure	Capacity/ flow rate	Use Factor	Fixed Use	Litres/ person/day
WC (dual flush)	Full flush volume	6	1.46	0	8.76
	Part flush volume	4	2.96	0	11.84
Taps (excluding kitchen/utility room taps)	Flow rate (l/min)	6	1.58	1.58	11.06
Bath (where shower also present)	Capacity to overflow	185	0.11	0	20.35
Shower (where bath also present)	Flow rate (l/min)	10	4.37	0	43.70
Bath Only	Capacity to overflow	N/A	0.5	0	0.00
Shower only	Flow rate (l/min)	N/A	5.6	0	0.00
Kitchen/utility room sink taps	Flow rate (l/min)	8	0.44	10.36	13.88
Washing machine	Litres/kg dry load	8.17	2.1	0	17.16
Dishwasher	Litres/place setting	1.25	3.6	0	4.50
Waste disposal unit	Litres/use	N/A	3.08	0	0.00
Water softener	Ltrs/person/day	N/A	0	0	0.00

Greywater Contribution	N/A	Rainwater Contribution	N/A	Normalisation factor	0.91

Normalised total water consumption	119.43
External water use	5.00

Total calculated use	131.25
Total Water Consumption	124.43
Part G 17.K Compliance?	Yes
Performance Target Met	Yes

The calculation methodology is to be used to assess compliance against the water performance targets in Regulation 36. It is not a design tool for water supply and drainage systems. It is also not capable of calculating the actual potable water consumption of a new dwelling. Behaviour and changing behaviour can also have an effect on the amount of potable water used throughout a home. The calculation methodology uses the water consumption figures provided from manufacturers' product details. Where details have not been provided, figures have been used to achieve compliance. These must be met in order to satisfy the Part G Calculation.

Management

A suitably designed Home User Guide will be produced and made available to all new occupants. It will provide information on the energy efficient design of the dwellings, how to operate the services and equipment in the home and provide important information about the remainder of the site and its surroundings.

Household Waste

All dwellings will be provided with external space for household waste, compliant with British Standard BS5906, i.e.: 100ltrs volume for a single bedroom dwelling, with a further 70ltrs for each additional bedroom. Additional space for green recycling bins, blue bags, and food waste bins, will also be provided in accordance with the local recycling initiatives.

Air Quality

The quality of the air in modern homes is perhaps not something many people think about, but the reality is that if this is not managed appropriately it can impact on health. The incidence of asthma and other breathing complaints is on the increase and it is widely accepted that the indoor environment can exacerbate and bring on such problems in many people whether or not they have suffered in the past.

Pollution

To reduce the amount of greenhouse gas emissions associated with the development, all insulation used in the building fabric and services shall have a Global Warming Potential (GWP) of less than 5. By selecting suitable insulation products, the development is helping to minimise future effects of global Climate Change. The proposed gas fired system boilers will have a NOx rating of under 40mg/kWh.

Safety and security

Safety & security is a primary factor when designing a new home these days. This development has been designed to ensure that suitable security measures have been considered, including security lighting fitted with PIR (Photo Infra Red) sensors, suitable locks on all windows and external doors, and the bike store is fitted with suitable security measures.

Construction considerations

This site will benefit from the most stringent of health and safety regulations, by seeking registration with considerate constructors. A NEBOSH accredited health and safety manager will ensure all measures are adhered to and followed. Including reducing sound and dust pollution during the construction phase, allocating appropriate parking and traffic control for the construction teams and all heavy machinery. Ensuring adequate temporary works design and coordination is applied in accordance with the HSE.

Lighting and natural light

High quality lighting design is an important and desirable feature that supports how you feel and use your home. Providing adequate access to and control of lighting within your home is a basic function that contributes to our comfort and health.

Careful consideration will be made to ensure that background lighting levels will meet the requirements as set out in CIBSE Internal Lighting Guide & SLL Lighting Guide with the following targets set as shown in Table 5.0.

All internal and external lighting will be supplied by energy efficient fittings with LED lamps which will offer luminous efficacy greater than 45 lumens per circuit Watt and greater than 60 lumens per circuit Watt for the non-domestic unit.

The dwellings have been designed to maximise the level of daylight into the Kitchens, and Living Rooms which will help to achieve the required average daylight factors (ADF's) and will have a view of sky.

ROOM TYPE	LUX LEVEL
Entrance Lobby	150
Kitchen	500
Living Space	200
Bathroom	200
Bedrooms	150

Table 5.0 – CIBSE Internal Lighting Guide - recommended lighting levels

Materials

Building and construction activities worldwide consume 3 billion tons of raw materials each year, which account for approximately 50% of total global consumption. Using green/sustainable building materials and products promotes conservation of dwindling non-renewable resources. In addition, integrating sustainable building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these source materials.

The aim for the proposed development will be for its overall environmental impact to be minimised through the specification of sustainable materials and components.

Materials with low overall environmental impact will be selected for the key building elements in the proposed scheme, targeting A/A+ ratings where possible, from the BRE 'Green Guide to Specification'. The Green Guide rates the environmental impact of different materials and components over their lifecycle, taking into account factors like toxicity, ozone depletion, extraction, ease of recycling, waste disposal etc.
Materials will be selected where possible from responsible suppliers, who can provide environmental certificates for the manufacturing processes of their products (including the supply chain processes), i.e. ISO14001, BES6001 or equivalent certificates.

Recycled materials will be specified where possible and it will be ensured that for all new raw materials being used, as much as much as possible can be recycled at the end of the buildings' life.

Specifying materials with a high-recycled content is a method of saving processing or manufacturing energy. The recycled content of a material can be described as either post-consumer or post-industrial to indicate at what point in the life cycle a material is reclaimed.
Some typical building materials that can contain a high percentage of recycled material include reinforcing and framing steel, concrete masonry units, gypsum wallboard, acoustic ceiling panels and their suspension system.

Opportunities for reusing materials that may be available from the demolition of existing buildings on the site will be identified.