Energy Strategy Statement

Kings Mews
James Taylor Construction

Camden Council

October 2018

Version 1

BriaryEnergy

Executive Summary

James Taylor Construction has instructed Briary Energy to create 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 following statement seeks to demonstrate the potential options available at the proposed development of Kings Mews. This application, in being submitted after October 2016, seeks by its design to surpass the CO² emission target of approved document part L1A 2013 by 35% of the regulated energy consumption. The GLA London Plan 5.2B sets 'zero carbon' traget for residential developments. However this is only for major developments (10+ dwellings) and therefore no Carbon off-set levy is applicable.

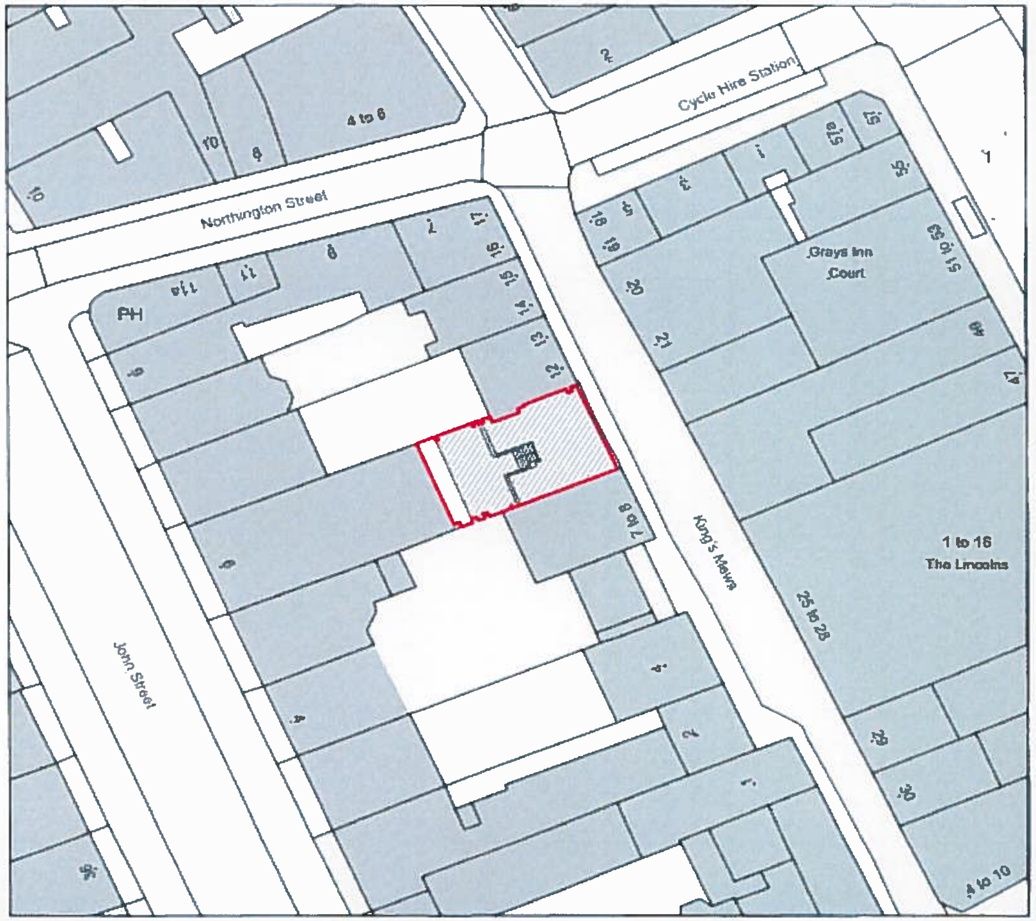
It also looks at energy efficiency measures that will be implemented at the development to make energy and CO_2 savings beyond current building regulations.

The energy consumption figures for the development are based on benchmark figures for each building type from CIBSE for non-domestic buildings or based on SAP 2012 for domestic buildings, and include regulated and non-regulated emissions.

The proposed Kings Mews development will comprise of 5 dwellings. The developer will meet the Building Regulations reduction in emissions across all dwellings relative to a 2013 Part L1A Building Regulations baseline, and will be achieved solely through the use of improved energy efficiency measures such as improved thermal fabric efficiency, air tightness and effective heating controls.

By taking a fabric first approach, this development seeks to take advantage of Mechanically Ventillated Heat Recovery and an improved air permeability rate of 2.5m³/hm²(@50Pa), along with a total of 9.24kWp Solar PV (southern plane orientation), this site exceeds the 35% improvement over approved document part L1A 2013.

Glazing to over 30% of the façade area will have a U-Value of 1.4 W/m²k with a solar transmittance factor 0.5 to provide day lighting and prevent overheating. Fully openable windows on the groundfloor are required with window bars or other security features.



Camden Local Plan

Policy CC1 Climate change mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d. support and encourage sensitive energy efficiency improvements to existing buildings;

e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes;

i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:

a. the protection of existing green spaces and promoting new appropriate green infrastructure;

b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

<u>Sustainable design and construction measures</u>

The Council will promote and measure sustainable design and construction by:

e. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;

f. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;

g. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment;

h. expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.

National Planning Policy Framework (NPPF) - 2018

On 1st July 2018 the Government published the National Planning Policy Framework (NPPF), which 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:

<u>Achieving a sustainable development</u>
7. The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the object sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generat meet their own needs.

<u>Planning for climate change</u>
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 colocating 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.

Energy hierarchy through design

The Kings Mews development will be developed with the aim to reduce annual energy consumption, whilst providing energy in the most environmentally friendly way to reduce the annual CO_2 footprints.

This outline strategy has been developed using established methodology (as recommended by Cibse and the London Plan). It has three priorities, seeking to reduce energy use through the cleanest possible solutions. Reducing the demand for energy in the first place, means our priority is always to use a fabric first approach: -

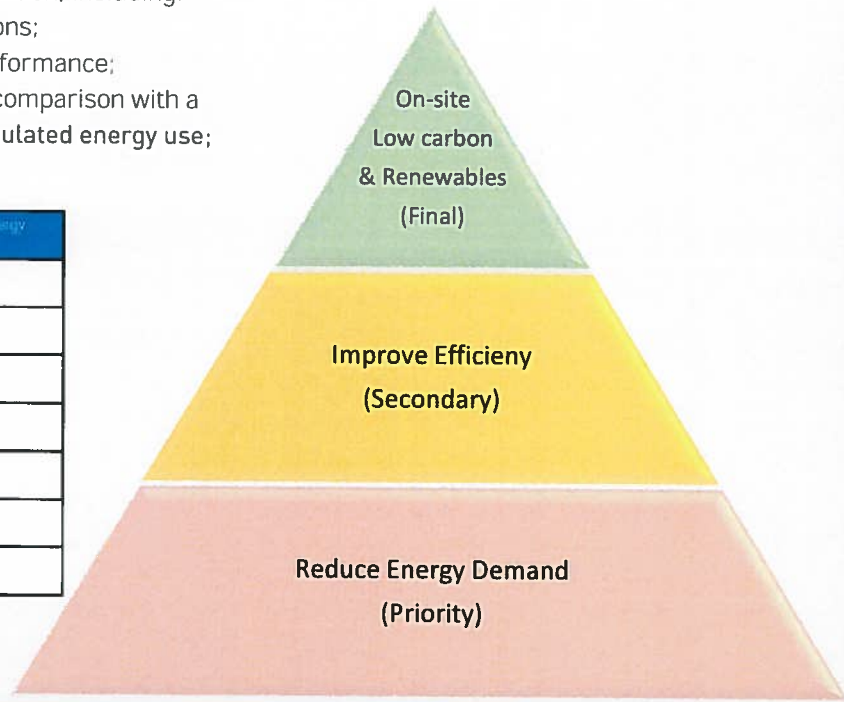
Be Lean - Reducing energy needs through improved design and construction.
Be Clean - Supply energy efficiently through the use of decentralised energy where feasible.
Be Green - Further reduce CO_2 emissions through the use of on-site renewable sources, where practical.

As this hierarchy demonstrates, designing out energy use is weighted more highly 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, 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	✓	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

Be Lean - Energy efficient design measures

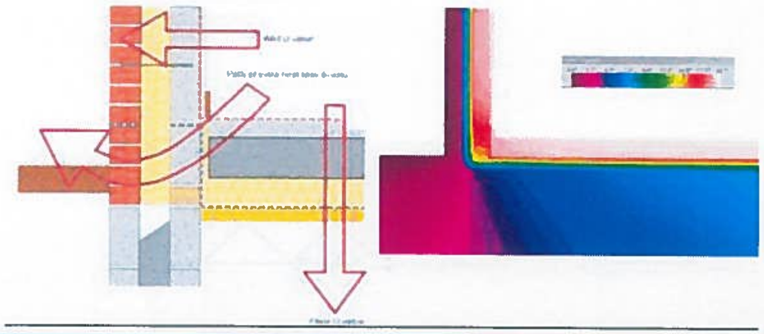
Enhancing the thermal performance of the building is usually cheaper than providing renewable energy, with more reliable CO_2 savings for the long-term lifecycle of the building. Without the cost of replacing mechanical or electrical components on a continual basis. Adding renewable technology will then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

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

Element	Building Regulations	Proposed
Basement Floor	0.25 W/m²k	0.13 W/m²k
Ground and Exposed Floor	0.30 W/m²k	0.14 W/m²k
Brick Wall	0.30 W/m²k	0.16 W/m²k
Flat Roof	0.20 W/m²k	0.16 W/m²k
Windows	2.00 W/m²k	1.40 W/m²k
Doors	2.00 W/m²k	1.09 W/m²k
Air Perm	10.00 m³/hm²(@50Pa	2.50 m³/hm²(@50Pa
Thermal Bridges	0.15 ≤ Y	Calculated Constructive Details

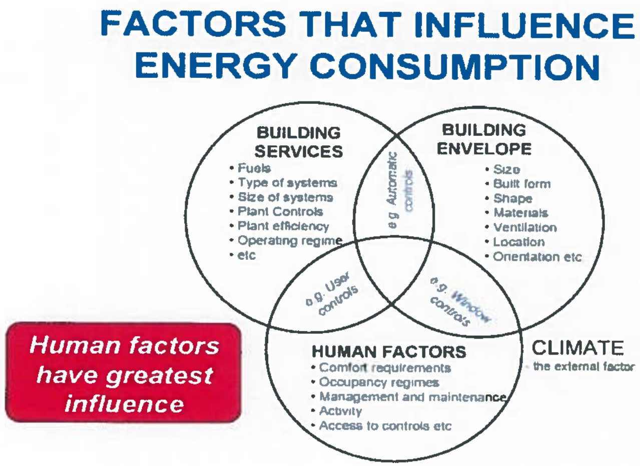
Improving the thermal bridge constructive details can have a great impact on the heat loss of the development, in some cases using enhanced details can make as much as a 27% improvement on fabric alone.

Wall - floor junction



Additional improvements to thermal performance can be achieved by ensuring good practice airtightness targets are achieved. Simple measures like sealing around services (eg 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.

Be Clean - Energy efficient mechanical & electrical systems



Having reduced energy demand through the fabric first approach, we seek to demonstrate how energy systems have been selected in accordance with the order of preference in Policy 5.6B (London Plan 2016): -

Policy 5.6 Decentralised energy in development proposals

a) Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate a so examine opportunities to extend the system beyond the site boundary to adjacent sites.

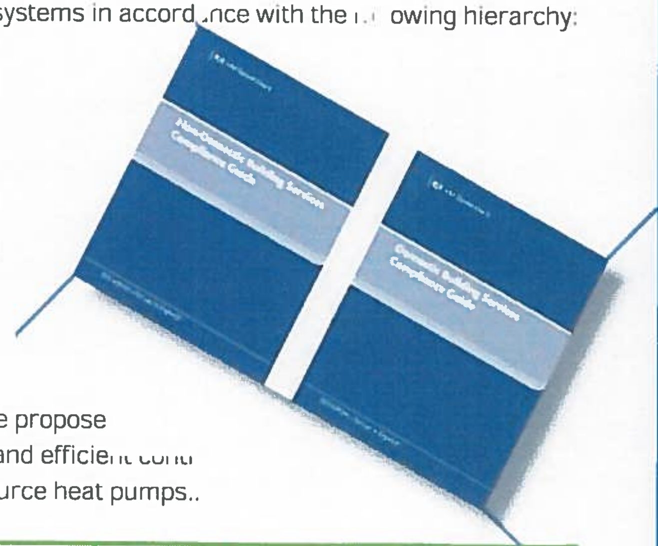
b) Major deve opment proposa s shou d se ect energy systems in accord nce with the owing hierarchy:

Connection to existing heating or cooling networks;

Site wide CHP network;

Communal heating and cooling;

c) Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.



On page 7 of this statement we identify the feasibility of selecting a heat network. The following energy efficient systems are propose this covers the clean mechanical and electrical systems. HVAC (heating, ventiallation, air conditioning), hot water, lighting and efficie
Some renewable factors may be considered and included at this stage, i.e: heat recovery, air source heat pumps, ground source heat pumps..

Element	Compliance	Proposed
Low energy lighting (efficacy ≥ 45lm/W)	75%	100%
Mattira Electric Boiler	N/A	100%
Shower Save (WWHRS)	N/A	N/A
50L cylinder	1.03 kWh/day	0.93kWh/day
Heating controls	Programmer, TRV's & room stats	Time & Temp Zone controls
Advanced controls	N/A	Weather/load compensator
Domus AQH240-S MVHR	1.5 l/W/s (SFP)	0.69 l/W/s (SFP)

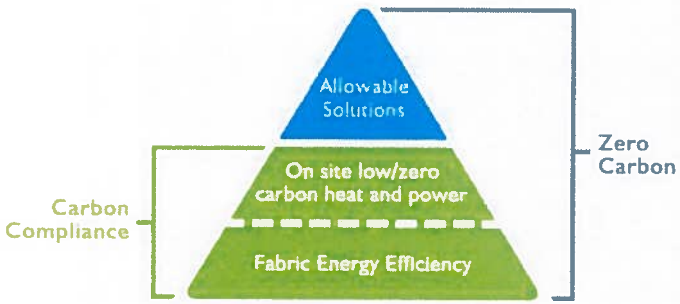
Be Green - Decentralised and Low to Zero Carbon sources

Feasibilty is based on location, cost, payback for both initial payment and ongoing maintanance and suitability. The following pages, show each Low to Zero Carbon energy solution that has been considered. Further feasibilty 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: -

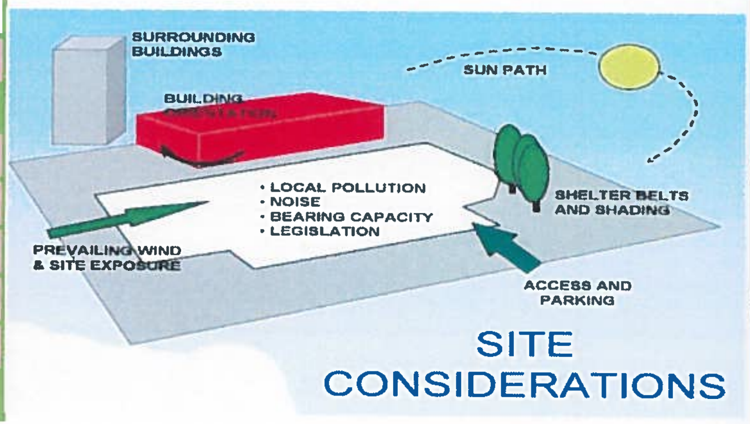
Zero carbon technologies
- Solar Hot Water;
- Solar Photovoltaic;
- Perovskite Photovoltaic;
- Wind Turbines; and
- Small Scale Hydro Power.

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).

In order to satisfy the local planning requirements, a more detailed assessment of each of the following solutions will be explored later on in this statement. Each energy efficiency measure has been looked at more fully, to give a greater understanding of which solutions could be implemented at the development to make energy and CO_2 savings beyond current building regulations.



Proposed technologies	
Solar hot water	No
Solar Photovoltaic	Yes
Wind Turbines	No
ASHP	No
GSHP	No
Flue Gas Heat Recovery	No
Waste Water Heat Recovery	No
Fabric Approach	Yes



District Heating

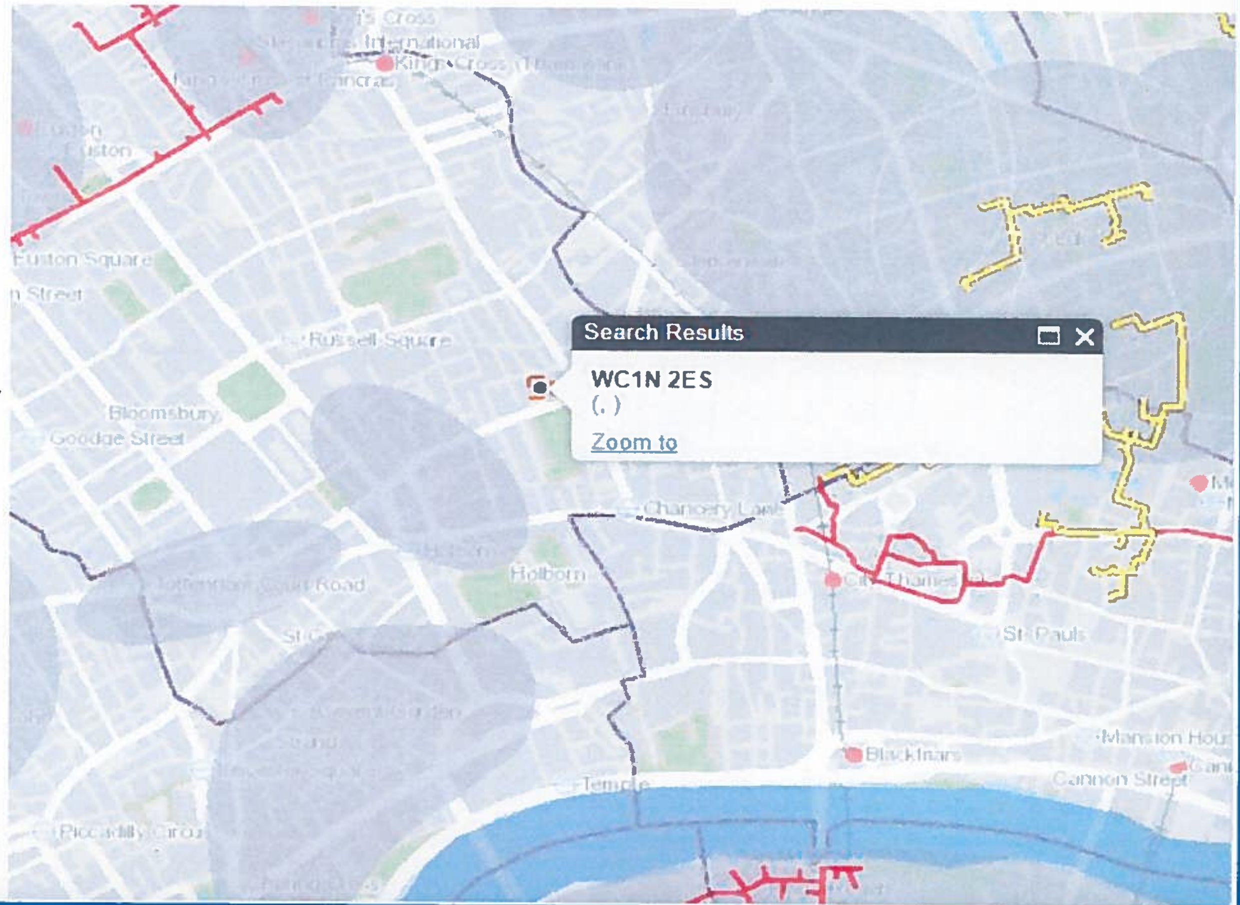
As part of planning, any major development proposals should select energy systems in accordance with the following hierarchy: -

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

The heat map shows that there are no district heating (DH) networks nearby. The heat map also shows if there are any future and potential DH networks planned nearby. Approximately 1.5km away there is a potential DH network (higlighted by the red line). The yellow lines show existing heat networks, these are also too far away.

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

- 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.
- this development is not a major development and therefore will not require a heat network feasibilty study.



Low to Zero Cabon 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 Kings Mews development.

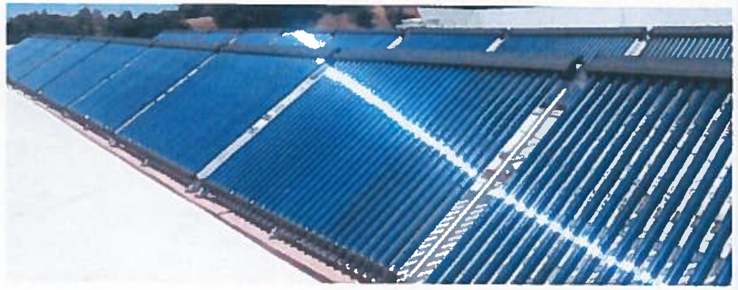
	Number of Dwellings Applied to	Energy Saved %	Carbon Saved %	Capita Cost per m^2	Cost Per kg/CO_2 saved over 15 years	Cost per Kw Saved over a 15 year period	Proposed?
Solar hot water	2	1.4%	0.9%	£30.12	£0.23	£0.03	No
Solar Photovoltaic	5	20.6%	36.6%	£20.48	£0.06	£0.03	Yes
Wind Turbines	2	12.2%	22.2%	£43.38	£13.84	£4.59	No
ASHP	1	4.4%	2.6%	£54.22	£0.78	£0.33	No
GSHP	1	4.9%	2.9%	£54.22	£0.87	£0.37	No
Flue Gas Heat Recovery	5	11.6%	0.0%	£3.61	£3.10	£4.44	No
Waste Water Heat Recovery	5	10.7%	6.5%	£5.42	£1.24	£2.06	No
Fabric Approach	5	0.2%	0.2%	N/A	£0.00	£0.00	Yes

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

Proposed for this development?
No

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.
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.

Kings Mews Solar Thermal Calculation	
Number of plots with panels	2
Size of Panel	4.5 m²
Number of Panels per plot	1
Total m^2	9 m²
Average kWh/m^2	294
Energy produced by panels	2642
Energy% Saved From Panels	1.4%
CO_2% Saved From Panels	0.9%

Not Proposed for this development because...

Solar Thermal panels on this development will only produce a saving of 0.9% carbon emissions and a 1.4% energy demand reduction, which is not the most efficient technology available for this development: -
*Solar Thermal relies on energy from the sun. During winter peaks and during the night time, this technology can be carbon intensive;
*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, optimizing of controls and more.
*This is not suitable for poorly orientated dwellings.

Photovoltaic Collectors (PV)

Proposed for this development?
Yes

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 generally 6-8m² for M6n crystalline or 102 for polycrystalline modules of PV will produce 1Kw peak of electricity.

In order to meet energy demand improvements using Solar Photovoltaics, this site would require 9.24kWp to be shared amongst 5 dwellings. Carbon emissions could be reduced by 36.6% compared with Part L 2013 Target Emission Rate, and energy demand reduced by a further 20.6%.

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.

Proposed for this development?
Yes

Photovoltaic Collectors (PV) Calculations

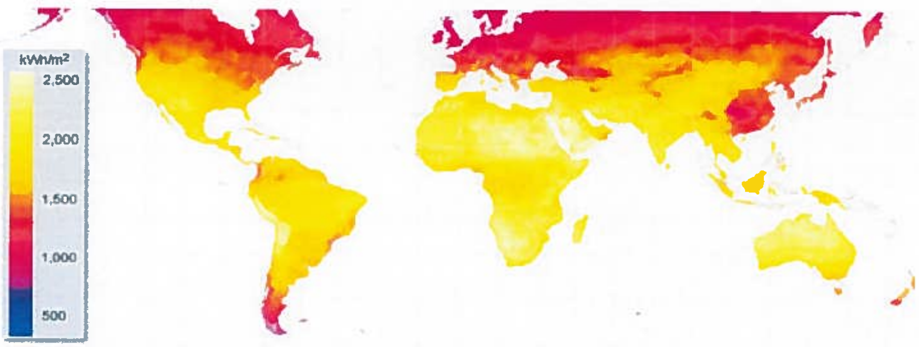
In calculating the feasibilty of Solar PV, we will use a global formula E = A x r x H x PR to calulcate the energy generated by the proposed PV to be placed on the development.

Losses details (depend of 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%

	Total site kWp	PR = Perf Ratio	H = Annual irradiation	r=panel yield(%)	A=Panel Area(m²)	E=Energy (kWh)
South	0.00	0.89	1054	20%	0	0.00
SE/SW	9.24	0.89	997	20%	46.2	8,198.93
East/West	0.00	0.89	854	20%	0	0.00
NE/NW	0.00	0.89	686	20%	0	0.00
North	0.00	0.89	640	20%	0	0.00
Total PV	9.24				Total Energy kWh	8,198.93

Yearly sum of global irradiance



Amount of PV Panels to meet 9.24kWp Requirement

250W Panels
37 Panels Required

310W Panels
30 Panels Required

360W Panels
26 Panels Required

Proposed for this development because...

In order to achieve a 35% carbon emissions improvement (over part L 2013), 9.24kWp of Solar PV is the preferred choice, after energy reduction and efficiency measures have been incorporated. Solar PV is the most viable option because -

*Clean green energy - during electricity generation with PV panels there are no harmful greenhouse gas emissions;
*PV panels have no mechanically moving parts, with good quality panels lasting up to 25 years and some inverters lasting as long as 10 years;
*There are direct cost savings to the dwelling occupier, less electricity to buy and often a FIT to be reclaimed.

Proposed for this development?
No

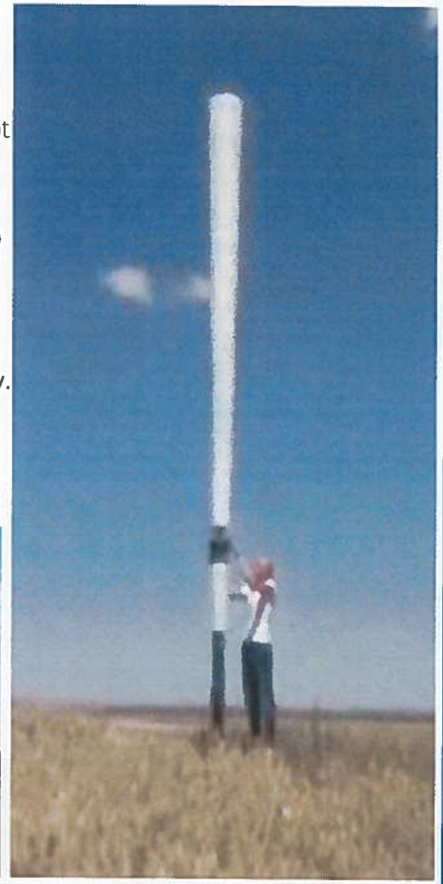
Wind turbines

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's 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.**
- **Vortex bladeless turbines, can be seen at road side and agricultural areas.**



Not Proposed for this development because...

The Government wind speed database predicts local wind speeds at Kings Mews to be 4.8 m/s at 10m above ground level, 5.6 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 and in addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

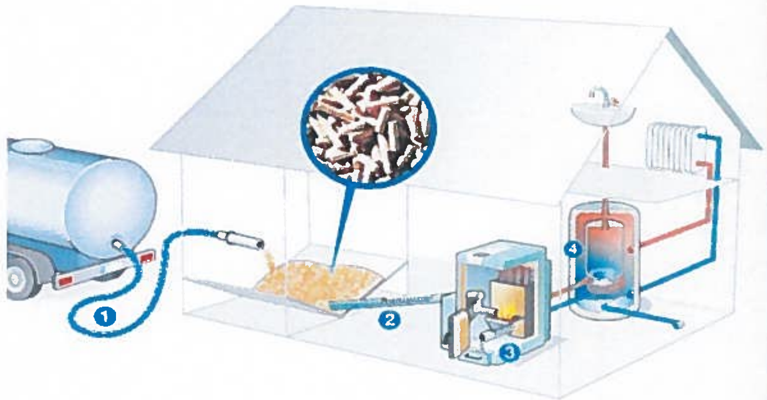
*Horizontal axis micro-wind turbines only reduce carbon emissions by a small amount. In high winds they need to be static due to fundamental design issues.

*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.

Proposed for this development?
No

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 doesn't include fossil fuels, which have taken millions of years to be created.
Biomass fall 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 you 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...

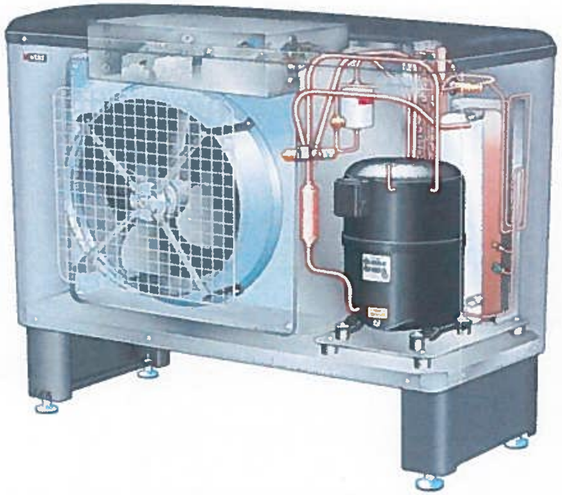
Biomass boilers, wood burning stoves and CHP engines all create a large amount of pollution and carbon emissions. Although it is considered that Biomass is a carbon neautral technology, thanks to the CO_2 being absorbed by growing new trees. It is not viable at Kings Mews development.
*With pollution levels in London 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 more pollution and more 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?
No

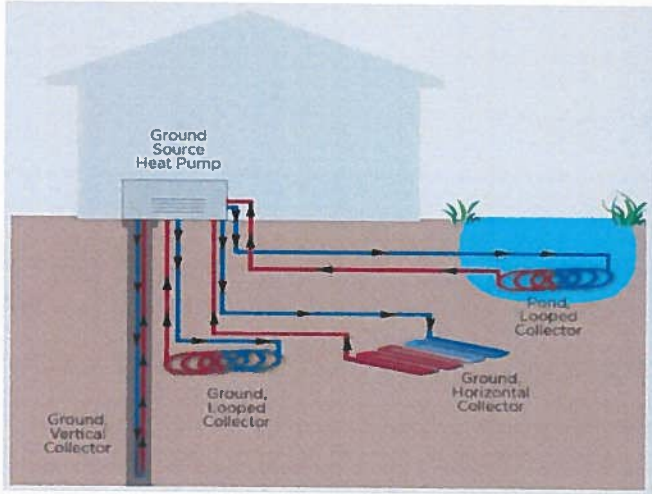
There are two types of heat pumps, ground source and air source. Heat pumps work in a very similar way to fridges and air conditioners and absorb heat from the ground or from the air. Ground or air source heat pumps are mainly designed to work with under floor heating systems because of the lower design temperatures of under floor systems. Efficiencies of ground source heat pumps are between 350%-600% 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. This is because 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 it is prevented from freezing by the natural warmth that surrounds it.This also means 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 simlar 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.



Not Proposed for this development because...

GSHP - the area of land required for individual systems means GSHP systems are not viable on this development and bore holes would need extensive survey work in relation to the seweres and Undergorund netwroks.

ASHP -while they are viable, there is a reduction on CO_2 but an increase in energy demand as they are powered by electricity. There is a question of 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. Meeting hot water demand solely from ASHP is an issue as they are a low temperature system, topping the heat up using the immersion element can create a high energy demand.

*Lower heat supply compared to oil and gas boilers, so larger radiators would be needed but they perform better with underfloor heating or warm air heating and work more efficiently when coupled with larger radiators

*A highly insulated development is required to take advantage of maximum energy demand reductions;

*Heat pumps need to run constantly during the winter, with similar noise to an air conditioning unit and a constant energy demand;

*The cost of installing an air source heat pump is usually between £3,000-£11,000.

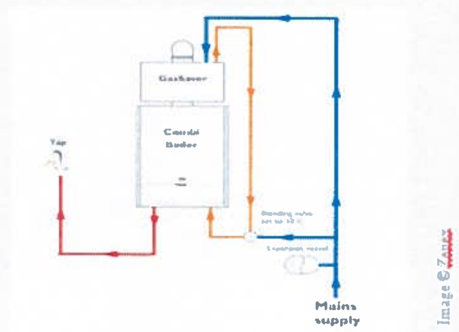
Flue Gas Heat Recovery Systems (FGHRS)

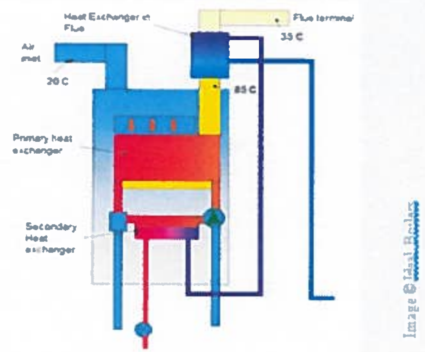
Proposed for this development?
No

In reality the 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

Systems can be either a "wet" or "dry" version





<u>Land use</u>
FGHRS requires no specific land use requirements.
<u>Planning</u>
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 Kings Mews 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. By including FGHRS at Kings Mews development, there would only be a 4% carbon emissions improvement with a small 6.5% energy demand reduction.

Proposed for this development?
No

Waste Water Heat Recovery Systems(WWHRS)

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 Recoh-vert (Figure 1), is applicable to upstairs showers, whilst the Recoh-tray (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.

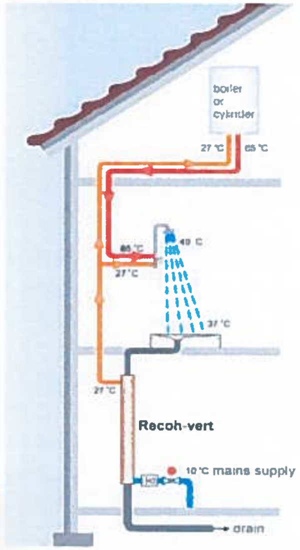


Figure 1

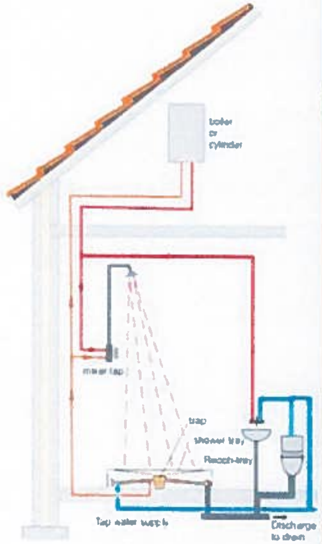
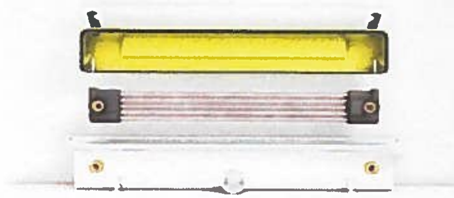


Figure 2

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, fo the foloowing reasons: -
*there would only be a carbon emissions reduction of 6.5% and an energy demand reduction of 10.7%.
*Although WWHR can be installed on ground floor-single floor dwellings, the devices are less efficient;
*multiple shower locations may require multiple WWHRS devices;

Regulated vs Unregulated Energy

Sometimes, an Energy Statement is required to show 'unregulated' energy savings, as well as 'regulated'. The only other instance where an 'unregulated' calculation is completed is for assessing whether a particular dwelling is truly 'Zero Carbon' by current definitions.

What Is Regulated Energy?

This is exactly what it sounds like: it is the energy used by systems governed by Building Regulations. These include space heating, water heating, ventilation and lighting – the basics of a modern house. All SAP and SBEM assessments, as well as EPC certificates, are calculated using regulated energy use only.

What Is Unregulated Energy?

This is everything that falls outside of Building Regulations. Televisions, kettles, hairdryers, ovens– all the appliances and devices the occupier adds themselves. In the interest of practicality, these appliances don't fall under Building Regulations.

Is there a future for Unregulated Calculations?

In the current definition of Zero Carbon homes, both types of energy consumption need to be offset by renewable sources; while in the Zero Carbon Hub's proposals, unregulated energy is being taken out of the requirements.
There are two main reasons for this: -

•Firstly, the unregulated energy calculation can only provide a ballpark figure based on the average household. There is no simple way of taking into account the human aspect of living in a house, and knowing how efficiently the occupants behave. Because of this, there have always been doubts around the accuracy of the unregulated calculation.

•Also, as the unregulated assessment can typically increase expected energy use of a dwelling by 40%, developers are required to significantly alter their specifications, which in the majority of cases leads to concerns over economical feasibilities of new dwellings.

Unregulated Energy from appliances for Kings Mews		
Dwellings	Energy	Carbon
5	6775 kWh/a	2382 kg/a

Baseline Energy Calculations

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

Floor plans for the Kings Mews development have been used in conjunction with an outline accommodation schedule and building specifications to prepare initial 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 which renewable energy technology makes to total energy requirements for the development once energy conservation measures have been considered.

Energy savings are measured in terms AC757of 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 $kgCO_2e$
Gaseous Fuels	Natural Gas	kWh	0.18416 $kgCO_2e$
Biomass	Wood Pellets	kWh	0.01270 $kgCO_2e$

Baseline Energy Calculations Domestic

	Carbon dioxide emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.3	2.4
After energy demand reduction	11.3	2.4
After heat network / CHP	11.3	2.4
After renewable energy	7.2	2.4

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0.0	0.2
Savings from heat network / CHP	0.0	0.0
Savings from renewable energy	4.1	36.6
Cumulative on site savings	4.2	36.8

When compared against Part L1A 2013 Building Regulations: -

The total CO_2 demand for the residential units at the Kings Mews has been calculated to be 7.2kg per annum. This represents a saving of 36.8% over the Part L1A 2013 compliant figure of 11.3 kg per annum

Carbon Reduction Summary

<u>Proposed Technologies</u>

A fabric first approach has been adotped at the Kings Mews site. By constructing to the specifications as detailed on Page 5, carbon emissions are reduced by 0.2% compared with Part L 2013 Target Emission Rate.

With 9.24kWp of Solar Photovoltaics installed across suitably positioned roof space on the development, carbon emissions could be reduced by 36.6% compared with Part L 2013 Target Emission Rate.

By taking a fabric first approach, this development seeks to take advantage of Mechanically Ventillated Heat Recovery and an improved air permeability rate of 2.5m^3/hm^2(@50Pa), along with a total of 9.24kWp Solar PV (southern plane orientation), this site exceeds the 35% improvement over approved document part L1A 2013.

As this site is for less than 10 dwellings, it is not classified as a major development and therefore there are no requirements to meet 'zero carbon' nor to pay a carbon off-set payment.