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ENERGY STRATEGY AND SUSTAINABILITY REPORT FOR PROPOSED REDEVELOPMENT OF 112 – 124 CAMDEN HIGH STREET, LONDON NW1 0RR

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P3	PE	22/02/19	RG

TABLE OF CONTENTS

1. SUMMARY & CONCLUSIONS

This report has been produced to accompany the planning application for the redevelopment proposals of 112 – 124 Camden High Street.

The energy and sustainability strategy for the redevelopment follows the three-staged priority approach by first considering measures to reduce demand (“Lean”), then selecting efficient systems to meet the remaining demand (“Clean”) and then looking at potential for low- and zero-carbon options (“Green”).

The report summarises design options for improving environmental sustainability of the redevelopment and an initial assessments of their potential applications has been carried out.

In summary:-

- Existing roofs and windows will be thermally upgraded to reduce specific energy requirements
- Services to existing areas will be renewed to current standards to improve internal conditions and to reduce specific energy requirements
- Reversible air source heat pumps will be used to provide simultaneous heating and cooling with heat recovery.
- Photovoltaic cells have been outlined as an on-site renewable energy source with the most potential to meet the Planning Policy’s expectation of a 20% reduction in the building’s carbon dioxide emissions from on-site renewables. However PVs have not been found to be an economically feasible approach for this project and would not be in line with the established character of the Conservation Area.
- These passive design and system’s efficiency upgrade proposals for the redevelopment will constitute to a reduction of approximately 16.9% in the building’s fuel (including electricity) emissions CO_2e per m2 (excluding cooling).

2. OVERVIEW OF REDVELOPMENT AND DESIGN PRINCIPLES

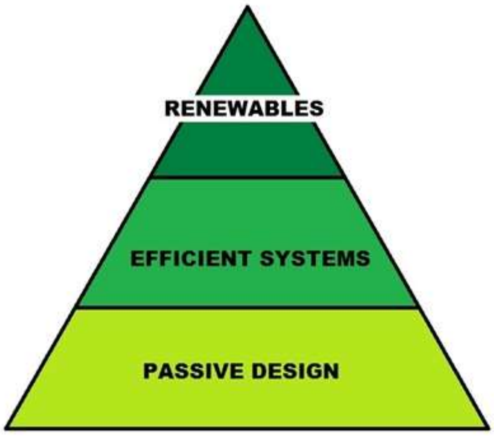
The mixture of uses for the proposed redevelopment will be similar to the existing development. There will be two retail units on the ground floor, the upper floors will be comprised of offices. An extension on the second floor will be provide an additional 199m2 of new office. .

The offices will have the main mechanical ventilation, heating and cooling and electrical plant and infrastructure provided for the tenants. Final M & E distribution (e.g. indoor fan coil units, small power within the floor, kitchenette, sanitary facilities etc) will be provided or extended by the tenants from designated locations. The new development will include two showers, primarily to cater for office occupants who cycle to work, however in general hot water will not be a large portion of the development’s energy use. Comfort cooling will be provided to the offices. Mechanical ventilation with heat recovery will be provided to all office areas as noise and some pollution through openable windows, from Camden High Street, is not desirable.

Spatial provision and key infrastructure (e.g. louvres and main ducts) for mechanical ventilation with heat recovery will be provided for the ground floor retail units as part of this contract. Retail units will be self-contained with provision for incoming services and space for dedicated reversible heating and cooling air source heat pumps. The tenants of the retail units will be able to utilise these provisions if they wish. No main plant for retail units (e.g. air handling units, air source heat pumps, branch controllers etc.) will be provided as part of this contract, this is expected to be undertaken by the tenants as part of their full fit out.

The strategy for providing energy at the site has taken into account a number of unique factors namely the restrictions on space available for plant, the construction of existing areas, intended uses of the building’s spaces and the site location within a Conservation Area. Taking these factors into account the design has sought to offer a solution which meets the redevelopments requirements in a cost-effective fashion both in terms of construction and running costs.

In the design of this building we have adopted the three tier approach. Initially ensuring that the fabric of the building is improved where practical (*being lean)*. This reduces the energy consumption and is a much more efficient approach than simply applying renewable energy generation to a basically inefficient building.



Once the basic fabric of the building minimises the energy requirements, we have then incorporated energy efficient systems to provide heat and light within the building (*being clean)*.

Finally, low carbon or renewable energy systems have been considered (*being green)*. Renewables and sustainable options have been appraised on their ability to reduce CO2 and running costs, ease and safety of maintenance and their visual impact on the local area.

3. PASSIVE DESIGN (BE LEAN)

SECOND FLOOR EXTENSION

The second floor extension will meet the U-values prescribed by Building Regulation Part L2B, as it is greater than 100m2 the Part L2A standards will be applied to the extension construction itself. As the existing building has a *total useful floor area** greater than 1000m2 the Part L2B *Consequential Improvements*** requirements will be adhered to.

**Total Useful Floor Area*: A measure of internal floor as described in Approved Document Part L2B, used to confirm whether *Consequential Improvements* should be applied.

** *Consequential Improvements*: Actions to improve energy efficiency, which should be made according to Approved Document Part L2B, dependent upon Part L2B criteria for economic feasibility.

EXISTING ARAES OF THE BUILDING

With the exception of the second floor windows on the front façade, the existing windows will be replaced with low U-value fittings designed to reduce solar gains, reducing the cooling load and heat losses. Increased glazing area will increase natural daylighting.

As Part L2B *Consequential Improvements* apply to this redevelopment project, the existing second floor roof will have further insulation installed to reduce its U-value to below the acceptable level.

4. EFFICIENT SYSTEMS (BE CLEAN)

As the existing building has a *total useful floor area* greater than 1000m2 the Part L2B *Consequential Improvements* requirements will be adhered to.

WATER CONSUMPTION

All sanitary fittings will be replaced as part of this redevelopment. All WCs will be low water volume cisterns and be dual flush to reduce the amount of water consumption, showers will be low water use also. This will reduce the HW load and also reduce energy use involved in the creation and delivery of potable water, as well as the treatment of waste water.

The incorporation of rainwater harvesting is not seen as having a reasonable cost-benefit balance due to the space required, and limited potential use of rain water rainwater below a possible rainwater storage vessel.

Heating and Hot Water

The existing building has a considerable amount of electric radiator heating. A new high efficiency condensing gas boiler will be installed to provide all heating and some hot water to the Landlord's and office areas. This will be sized to replace all electric heating which is currently serving some of the areas which will become the Landlord's or office areas. Heating will distributed using radiators as the lag time of underfloor heating and the desire for a suspended floor (to facilitate changing office layouts) will make underfloor heating unsuitable for this building and its users.

The new condensing gas boiler will provide hot water for the showers. As is currently the case in the existing building, local electric water heaters will serve the hot water loads of basin taps and potential kitchenettes, which are located at distance from the new boiler. This is because the waiting time for hot water will be unacceptable without installing a secondary return hot water system which will waste heat and won't be cost-effective for the redevelopment.

Lighting

All new lighting will be high efficacy LED fittings. These will give sufficient lighting for the tasks being conducted and the aesthetic desires for the building interiors. New roof lights in the existing second floor, large windows in the new extension area and an increase of vertical glazing in other building areas will increase natural daylighting and reduce dependency on artificial lighting.

5. PASSIVE DESIGN & SYSTEMS DESIGN PROPOSAL SUMMARY

The table below gives an initial assessment of the expected annual fuel CO2e savings from the above, fabric and systems improvements as part of the proposed development. Figures have been displayed per metre sq of floor area to take into account the proposed increase in floor area. As the existing offices do not have cooling we have excluded cooling from the table below in order to compare like with like.

We expect the building's annual fuel CO2e footprint per metre square to reduce significantly. This reduction is due to a combination of the above fabric and systems improvements, and in particular the removal of almost all electric radiator heating and replacement with ASHPs. These figures exclude the installation of any potential on site renewable energy generation.

BUILDING TOTAL FUEL CO2e EMISSIONS PER YEAR PER METRE SQ (EXCLUDING COOLING)				
EMISSIONS			CHANGE IN EMISSIONS (EXISITNG TO PROPOSED)	
EXISTING	PROPOSED			
(kG CO2e/yr/m2)	(kG CO2e/yr/m2)		(kG CO2e/yr/m2)	%
74.9	**62.2**		**-12.7**	**-16.9%**

Note: These figures regard electricity as a fuel. Figures are an initial assessment and exclude fuel for cooling.

6. POTENTIAL RENEWABLE AND LOW CARBON ENERGY GENERATION (BE GREEN)

The various LZC technologies were reviewed to identify those most likely to be suitable for application in the redevelopment. From this initial review the following were identified as possible and are discussed in further detail below:-

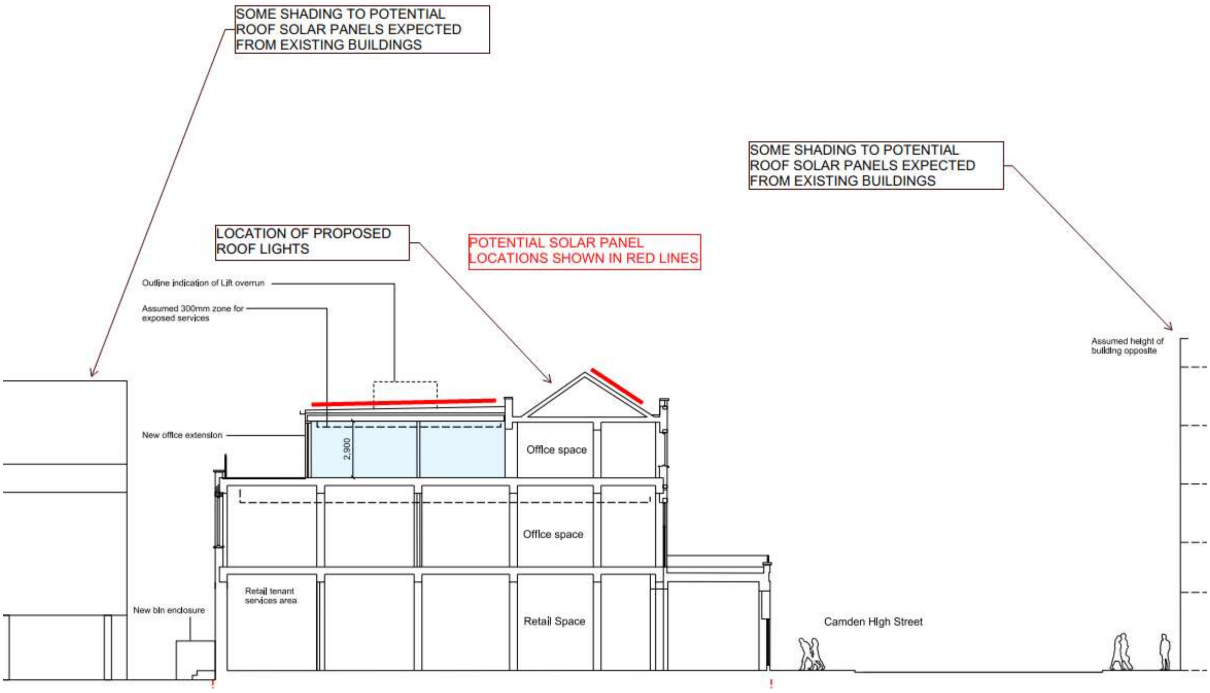
- Photovoltaic solar collectors (PVs)
- Solar thermal solar collectors
- Air source heat pumps

The following were identified as not applicable and are discussed only briefly:-

- Wind turbines
- Ground source heat pump (GSHP)
- Biomass
- Combined heat and power (CHP)
- District heating (DH)

6.1 SOLAR – PHOTOVOLTAIC (PV) AND THERMAL

Two types of solar energy uses are covered in this report, photovoltaic and thermal. A lot of factors for assessment apply equally to both, where so, these are assessed here under this heading. Factors which apply specifically to either photovoltaic or thermal are assessed in their subsequent sub-headings.



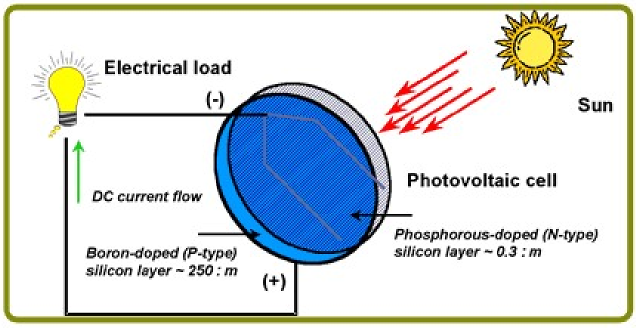
Prospective areas for solar panel location and surrounding factors for consideration.

The site has an existing pitched roof facing approximately south west and a proposed second floor flat roof. The existing south west facing pitched roof offers the best location for both PVs and thermal panels. Structurally speaking both these areas should be suitable. These areas are unoccupied and could potentially accommodate PVs or solar thermal collectors. Although external aesthetic implications of installing PVs or solar collectors are not expected to be in keeping with the established character of the site's Conservation Area.

The buildings on the opposite side of Camden High Street, to the south and south west of the site, would impose some shading on the roof area towards sun down. The existing pitched roof, its parapet and the lift overrun will also cast some shading over proposed solar panel areas.

Maintenance and cleaning of potential solar panels on the existing south west facing apex roof would be impeded by the roof's distance from which a telescopic cleaning system or cherry picker could be positioned. Access from the other side of the existing apex roof would be complicated by the proposed roof lights on the opposite side of that pitched of roof. In terms of practicality, the optimal location for solar panels would be on the proposed flat roof construction, although there would be some shading from the lift overrun.

6.1.1 SOLAR PHOTOVOLTAICS (PV CELLS)



Solar photovoltaic schematic

DESCRIPTION

Solar photovoltaic cells are made up of a special silicone material that directly converts the energy found within sunlight into electricity. Photons found in sunlight that have enough energy will hit free electrons on the semiconductor material of the cell. This sets the electrons in motion and electricity begins to flow.

A typical cell will be approx. 100cm2. A module typically contains 28 to 36 cells. Modules connected in parallel or series make up an array.

The electricity generated can be used to power everything from household appliances, lights to commercial buildings and power plants. Solar photovoltaics can be used to benefit from the FIT scheme.

PRO'S

- Free and renewable source of electricity
- No moving parts and so very little maintenance
- Long life technology (over 20 years)
- Can be used in remote areas with no access to the electricity grid
- Noise and exhaust free
- Highly visible from outside the building
- Excess generation can be exported to the grid

CON'S

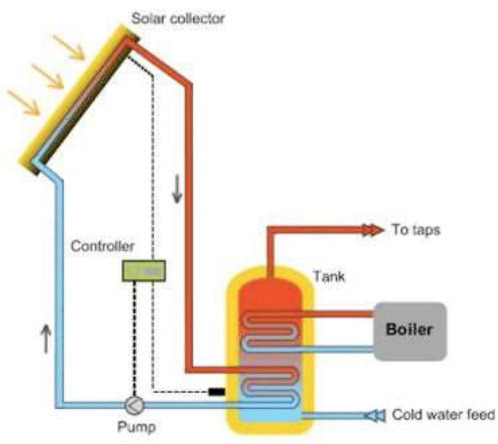
- Doesn't produce any power during the night or cloudy days
- Low efficiency. Large areas required to provide a worthwhile power output
- Very expensive form of renewable technology
- Some toxic material used in PV cell production process
- Energy output varies daily and seasonally
- Batteries (where they are integrated in to the system) are not particularly environmentally friendly

REDVELOPMENT ASSESSMENT

Photovoltaic cells could provide some of the building's energy use and when the electricity generated is not used on site (e.g. outside of office hours) the building could contribute to reducing carbon emissions by feeding PV electricity into the grid.
This has been explored further to investigate the feasibility of locating solar panels at 112 – 124 Camden High Street. The site is within a Conservation Area and PVs would interfere with the area's established character. Shading and maintenance access requirements would restrict a solar PV array to approximately 42m2, located on the new flat roof. This would reduce the building's CO2e footprint by approximately 4%. The estimated payback period is 11 years which is in excess of the 7 year threshold prescribed by Part L2B (Consequential Improvements) in regards to economic feasibility.

Due to the economic unfeasibility of a potential PV installation and the fact it would not be in line with the Conservation Area's established character, PVs have been discontinued for this redevelopment proposal.

6.1.2 SOLAR THERMAL COLLECTORS



Solar collector within hot water system

DESCRIPTION

Solar thermal collectors absorb radiated heat from the sun and transfer it to a fluid (usually water) passing through the collector. The water from the collector continues to a heat store (hot water tank) and is used to contribute to the building hot water demand. They can also be used to contribute to heating demand which can be done most efficiently with lower temperature heating systems such as underfloor heating.

The output of the collectors will vary with the seasons, with more output available during the summer. They are most effective when facing south at an angle of approx. 45° and free from shaded areas.

The main two types of solar collectors are flat plate and evacuated tube collectors.

PRO'S

- Renewable supply of heat energy
- Few moving parts so little maintenance issues
- High visibility, community to see the building is environmentally friendly
- Low maintenance requirement
- Long life technology (minimum 25 years)

CON'S

- Fairly high capital costs
- Additional back up heating system required.
- Output mainly in the summer months
- Storage tanks and collectors must be located close to one another
- Space required both on roof for the collectors and within the property for hot water storage
- Needs a non-shaded location

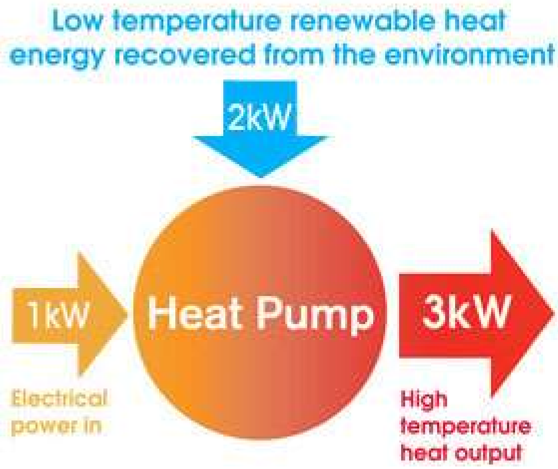
REDVELOPMENT ASSESSMENT

There will be 2 showers at the proposed site but hot water use will not be high. Heating will be with standard temperature radiators for the offices. The required heat up temperature of approx. 80 degC for the radiators will reduce the effectiveness of solar thermal collectors in reducing the building's energy demand. The expected times of office use will also mean that solar collectors would not contribute much to reduce building energy use over weekends.

6.2 AIR SOURCE HEAT PUMP - ASHP

DESCRIPTION

A Heat Pump is a device that extracts heat from a low temperature source and upgrades it to a higher temperature. The process of upgrading the low temperature to a high temperature requires an energy input into the heat pump.



The main feature of a heat pump is that is produces more usable energy than it consumes. This efficiency is measured by a Coefficient of Performance (COP). This is essentially its efficiency. A COP of 3 is equivalent to 300% efficiency.

The ASHP can operate with external air temperatures as low as -15°C. ASHP's are extremely efficient at optimum operating conditions, for every kW of electricity input into the system, up to 3 – 4 kW's of heat are produced. This means ASHP's are cheap to run and are relatively low on CO_2 emissions.

ASHP are at their most efficient when they only need to raise the temperature by about 40°C. At lower external conditions, or where high internal conditions are required the COP of the ASHP will drop off to as low as about 1.6.

These are a low energy system, not a completely renewable energy technology. ASHP's are powered by electricity which in today's grid electricity generation make-up has a worse environmental footprint than gas.

- Electricity 0.52 kg CO2/kWh
- Gas 0.2 kg CO2/kWh

These systems can be very effective when used on the right type of project.

PRO'S

- Extremely efficient at optimum external conditions (1 electricity unit input for every 3-4 units heat output)
- Units come in a range of outputs
- Can work very efficiently with underfloor heating. As underfloor heating operates at a fairly low temperature
- Inverter driven and so not constantly switching on and off.
- Unwanted heat or "coolth" in one area can be recycled in another area where desired.
- Can be powered by renewable electricity (either on site or a green energy tariff) to reduce their carbon footprint.

CON'S

- Not usually a zero carbon system as they require electricity to power them usually from the grid. Although grid electricity is becoming greener, and green electricity tariffs are available.
- Units need to be externally located, space needed external to the building
- Units are fairly noisy. Not a problem in a city, but can be a problem in a quiet rural environment
- Huge variations in COP throughout the year. At low temperatures the COP may be close to 1
- Can only provide temperature to a maximum of 50degC, meaning that radiators may need to be uprated
- Not a very visible system, if green credentials are to be demonstrated

REDVELOPMENT ASSESSMENT

Air source heat pumps will be installed for the offices of the redevelopment as this can offer the comfort cooling capacity planned for the office spaces. Spatial accommodation and key infrastructure will also be made for the ASHP to be installed ground floor retail units tenants, it is expected tenants would also use ASHPs for heating the retail units.

An acoustically louvered enclosure is planned for containing the outdoor ASHPs in a fashion which can reduce their negative impacts on noise and aesthetics.

7. OTHER LZC MEASURES IDENTIFIED AS NOT APPLICABLE

Other measures reviewed but not considered applicable in the redevelopment are discussed briefly below

7.1.1 WIND TURBINES

Standalone vertical axis wind turbine

DESCRIPTION

Wind turbines use the kinetic energy of natural wind currents to generate electricity. The power generated by a turbine is dependent on density of air, wind speed and the area covered by the rotating blades.

They can be used in rural or urban areas. Rural environments are preferred as the undisturbed higher velocity winds are key to increasing the output from the turbine.

Wind turbines can be standalone or building integrated, with either horizontal or vertical axis types available. Wind turbines can be used to benefit from the FIT scheme mentioned previously.

PRO'S

- Renewable source of electrical power
- Reliable and proven technology
- Minimal impacts on the environment
- Available in a wide range of sizes
- Very few maintenance issues, a check every few years may be required
- Electricity generation matches demand. Greater output during the evening and winter when demand for power is higher
- High visibility, community to see the building is environmentally friendly

CON'S

- Can be noisy
- Unsightly, depending on personal preference
- High capital costs
- Long lead time with large standalone turbines (not a problem with smaller building integrated turbines)
- Additional electrical supply required for back up
- Planning permission required
- Turbine and generator require regular maintenance

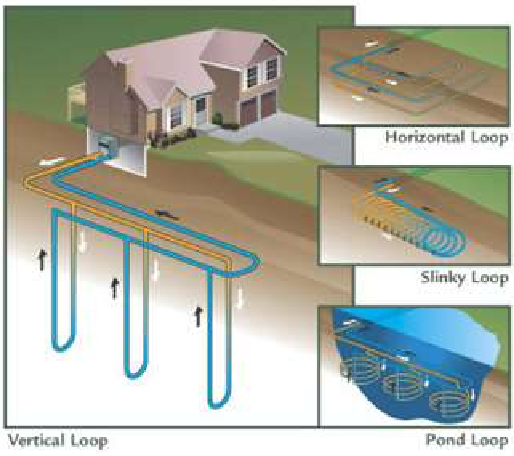
REDVELOPMENT ASSESSMENT

The location of site prevents wind turbines being installed on a large scale without an impact on the local area's aesthetic character, which makes up part of a conservation area.

The building foot print and structural make-up would limit the size and generation capacity of a wind turbine installation at the site. Without significant economies of scale to better spread capital costs and maintenance costs, a wind turbine installation at the site is unlikely to offer a cost–effective payback period for the Client.

7.1.2 GROUND SOURCE HEAT PUMP - GSHP

DESCRIPTION



Works in the same way as an ASHP, instead of extracting/dissipating energy from the air, it is taken from the ground. The benefit of this being that the ground does not vary in temperature very much through the year (10 – 15 degC) and the amount of heat energy output from the system will remain fairly constant.

The method of heat abstraction from the ground could be open loop or closed loop.

An open loop system would consist of a well abstracting water which would then be discharged to a water course or injected back below ground. A closed system would consist of water running through a network of pipes below the ground. This would abstract the heat from the ground which would then be transmitted to the heat pump inside the building.

They do not suffer as much with lowering COP figures as ASHP. This is because the temperature of the ground is fairly stable over the year.

Similar to ASHP they are a low energy system not a renewable energy technology.

PRO'S

- Can be a very efficient system. For every unit of energy input, 3 – 4 units of heat output is possible
- Reliable. Fairly constant output from heat pump all year round, even in Winter the temperature in the ground will not fall too dramatically
- Little maintenance required. Once pipes are buried there are no problems with corrosion or degradation
- Long life system, heat pump have a life expectancy of 25 years
- Completely invisible system, so the planners are usually kept happy.

CON'S

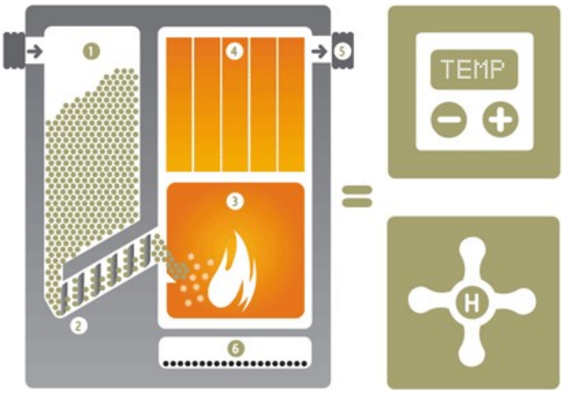
- Not a completely renewable system as they require some energy to power them.
- Expensive technology, mostly from the process of installing the loops within the ground
- Space requirement for the heat pump and storage cylinder required within the property
- If a buried pipe were to fail once installed they cannot be easily accessed for maintenance. This is usually only a slight risk
- Completely invisible system, if green credentials are to be demonstrated.

REDVELOPMENT ASSESSMENT

Ground source heat pumps will not be a cost effective method of providing heating or cooling for the proposed redevelopment. Planned ground works, which could absorb some of the capital costs for this technology are minimal. The redevelopment area does not offer much space to install horizontal/slinky loops limiting capacity. Vertical loops would need to coordinate with potential existing below ground services as well as abandoned WW2 air raid shelters, and possibly the Northern Line underground.

7.1.3 BIOMASS

DESCRIPTION



Biomass usually refers to living or recently dead plant material that can be used for fuel purposes.

Biomass is carbon neutral as the carbon that is released in to the atmosphere by burning the fuel has recently been soaked up from the atmosphere by growing the fuel.

Biomass is part of the carbon cycle, where carbon in the air is converted into a biological matter using photosynthesis. Biomass is a renewable energy, as plants or trees specifically grown to produce biomass can be replaced, and don't take long to grow. Biomass is seen as more environmentally friendly and longer lasting than traditional fossil fuels

Biomass systems are more effective where the fuel is grown locally. If the fuel has to be transported long distances, then the carbon used in this process makes the system less sustainable.

Storage of biomass is required; it is fed into the boiler and burned to produce heat. The heat generated is used for the heating and hot water.

PRO'S

- Local source of renewable energy
- Ideal for rural or semi-rural location where biomass fuel is local, although not essential
- Can be used with a number of different fuels such as wood, straw, biofuels such as Miscanthus, Rape etc
- Reliable technology
- Supports local agriculture
- Additional back up heating system not always required
- Close to carbon neutral

CON'S

- Capital costs can be high
- Lead times can be long depending on the project
- May be reliant on infrastructure and partnerships
- Needs someone who is willing to handle and correctly store the biomass fuels and waste
- Space required to store the biomass fuels and waste local to the boiler
- Additional maintenance is required on the boiler and the fuel handling systems
- Can be difficult to control effectively

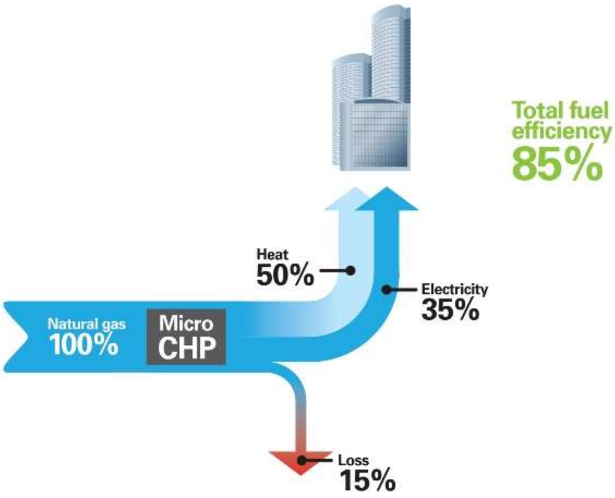
REDVELOPMENT ASSESSMENT

Biomass will not be suitable for the redevelopment as issues due to smoke emissions, delivery and supply of fuel, space for fuel storage and maintenance/operation heavily reduce its feasibility.

7.1.4 COMBINED HEAT AND POWER – CHP

DESCRIPTION

Combined heat and power (CHP) integrates the production of usable heat and power (electricity), in one single, highly efficient process.



In the process of generating electricity, heat is produced. This heat is usually wasted as the demand for this excess heat is not required at the location of generation (coal and gas power stations) leading to an overall efficiency of electricity generation of about 35%. Generating your own electricity on site allows you to capture this heat that would otherwise be wasted and use it to heat the building.

As an energy generation process, CHP is fuel neutral. This means that a CHP process can be applied to both renewable and fossil fuels. CHP provides a cost-effective means of generating low-carbon or renewable energy.

CHPs are very efficient when both the heat and the electricity is being fully used on site. They are less efficient where some of either the heat or the electricity has to be dumped.

There is a possibility CHP to benefit from FIT's.

PRO'S

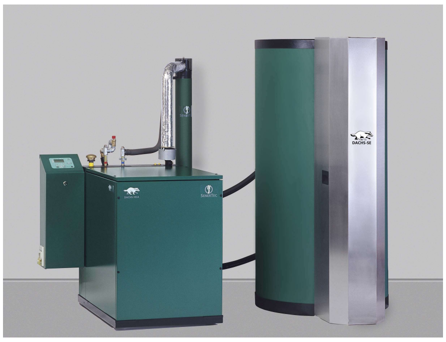
- Highly efficient at the point of use (up to 85%)
- Enhanced security of supply
- Could be powered by biofuel, making them even more sustainable
- Possibility to store excess heat for when it is required

CON'S

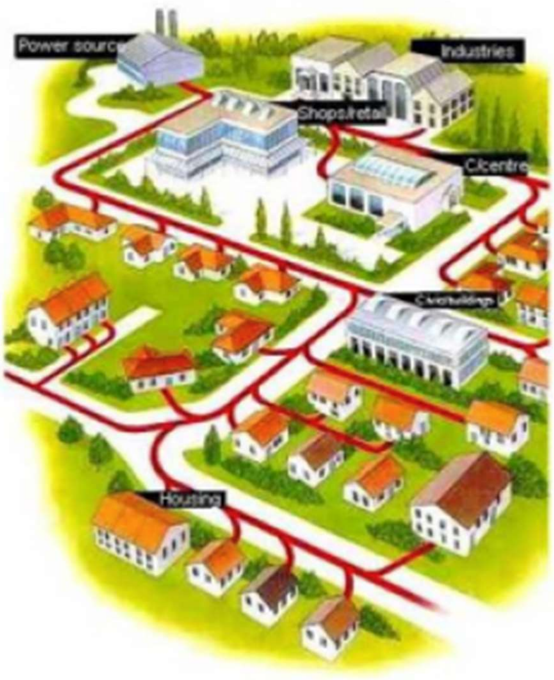
- CHP units are noisy
- Will require fairly regular maintenance
- Not completely carbon neutral
- Space requirement
- Most effective when the heat and electricity demand are required simultaneously, e.g. Swimming pool

REDVELOPMENT ASSESSMENT

The noise issues and space requirements of a CHP unit would lead to design changes and cost increases which would outweigh the benefits of ta CHP system. The system would produce unwanted heat during the summer, which unless stored until winter would be wasted. For these reasons a CHP unit is not suitable for this project.



7.1.5 DISTRICT HEATING



District heating network

DESCRIPTION

A district heating scheme consists of a centralised energy source which would then distributes to the various energy consumers on the site.

The advantage of this type of scheme is that it can be more efficient to generate energy centrally. For instance one large boiler will be more efficient than several smaller boilers. This would be partly because the central boiler would be more sophisticated and so more efficient. It would also hopefully be better run, by a dedicated trained staff, again resulting in a higher operating efficiency.

With a district heating system there is also the possibility of using waste heat from a process or a factory. This would greatly increase the overall efficiency of the entire system.

It can also allow the use of other desirable energy generation systems that would not be suitable for small scale self-contained heating systems. This is the case with Camden's Somertown Heat Network which incorporates a CHP plant to recycle residual heat from electricity generation into the district heating network.

PRO'S

- Reduced carbon emissions
- No local plant to maintain
- Allows the use of other fuels that otherwise would not be appropriate
- Can use waste heat which can be highly efficient

CON'S

- Energy losses from transmission network around site
- Centralised energy supply requires centralised metering and management
- High capital cost
- Space required for central plant
- Only appropriate for developments of multiple units.

REDVELOPMENT ASSESSMENT

District heating will not be suitable as there is no district heating network in close proximity to the building to connect to***.

***www.london.gov.uk/what-we-do/environment/energy/london-heat-map/view-london-heat-map