TECHNICAL NOTE

Job Name: Sydenham Hill

Job No: 43955

Note No: TN001_P01

Date: 14.03.19

Prepared By: [redacted]

Subject: **Heating Strategy**

Introduction

The purpose of this technical note (TN) is to set out options for the heating strategy.

One of the key drivers for heating strategy is planning policy, in particular the requirements of the London Plan. The GLA's energy hierarchy includes four sequential steps:

1. Be lean – energy efficiency
2. Be clean – heat networks/CHP
3. Be green – renewable energy
4. Offset payment or further savings on site

All four steps are independent, but this TN only directly addresses step 2. It assumes a fairly conventional approach to the first step, energy efficiency, with high levels of fabric performance that nonetheless fall short of the Passivhaus standard.

There would be merit in adopting the Passivhaus standard, which could open up alternative solutions for heating. However, this is outside the scope of this TN.

This note has been updated to show the estimated annual consumption and carbon emission factors which have been previously issued to Turner and Townsend but added to this note for completeness.

It has been also issued to record the Client's preference to proceed with option B1 as listed in the note below.

DOCUMENT ISSUE RECORD

Technical Note No	Rev	Date	Prepared	Checked	Reviewed (Discipline Lead)	Approved (Project Director)
43955/2501/TN001	-	12.11.18	DS/RF	RF	RF	SMcD
43955/2501/TN001	P01	14.03.19	DS/RF	RF	RF	SMcD

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Planning policy context

Regional planning policy in London has long favoured community heating systems within buildings and sitewide heat networks across masterplan sites. The primary reasons cited are to facilitate technology substitution and take advantage of 'waste' heat sources and other energy opportunities, either on a site-by-site basis or via build larger district heat networks.

For a long time, there has been a general presumption in favour of gas-fired boilers and CHP. However, more recently, the use of gas-fired CHP has been subject to more scrutiny by the GLA, primarily due to instances of CHP engines being installed, to satisfy planning policy, but not being economically viable to operate, due to the lack of a floor price or feed-in tariff for the electricity generated. Current guidance for CHP viability assumes a threshold of circa 500 dwellings, unless there is a suitable non-domestic consumer for the generated electricity.

The Draft New London Plan and the recently published Energy Assessment Guidance (October 2018) moves away from this presumption. For referable developments from January 2019, applicants are encouraged to use the updated SAP 10 emission factors, which better reflect ongoing grid electricity decarbonisation.

Figure 1 illustrates the effect of grid electricity decarbonisation on the emissions from various heat sources.

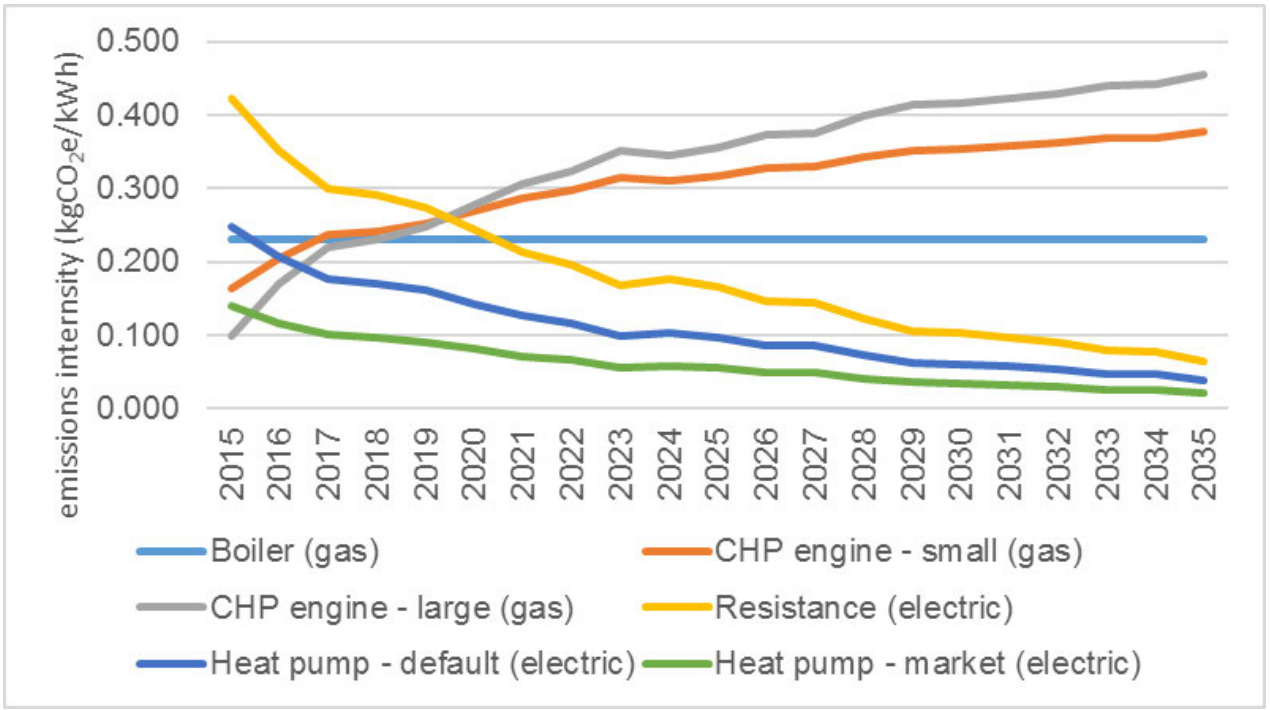

Figure 1: emissions intensity for heat from selected sources

Proposed options

At feasibility stage, five options are being considered for the project, two using gas-fired heat sources, two using electric heat pumps and one using gas-fired and electric heat pump sources.

- Option A1 – sitewide heat network with gas-fired boilers and CHP
- Option A2 – sitewide heat network with gas-fired boilers
- Option B1 – sitewide heat network with gas-fired boilers and centralised air-source heat pumps.
- Option B2 – sitewide heat network with gas-fired boilers and local water-source heat pumps
- Option B3 – sitewide heat network with centralised and local water-source heat pumps

The characteristics and merits of these options are tabulated below.

	A1 sitewide heat network with gas-fired boilers and CHP	A2 sitewide heat network with gas-fired boilers	B1 sitewide heat network with central air-source heat pumps	B2 sitewide heat network with local water-source heat pumps only	B3 sitewide heat network with central and local water-source heat pumps
Dwelling					
Equipment	Heat interface unit	Heat interface unit	Heat interface unit	Zeroth indoor heat pump unit	Indoor heat pump unit
Space requirements (Includes MVHR & washing mc)	1550x800mm (radiator htg) 1800x700mm (UF htg)	1550x800mm (radiator htg) 1800x700mm (UF htg)	1550x800mm (radiator htg) 1800x700mm (UF htg)	1550x800mm (radiator htg) 1800x700mm (UF htg) (Includes HW storage)	1550x800mm (radiator htg) 1800x700mm (UF htg) (Includes HW storage)
Acoustic performance	Insignificant noise impact	Insignificant noise impact	Insignificant noise impact	Insignificant noise impact	Insignificant noise impact
Heat metering	Required; integral to HIU.	Required; integral to HIU.	Required; integral to HIU.	Not required.	Not required.
Refrigerant Leak detection	Not applicable	Not applicable	Not applicable	Not required.	Not required.
Smart home system interfaces	Yes, can connect to smart home systems (E.g. Hive, Nest)	Yes, can connect to smart home systems (E.g. Hive, Nest)	Yes, can connect to smart home systems (E.g. Hive, Nest)	Yes, can connect to smart home systems (E.g. Hive, Nest)	Yes, can connect to smart home systems (E.g. Hive, Nest)
Space Heating capacity	Up to 10kW	Up to 10kW	Up to 10kW	Up to 6kW	Up to 6kW
DHW capacity	Up to 90kW (instantaneous)	Up to 90kW (instantaneous)	Up to 90kW (instantaneous)	72 L/hr heat up time (180L cylinder) Up to 6kW heat input to heat cylinder	72 L/hr heat up time (180L cylinder) Up to 6kW heat input to heat cylinder
Cooling capacity	Not applicable	Not applicable	Not applicable	Up to 5kW	Up to 5kW
Emitters	Radiators or UF heating	Radiators or UF heating	Radiators or UF heating	Radiators or UF heating (or fan coil units where cooling is provided)	Radiators or UF heating (or fan coil units (where cooling is provided)
Landlords Demise					
Distribution temperature	70/40°C	70/40°C	70/40°C	25/20°C	25/20°C
Pipework insulation	~25mmØ insulation required	~25mmØ insulation required	~25mmØ insulation required	Would not be required in communal areas (corridors)	Would not be required in communal areas (corridors)
Pipeline sizing	Typical corridor pipes sized at ~40mmØ ~90mmØ (with insulation).	Typical corridor pipes sized at ~40mmØ ~90mmØ (with insulation).	Typical corridor pipes sized at ~40mmØ ~90mmØ (with insulation).	Typical corridor pipes sized at ~40mmØ	Typical corridor pipes sized at ~40mmØ
Pipeline materials	Steel or copper	Steel or copper	Steel or copper	Steel, copper or plastic	Steel, copper or plastic
Energy Centre					
Equipment	Boilers, pumps and pressurisation units, CHP and buffer vessel(s)	Boilers, pumps and pressurisation units	Centralised heat pumps, boilers, heating pumps and pressurisation units	Boilers, pumps and pressurisation units	Centralised heat pumps, heating pumps and pressurisation units

	A1 sitewide heat network with gas-fired boilers and CHP	A2 sitewide heat network with gas-fired boilers	B1 sitewide heat network with central air-source heat pumps	B2 sitewide heat network with local water-source heat pumps only	B3 sitewide heat network with central and local water-source heat pumps
Heat source capacity (excluding allowance for distribution losses)	~950kW heating required	~950kW heating required	~250kW from heat pumps ~700kW from boilers	~600kW heat input to loop	~600kW heat input to loop
Space requirements	10,000x5,0000x3,500mm LxWxH	7,000x4,500x3,500mm LxWxH	18,000x9,500x2,200mm LxWxH for heat pumps plus 7,000x4,500x3,500mm LxWxH for boilers	7,000x4,500x3,500mm LxWxH	26,000x6,500x2,500mm LxWxH
Ventilation requirements	0.6m^2 (free area) HL ventilation. ~0.3m^2 (free area) LL ventilation.	~0.5m^2 (free area) HL ventilation. ~0.25m^2 (free area) LL ventilation.	Heat pumps need to be located in an open air acoustic and ventilated enclosure. Boilers room to be ventilated: ~0.5m^2 (free area) HL ventilation. ~0.25m^2 (free area) LL ventilation.	~0.5m^2 (free area) HL ventilation. ~0.25m^2 (free area) LL ventilation	Central heat pumps need to be located in an open air acoustic and ventilated enclosure.
Electricity supply	~5kW for pumps and pressurisation units	~5kW for pumps and pressurisation units	~80kW/90VA electrical supply required for heat pumps	~5kW for pumps and pressurisation units.	~250kW/280kVA electrical supply required
Gas supply	Yes, ~1175kW peak input required for CHP and Boilers	Yes, ~1050kW peak gas input required for boilers	Yes, ~800kW peak gas input for the boilers.	~650kW peak gas input required for the boilers	Not applicable
Acoustic performance	No specific acoustic requirements required for energy centre	No specific acoustic requirements required for energy centre	Central heat pumps need to be located in an open air acoustic and ventilated enclosure.	No specific acoustic requirements required for the energy centre	Central heat pumps need to be located in an open air acoustic and ventilated enclosure.
System Performance					
Emissions factor for input fuel	0.216	0.216	0.216	0.519 (will reduce to 0.398 with draft SAP 2016 and 0.210 with draft SAP 10)	0.519 (will reduce to 0.398 with draft SAP 2016 and 0.210 with draft SAP 10)
Refrigerant charge	Not applicable	Not applicable	15kg R600a + 15kg R290	0.83kg per indoor unit	Central plant: ~290kg + 0.83kg per indoor unit.
Refrigerant GWP	Not applicable	Not applicable	GWP - 3	Indoor unit R410A - 2088	Indoor unit R410A – 2088 Outdoor unit R417A – 2346

	A1 sitewide heat network with gas-fired boilers and CHP	A2 sitewide heat network with gas-fired boilers	B1 sitewide heat network with central air-source heat pumps	B2 sitewide heat network with local water-source heat pumps only	B3 sitewide heat network with central and local water-source heat pumps
Technology risk	Little risk as the technologies have been used for many years	Little risk as the technologies have been used for many years	TBC. However, the system is widely used in Scandinavia	Working installation at Elephant Park	Working installation at Elephant Park
Estimated System Costs – have been developed by Turner and Townsend (refer to separate T&T cost analysis					
Estimated Energy and carbon performance – based on Distribution Loss Factors allowed under SAP 2012 (used for Building Regulations and planning policy)					
SAP 2012 total annual CO_2 emissions (kg)	114,045	184,076	158,926	204,901	148,064
SAP 2012 heat network emissions factor ($kgCO_2/kWh$)	0.160	0.257	0.222	0.287	0.207
SAP 10 total annual CO_2 emissions (kg)	204,413	176,924	118,491	165,261	66,472
SAP 10 heat network emissions factor ($kgCO_2/kWh$)	0.286	0.247	0.166	0.231	0.093
Estimated Energy and carbon performance – based on Distribution Loss Factors allowed under SAP 10 (more realistic)					
SAP 2012 total annual CO_2 emissions (kg)	163,277	263,539	227,532	226,359	160,996
SAP 2012 heat network emissions factor ($kgCO_2/kWh$)	0.228	0.369	0.318	0.317	0.225
SAP 10 total annual CO_2 emissions (kg)	292,654	253,300	169,641	185,886	72,278
SAP 10 heat network emissions factor ($kgCO_2/kWh$)	0.409	0.354	0.237	0.260	0.101