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DATE
24 APRIL 2019

ENERGY STRATEGY MODIFICATION

18-22 HAVERSTOCK HILL
CAMDEN

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DOCUMENT STATUS

PROJECT
18-22 Haverstock Hill,
Camden

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Vabel
1 Devonshire Street,
London
W1W 5DS

IN CONJUNCTION WITH

REVISION	STATUS	CHECKED	DATE
0	Issue for Comments	Dr Alan Harries	11.04.2019
1	Carbon offset payment in Summary	Dr Alan Harries	24.04.2019

CONTENTS

1 INTRODUCTION

This Energy Strategy Modification has been prepared by Integration Consultancy Limited in related to the proposed development at 18 – 22 Haverstock Hill in Camden.

This follows the original Energy Assessment prepared on 11/04/2018 by Silcock Dawson and Partners.

The original energy strategy, which achieved 27% below Part L 2013 via the "SAP 2012" methodology, contemplates a centralised gas-fired heat network system to supply heat and hot water to 29 residential units.

In light of the upcoming change to carbon factors associated with the updated "SAP 10" compliance methodology, the scheme now proposes to use individual Air Source Heat Pumps for each unit in place of a central heat network.

A representative apartment has been modelled in SAP 2012 to show the achieved CO2 reduction for both approaches (ASHP vs Central gas-fired heat network) based on SAP 2012 carbon factors and the SAP 10 carbon factors.

2 THE DEVELOPMENT SITE

The proposal includes the demolition of an existing building and the erection of a 5 storey building with a ground floor plus basement level comprising of 29 residential (Use Class C3) units (4 x Studio's, 9 x 1 bed, 11 x 2 bed, and 5 x 3 bed apartments and approximately 279 sqm of commercial space at the ground floor level).

3 AIR SOURCE HEAT PUMPS (ASHP)

Air Source Heat Pumps operate by extracting heat energy from the surrounding air and transferring that energy in the form of higher-grade heat into a building using underfloor heating or radiator systems. Generally radiators need to be oversized to account for the lower mean water temperature circulating through the system.

An electrical heat pump can deliver in around 3kW of thermal energy for every 1kW of grid supplied electricity used (3:1 ratio). Under the principles of a vapour compression cycle using a refrigerant, an ASHP can provide both space heating, hot water and cooling. The system includes a compressor and a condenser to absorb heat from one space and deliver it to another. Generally, these systems require very low maintenance.

Generally, ASHP do not work well with heat network as they are significantly more efficient if they operate at low temperatures and do not have the burden of network distribution losses or heat exchange through Heat Interface Units (HIUs).

Heat pump technology will work well with the proposed scheme as it uses employs a high standard of building fabric. The values of the insulation are better than the Building Regulation's Notional Building including high performance glazing and a target air permeability of 4.0 $m^3/hr/m^2$ (compared to 5 $m^3/hr/m^2$ for the Notional Building).

The scheme proposes 80m^2 of solar PV. This complements heat pump operation well.

4 CARBON FACTOR SAP 2012 VS SAP 10

Typically, fossil fuels are used to heat our homes. However, the UK's electricity grid has decarbonised significantly in recent years. Grid electricity is produced by around one quarter renewable energy and coal power generation has been cut significantly. Carbon intensities continue to reduce each year as the grid decarbonises. This is reflected by long term government projections[1] - see Figure 1. The updated official electricity carbon emissions factors, as part of the SAP compliance process, show emissions from electricity have reduced by half compared to the current SAP 2012 method. In the new version of SAP 10 the electricity carbon factor has decreased from 0.519 $kgCO_2/kWh$ to 0.233 $kgCO_2/kWh$.

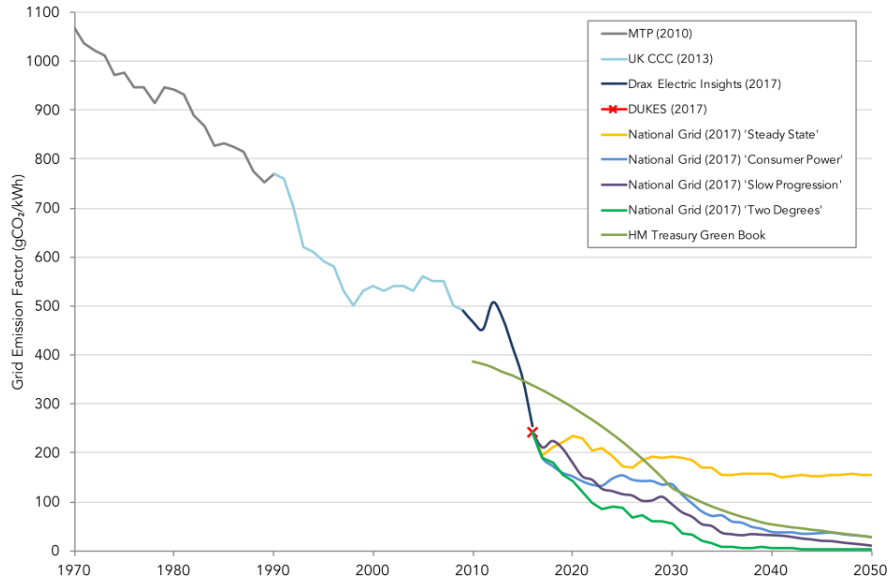

Figure 1: Historic and long-term UK grid electricity carbon emission factors.

Source: Figure 1.01 taken from "Low Carbon Heat: Heat Pumps in London", Greater London Authority, September 2018

The table below summarise the new carbon factors for available fuel types. SAP 10 will come into effect with the update to the new building regulation expected within the year.

Fuel	SAP 2012 Carbon Factors	SAP 10 Carbon Factors	% difference
Main Gas	0.216	0.210 (-0.06)	-3%
Bulk LPG	0.241	0.241 (-)	0%
Oil	0.298	0.298 (-)	0%
Wood Logs	0.019	0.028 (+0.009)	47%
Electricity	0.519	0.233 (-0.286)	-55%

Table 1: Carbon Factor for available fuel types for SAP 2012 and the new SAP 10

[1] The UK governments latest CO_2 emissions projections published, January 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/671187/Updated_energy_and_emissions_projections_2017.pdf

5 TYPICAL CO_2 PERFORMANCE OF ASHP VS CENTRAL HEATING

As shown in the table below, for SAP 2012, when the system efficiency is factored, ASHP is 42% better than a mains gas central system (assuming 20% heat network loss and a general ASHP heat pump of 300% efficiency).

Scheme	System Efficiency	SAP 2012 Carbon Factors	Efficiency Adjusted Carbon Factor	Variation compared to Mains Gas Central
Main Gas Central system	72%	0.216	0.30	-
Main Gas Individual Boilers	90%	0.216	0.24	80% (20% better)
Electricity radiators	100%	0.519	0.52	173% (73 worse)
Electricity ASHP	300%	0.519	0.17	58% (**42% better**)

Table 2: SAP 2012 Efficiency Adjusted Carbon Factors

As shown in the table below, for SAP 10, when the system efficiency is factored, ASHP is 74% better than a mains gas central system (assuming 20% heat network loss and a general ASHP heat pump of 300% efficiency).

Scheme	System Efficiency	SAP 2012 Carbon Factors	Efficiency Adjusted Carbon Factor	Variation compared to Mains Gas Central
Main Gas Central system	72%	0.216	0.29	-
Main Gas Individual Boilers	90%	0.216	0.23	78% (22% better)
Electricity radiators	100%	0.519	0.23	78% (22% better)
Electricity ASHP	300%	0.519	0.08	26% (**74% better**)

Table 3: SAP 10 Efficiency Adjusted Carbon Factors

6 TYPICAL COST PERFORMANCE OF ASHP VS CENTRAL HEATING

In terms of energy (fuel) costs (p/kWh), as shown in the table below, for SAP 2012, when the system efficiency is factored, ASHP is 9% better than a mains gas central system (assuming 20% heat network loss and a general ASHP heat pump of 300% efficiency).

Scheme	System Efficiency	SAP 2012 Fuel Costs	Efficiency Adjusted Fuel Costs	Variation compared to Mains Gas Central
Main Gas Central system	72%	3.48p/kWh	4.83p/kWh	-
Main Gas Individual Boilers	90%	3.48p/kWh	3.87p/kWh	80% (20% better)
Electricity radiators	100%	13.19p/kWh	13.19p/kWh	273% (173% worse)
Electricity ASHP	300%	13.19p/kWh	4.40p/kWh	91% (**9% better**)

Table 4: SAP 2012 Efficiency Adjusted Fuel Costs

For SAP 10, when the system efficiency is factored, ASHP is approximately equivalent (1% worse) than a mains gas central system (assuming 20% heat network loss and a general ASHP heat pump of 300% efficiency).

Scheme	System Efficiency	SAP 10 Fuel Costs	Efficiency Adjusted Fuel Costs	Variation compared to Mains Gas Central
Main Gas Central system	72%	3.94	5.47	-
Main Gas Individual Boilers	90%	3.94	4.38	80% (20% better)
Electricity radiators	100%	16.55	16.55	302% (202% worse)
Electricity ASHP	300%	16.55	5.52	101% (**1% worse**)

Table 5: SAP 10 Efficiency Adjusted Fuel Costs

7 SCHEME "SAP" PERFORMANCE OF ASHP VS CENTRAL HEATING

A representative apartment was modelled in SAP 2012 comparing the central heat system to an ASHP system (all other aspects equal).

The results have been calculated and shown below for both SAP 2012 carbon factors and SAP 10 carbon factors.

	TER kgCO2/m^2.yr	**DER kgCO2/m^2.yr**	**% Below Part L (2013)**
Using SAP 2012 Carbon Factors	17.0	12.23	28%
Using SAP 10 Carbon Factors	15.54	**9.67**	**37%**

Table 6: For Central Heat scheme - CO2 % Reduction for Part L 2013 (SAP 2012) using SAP 2012 and SAP 10 carbon factors.

	TER kgCO2/m^2.yr	**DER kgCO2/m^2.yr**	**% Below Part L (2013)**
Using SAP 2012 Carbon Factors	25.2	13.49	46%
Using SAP 10 Carbon Factors	22.8	**6.05**	**73%**

Table 7: For ASHP scheme - CO2 % Reduction for Part L 2013 (SAP 2012) using SAP 2012 and SAP 10 carbon factors.

The Dwelling Emission Rate (DER) for the ASHP scheme is 6.05 kgCO_2/m^2.yr using the latest SAP 10 carbon factors compared to 9.67 kgCO_2/m^2.yr for a central heat system. This is a **37%** reduction in carbon emissions.

The ASHP schemes also shows **73%** below Part L (2013) using SAP 10 carbon factors.

8 SUMMARY

The scheme specific study shows that an ASHP system is significantly more carbon efficient than the original gas-fired centralised heat network system under the new SAP 10 carbon factor figures. The study shows a **37%** reduction in carbon emissions (i.e. comparing the DER of the central heat network with the DER of the ASHP scheme).

The ASHP schemes also shows **73%** below Part L (2013) using SAP 10 carbon factors.

Therefore, the **energy strategy is proposed to be modified to adopt individual air source heat pumps for heating and hot water for each unit**.

The long-term trend of UK electricity grid decarbonisation further reinforces this position.

Carbon Offset Payment

The carbon offset payment calculated in the energy assessment date 11 March 2018 was £73,305 to take the residential units to 100% below Part L. This is based on 27% below Part L and £90/tCO2 over 30 years. Note that commercial spaces need only achieve 35% below Part L.

For a scheme achieving 37% below Part L the carbon offset payment would be £63,158.

	% Below Part L (2013)	Offset to 100% below Part L (tonneCO2/yr)	Carbon Offset Payment
Original Scheme	27%	27.15	£73,305
Proposed Scheme (ASHP)	37%	23.39	**£63,158**

Table 8: Carbon Offset Payment Calculation