AppliedENERGY

GMG

15 - 29 EYRE STREET HILL, LONDON EC1R 5DZ

CHP & DHN REPORT

PLANNING CONDITION 12

1.0 INTRODUCTION

This document provides details of the proposed CHP installation at the proposed development of 15 - 29 Eyre Street Hill, London EC1R 5DZ together with the provisions made for connections to any future District Heating Network. This document provides further details outlined within the Energy Strategy Report RevD and the Camden Borough Council CHP&DHN Checklist RevA which were submitted as part of the planning application.

It outlines what the requirements are, as set out by the Camden Local Plan 2018 Core Strategy Policy CC1 - Climate change mitigation and the Mayor's Sustainable Design & Construction SPG 2014, the status of the existing DHN in the vicinity of the project and how the Development plans to make the requisite provisions to accommodate a point of connection.

2.0 PLANNING APPLICATION (REF 2018/6016/P) REQUIREMENTS

Pre-commencement Planning Condition No 12 states the following:

"Prior to commencement of any development other than works of demolition, site clearance & preparation, full details of the proposed combined heat and power unit (CHP) plant and confirmation that the plant will comply with the Mayor's emission standards as set out in the Mayor's Sustainable Design and Construction SPG (2014), and details of any necessary NO2 abatement mechanisms shall be submitted to and approved in writing by the Local Planning Authority."

3.0 PROPOSAL

3.1 London Heat Map

The Borough-Wide Heat Demand and Heat Source Mapping' (LB Camden, 2015) has been used to determine if there are any existing or proposed district heating schemes in close proximity for the development to utilise.

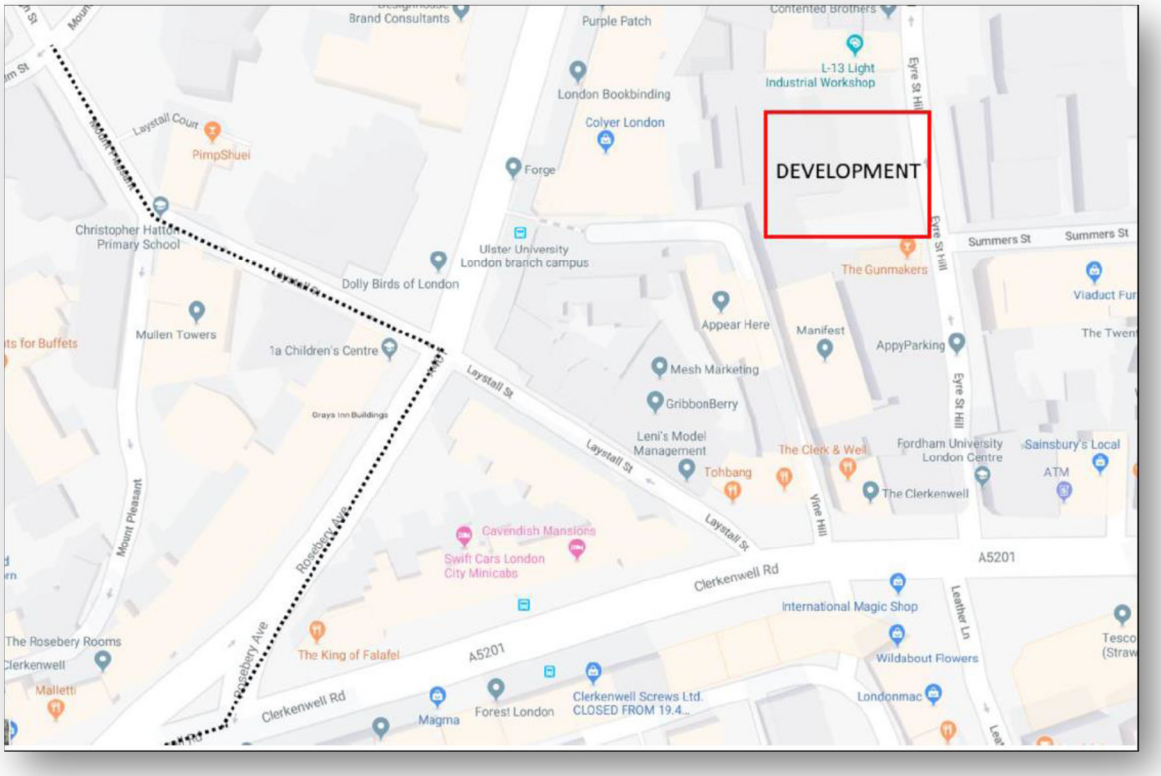


Figure 1: Borough-Wide Heat Demand and Heat Source Mapping' (LB Camden, 2015) for the Proposed Site

From the map, there appears to be no communal or district heating scheme in close proximity to the site at this time, or planned for the near future.

Nevertheless, the development has been designed to allow future connection to a district heating network should a feasible system become available in the immediate area by ensuring the plant room has been designed with enough space to accommodate the necessary equipment.

If the district heating network becomes available for the site, it is proposed that when the on-site decentralised energy plant (e.g. water heaters/CHP) reaches the end of its serviceable life-span (15-20 years in line with CIBSE Guide M indicative economic life expectancy), a feasibility study will be carried out in order to determine the viability of connecting to the district heating network, rather than replacing the water heaters/CHP like for like.

3.2 Proposed Plant

The proposed plant room is located at roof level and will house the domestic hot and cold water plant and equipment to serve all outlets in the hotel (bedroom ensuites, toilets, bar, restaurant, leisure area, etc) with further details shown in Appendix A. This will include, but is not limited to:-

- Cold Water Storage Tanks

- Cold Water Booster Sets
- Water Conditioning equipment
- CHP pipework connections to thermal stores
- Domestic Hot Water calorifiers/ buffer vessels
- Gas network
- Back up gas fired water heaters
- Circulation Pumps, valves, etc

The CHP system will be used to generate and store domestic hot water at 70°C, for it then to be distributed out to the hotel at 60°C. In line with current standards such as CIBSE, BSRIA and Water Regulations, the HWS system will be fully insulated to ensure that the return temperature does not drop below 50°C, with a target of 55°C. The CHP unit will be located internally together with all pipework routed the thermal stores.

The proposed Totem T10 CHP unit manufactured by Adveco, has not changed from the unit assessed in the 2875-18 Vine Hill & 15-29 Eyre Street Hill-Air Quality Assessment submitted as part of the planning application. The Air Quality Assessment stated the following:

"The gas-consuming energy plant will meet the following requirements:

• CHP with NOx emissions of no more than 240 mg/kWh of input natural gas (achieving the indicative emissions factor for compliance with the Sustainable Design and Construction: SPG (GLA, 2014).

• Gas-fired boilers with NOx emissions of no more than 36 mg/kWh of input natural gas (achieving a betterment of the GLA (2014) requirement for no more than 40 mg/kWh.

The impact of the operation of the building on air quality has been assessed in accordance with the AQN guidance, against the notional building emissions benchmark (BEB) for the development (Table 17). The total NOx emissions generated by the CHP and gas-fired boilers are calculated to be approximately 230.4 kg/year of NOx."

Manufacturer details can be found within Appendix A of this report.

3.3 Future District Heating Provision

Provision for future district heating will be designed in line with the Mayor of London's "District Heating Manual for London 2014". In addition to the above document, a "Technical Specification for Commercial Developments 2016" by ENGIE Group has also been used for technical support.

In this case, where the EMP has identified the feasibility of an area-wide heat network, but there are no firm plans in place as to who will build the network or when, actions should be taken to 'future proof' a

connection point. This will be on the assumption of a connection to a single plant room which serves the hot water demand.

3.4 Future DEN Interfacing Heat Exchanger

From the table below, provided by District Heating Manual for London, the site load of 630kWh could be satisfied with a heat exchanger with an area of 2.25x0.75m to accommodate the plate heat exchangers and associated pipework and fittings.

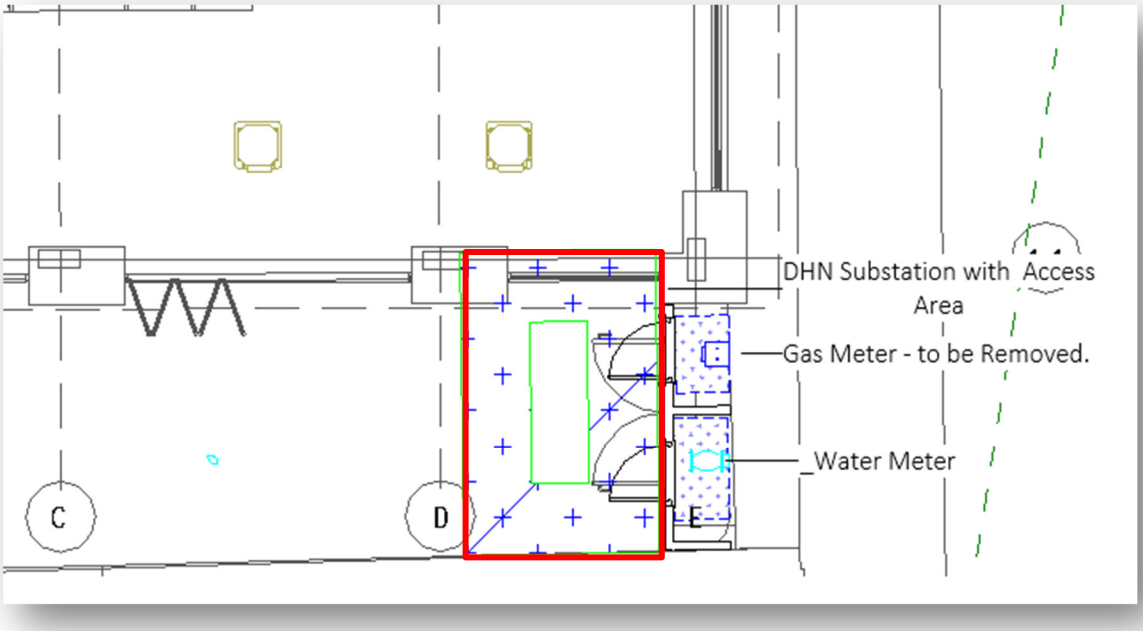
Output (kW)	250	500	800	1000	1500
Number of Heat Exchangers	1	1	1	2	2
Length (mm)	1500	2250	2250	2750	2750
Width (mm)	500	750	750	1500	1500
Height (mm)	2000	2500	2500	2500	2500
Approximate Dry Weight (kg)	750	1050	1300	1725	1800

Figure 2: Plant Room Spacing Requirements

Access of 1m on all sides will need to be provided for maintenance, increasing the footprint area to 4.3x2.8m.

3.5 Space and Position Provision for Future District Heating Equipment

Given the future district heat network substation spatial requirements established earlier in this document, it is envisaged that sufficient space in the court yard outside of the hotel will be allocated for future installation and connection, as per Figure 3 below.



Future Space allocation

Figure 3: Plant Room Layout with Future Space Provision

The following process will be followed should district heating become available:

1. New DHN substation containing DHN plate heat exchangers, pumps and all auxiliary equipment will be manufactured off site and contained within an insulated GRP enclosure and dropped into the allocated space outside.
2. All necessary connections made to the primary and secondary side of the DHN PHE via a new closed loop circuit, complete with pumps, pressurisation units, etc
3. Connection made from secondary side of the DHW plate heat exchangers to the hot water flow and return pipework.
4. New system commissioned and set into operation
5. CHP, back up gas water heaters and gas connection decommissioned and removed once DHN is live, established and proved to function as intended.

The DEN substation serving the hotel is to be located within the courtyard at the ground level (below the Eyre Street level). It is assumed that the connection to a DEN will be from Eyre Street as per Figure 5.

3.6 Provision for Future Connection within the Existing System

It is envisaged that capped connections within the hotel DHWS will be provided to allow for future connections to the district Heating Network (highlighted in yellow), as per the below Figure 4. The schematic shows the proposed arrangement of the CHP and storage vessels which then feed into the back up water

heaters and the proposed valved future network connection points. This arrangement allows the CHP and water heaters to be isolated, decommissioned and the new heat exchanging interfaces to be inserted, without effecting on the operation of the system.

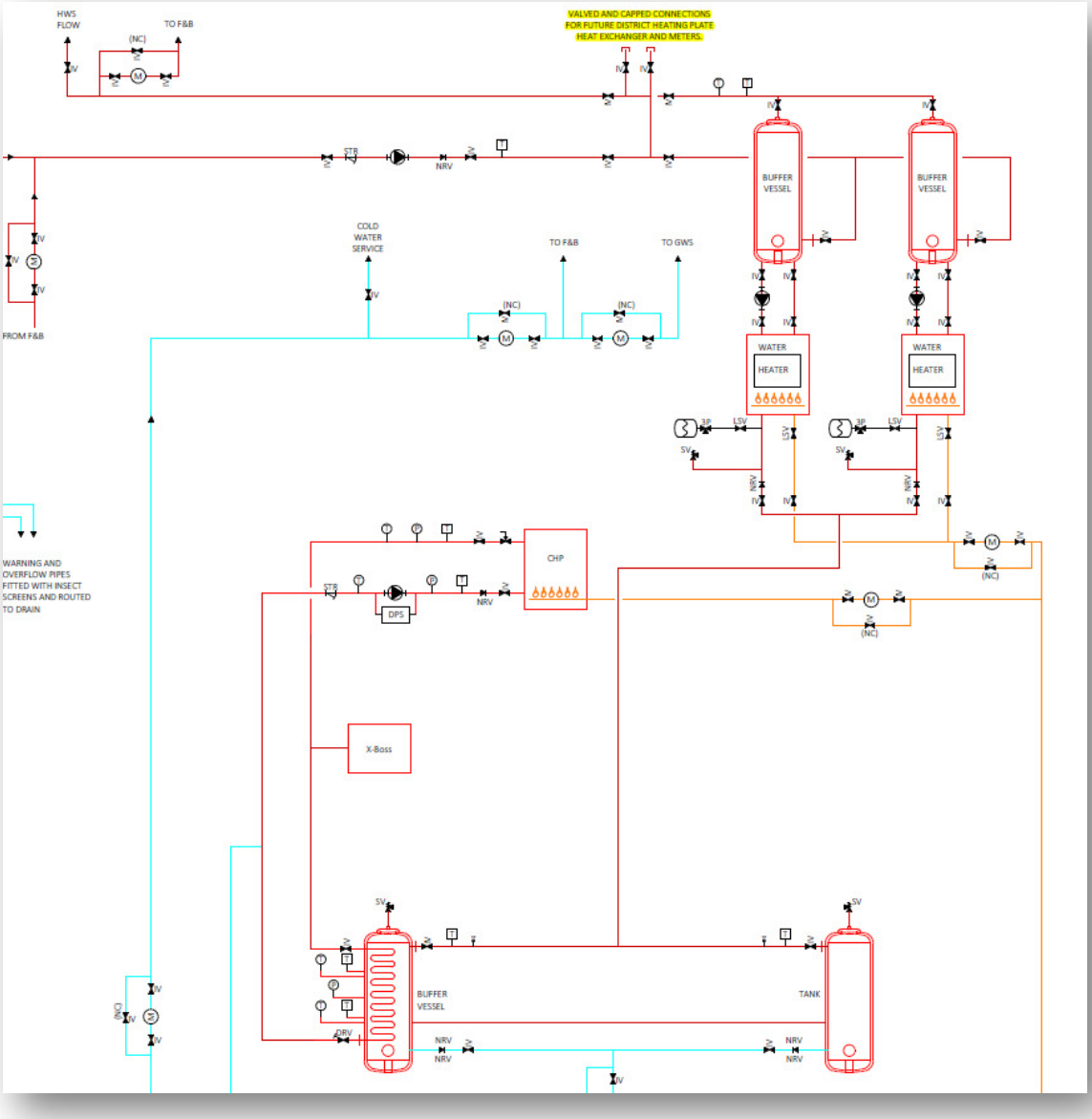


Figure 4: Hotel Plant Room Schematic

3.7 Safeguarding Future DEN Pipework and Routes

A route from the plantroom to the DEN substation at the building's boundary will be safeguarded to provide a point of connection to a District Heating Network in the future.

The District Heating Manual for London's specification for a Heating Network being used to supply heat for the DHW indirectly should operate with secondary side flow and return temperatures of 70℃ and 25℃, providing a temperature difference of 45℃. This will mainly be achieved through the use of instantaneous hot water generation via PHE which can generate large Delta T's. Pipework, valves and accessories will be fully insulated throughout with insulation in accordance with BS5970:2012 and BS 5422:2009 and storage vessels will be reduced as far as possible which typically have standing heat losses. The results of the above measures will keep heat loss to a minimum.

A clear route will be maintained for future connection from the proposed DEN substation to the roof plantroom as shown in Figure 5. An indicative route is shown below of the pipework which will run at high level within the ground floor and within the main riser to the plantroom. Service penetrations in the external wall construction at the boundary and soft spots in the slab where the pipes pop up, will be allowed for to make future installation easier.

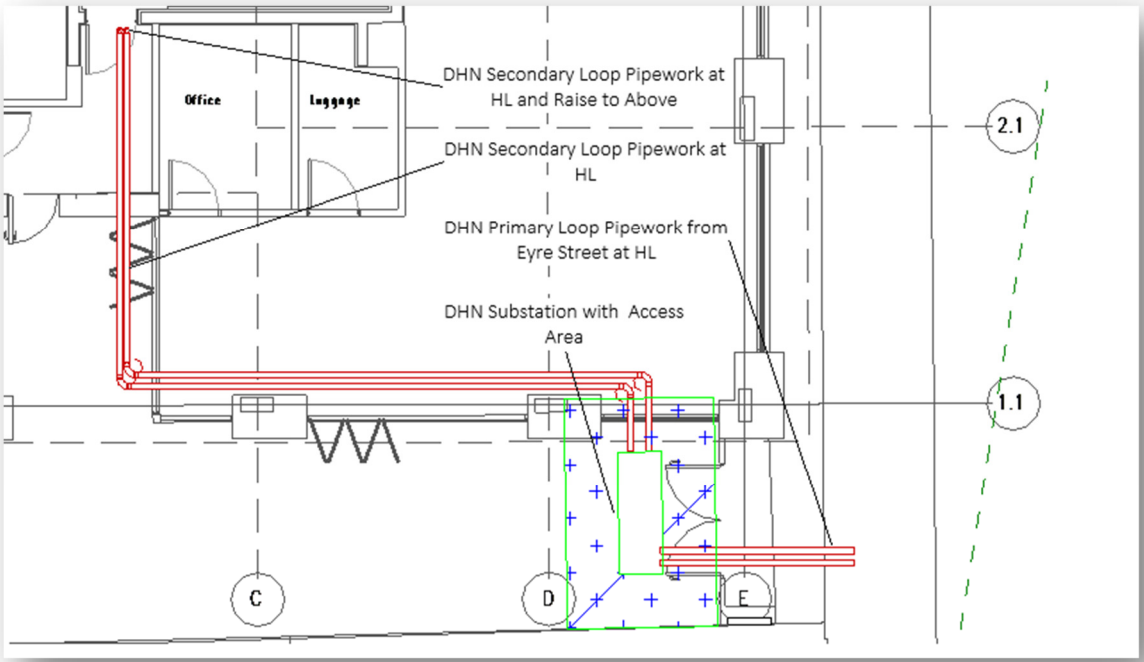


Figure 5: Proposed Route for DHN Pipework to Plantroom

4.0 SUMMARY

The report provides details on the proposed CHP plant as outlined in the Planning Condition No 12.

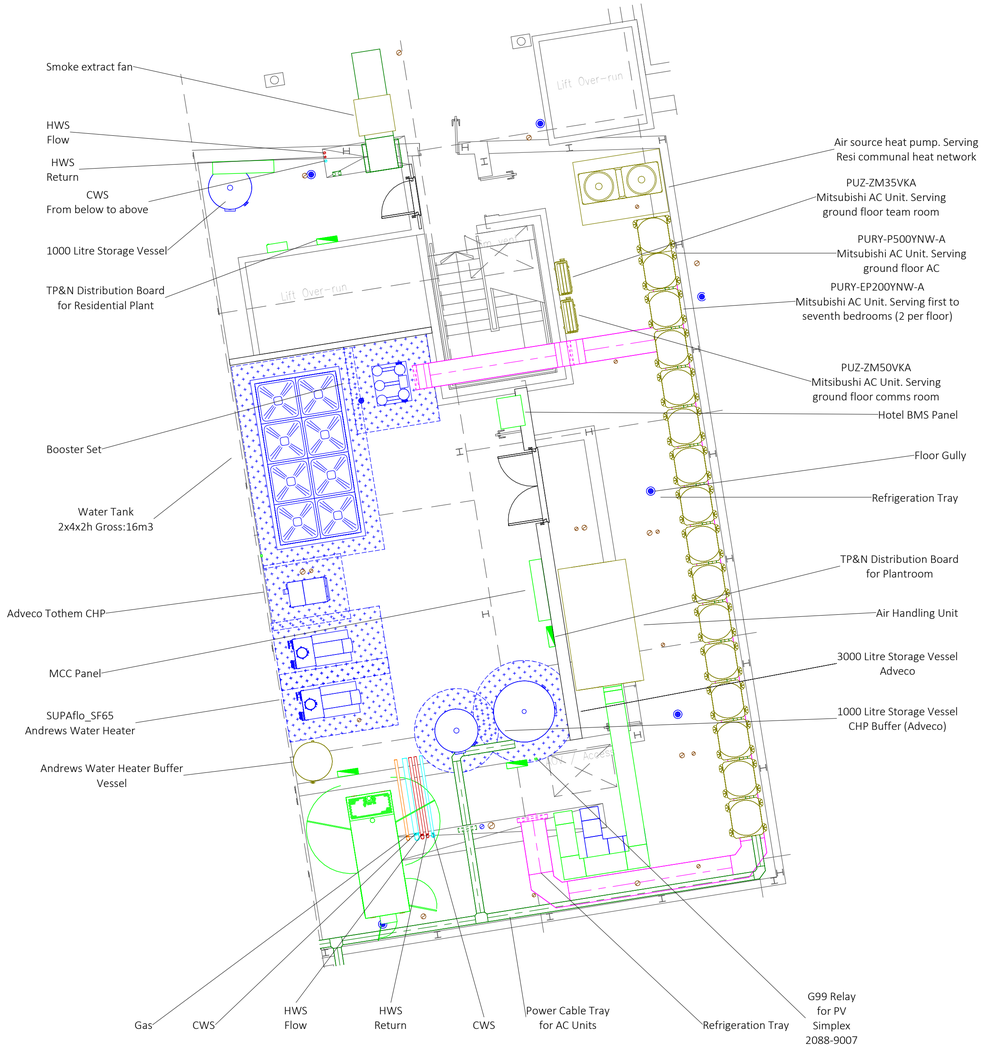
The report also outlines the existing energy plan for the proposed development as well as the proposed energy plan moving forward to include a DHN connection. Included in the development's plans are spatial provisions in the external courtyard for an appropriately sized interfacing heat exchanger enclosure to be

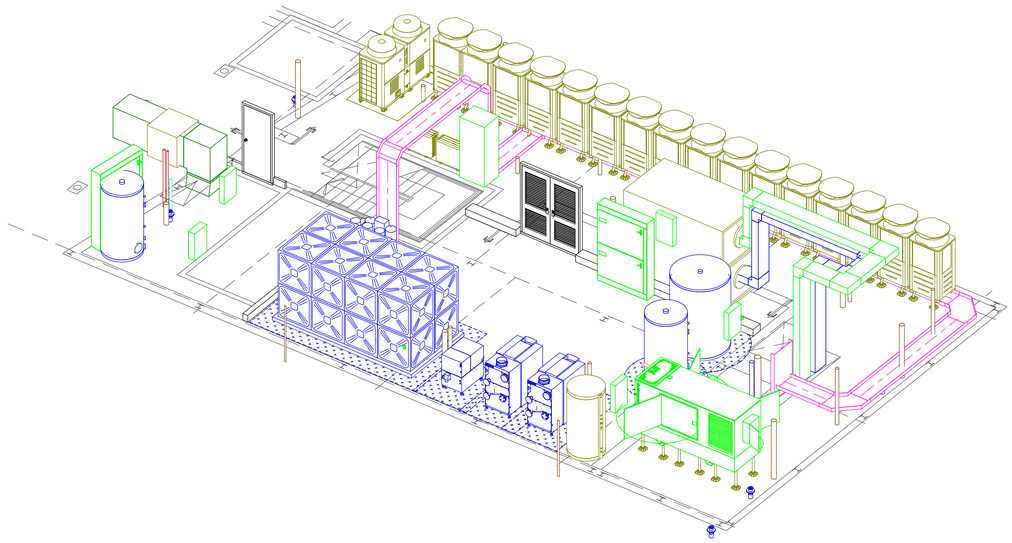
located, as well as connections to interface with the incoming DHN supply, in the event of a network becoming available to connect to. This information shows the adaptability of the proposed DHW and heating system to connect to a future DHN, thus meeting with the recommendations set out in the Camden Policy CC1 and the Sustainable Design and Construction: SPG (GLA, 2014) document.

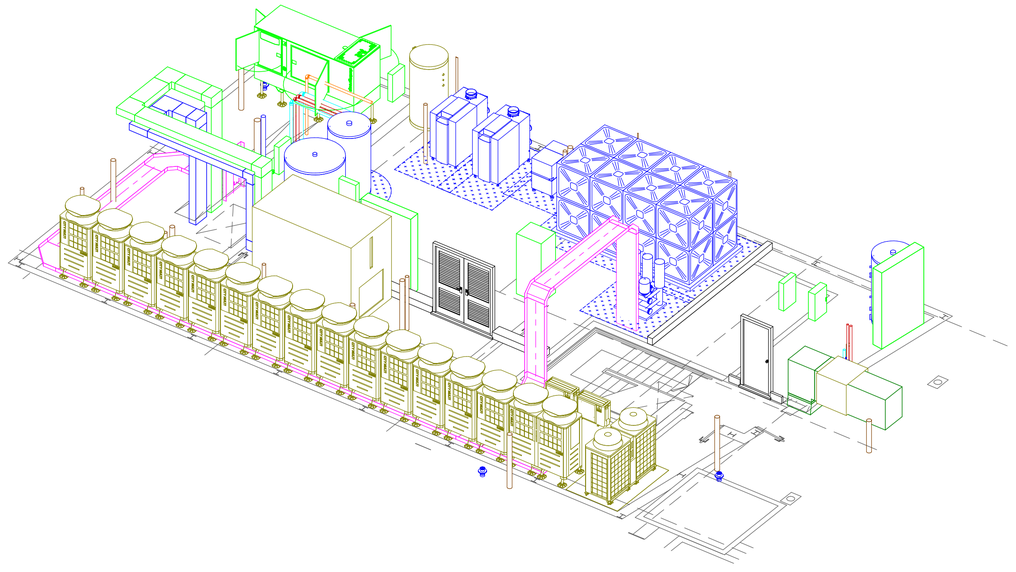
It should be noted that if the district heating network becomes available for the site, it is proposed that when the on-site decentralised energy plant (e.g. water heaters/CHP) reaches the end of its serviceable life-span (15-20 years in line with CIBSE Guide M indicative economic life expectancy), a feasibility study will be carried out in order to determine the viability of connecting to the district heating network, rather than replacing the water heaters/CHP like for like.

APPENDIX A

- CONTRACTOR TO PREPARE DETAIL WORKING DRAWINGS FOR APPROVAL SUBSEQUENT TO SITE SURVEY.
- CONTRACTOR TO AGREE FINAL SETTINGS OUT PRIOR TO INSTALLATION.
- THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL NECESSARY ARCHITECTURAL, STRUCTURAL & SPECIALIST DRAWINGS, SCOPE OF WORKS, ROOM DATA SHEETS & SPECIFICATIONS.
- ANY CALCULATIONS, SIZES, EQUIPMENT SELECTIONS, ARE INDICATIVE. CONTRACTOR TO UNDERTAKE CALCULATIONS, SIZING, EQUIPMENT SELECTION ETC. AS PART OF DESIGN RESPONSIBILITIES.
- DIMENSIONS SHALL NOT BE SCALED & FIGURED.
- DIMENSIONS MUST BE VERIFIED ON SITE BEFORE WORK COMMENCES.
- DIMENSIONS SHOWN MAY BE TYPICAL AND NOT SPECIFIC TO THIS SITE.







Rev	Revision	Date
B	Tender Issue	02.12.19
A	Tender Stage 1	13.03.19
11	Stage 3 Issue	05.02.19

PROJECT
Vine Hill - Clerkenwell Office and Hotel

TITLE
Hotel - Plantroom - Mechanical and Plumbing Services

DRAWING No.	SCALE (@A1)	Project Ref:
H_ALPR_061	1 : 75	17089

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TECHNICAL SUBMITTAL
TR400018.r3

ADVECO

TOTEM
Cogeneration (CHP) Range

A+++

Highest total efficiency with modulating output and lowest NO_X emissions available

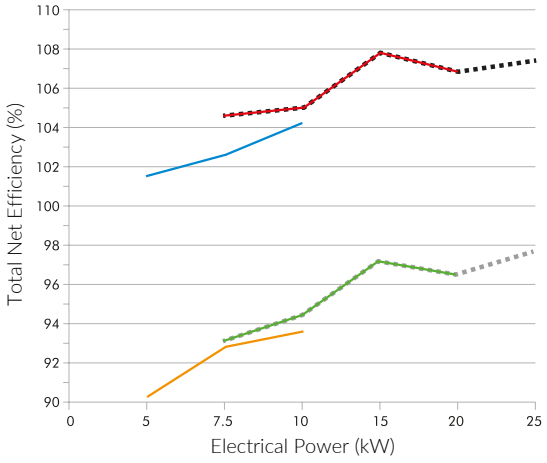
PRACTICAL, EFFICIENT & SUSTAINABLE
BUILDING SERVICES SOLUTIONS

Totem Product Range

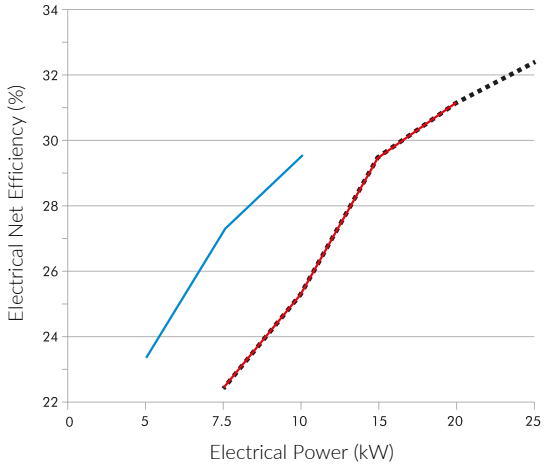
MODEL		T10	T20	T25	T50
OUTPUT air inlet @ 25°C and 101.3 kPa, natural gas (G20) @ 20 mbar					As 2× T25
MAX Output:					
Rated electrical power	kW	10	20	25	50
Power modulation range	kW	≥5	≥7.5	≥7.5	≥7.5
Seasonal space heating efficiency†	%	200	226	251	251
Electrical efficiency (net of machine consumption)*	% LHV (HHV)	29.6 (26.9)	31.2 (28.4)	32.5 (29.5)	32.5 (29.5)
Thermal output (35°C return temperature)*	kW	25.0	48.5	57.6	115.2
Thermal output (70°C return temperature)*	kW	21.6	41.9	50.2	100.4
Thermal efficiency (35°C return temperature)*	% LHV (HHV)	74.7 (67.7)	75.6 (68.7)	74.9 (68.1)	74.9 (68.1)
Thermal efficiency (70°C return temperature)*	% LHV (HHV)	64.0 (58.1)	65.3 (59.4)	65.3 (59.4)	65.3 (59.4)
Total efficiency (35°C return temperature)*	% LHV (HHV)	104.3 (94.7)	106.8 (97.1)	107.4 (97.6)	107.4 (97.6)
Total efficiency (70°C return temperature)*	% LHV (HHV)	93.6 (84.8)	96.5 (87.7)	97.8 (88.9)	97.8 (88.9)
Gas energy input*	kW LHV (HHV)	33.4 (37.0)	64.0 (70.9)	76.6 (84.9)	153.2 (169.8)
Natural gas (G20)*	Nm^3/hr	3.29	6.27	7.56	15.12
Heat to power ratio**		2.50	2.42	2.30	2.30

LHV = Lower Heat Value (Net) HHV = Higher Heat Value (Gross)

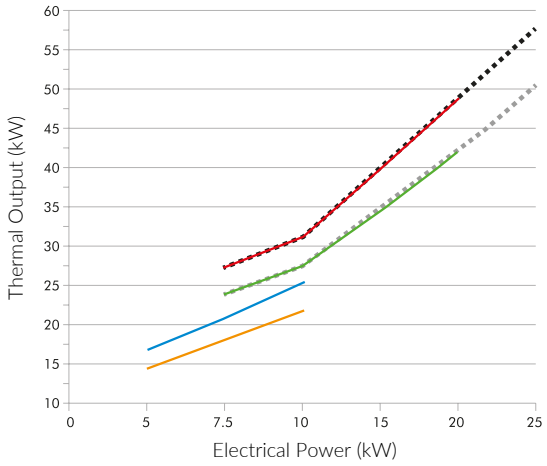
Total Efficiency vs. Electric Load



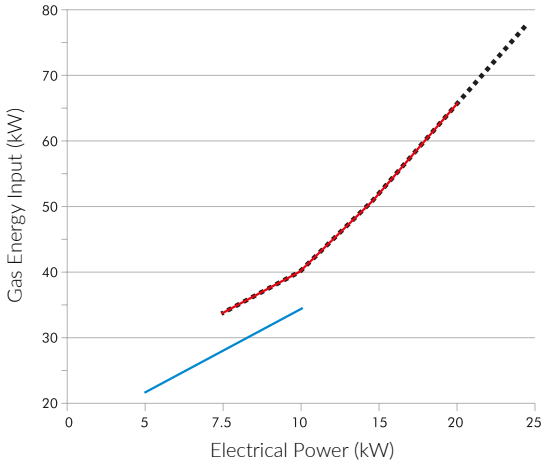
Electrical Efficiency vs. Electric Load



Thermal Power vs. Electric Load



Input Power vs. Electric Load



TOTEM 10 @ 35°C TOTEM 20 @ 35°C TOTEM 25 @ 35°C
TOTEM 10 @ 70°C TOTEM 20 @ 70°C TOTEM 25 @ 70°C

TOTEM 10 @ 35-70°C TOTEM 20 @ 35-70°C TOTEM 25 @ 35-70°C

* Values from independent testing at Milan Technical University and verified by TÜV Rheinland. Unit certified by TÜV Rheinland.

** Heat to Power ratio must be input into SBEM calculations alongside Maximum Gross (HHV) Total Efficiency. For normally stated net efficiencies, divide by 1.1 to calculate gross efficiency.

† As defined by EU No. 811/2013, EN 50465/2015

MODEL		T10	T20	T25	T50
OUTPUT air inlet @ 25°C and 101.3 kPa, natural gas (G20) @ 20 mbar					As 2× T25
Modulating 40/50% Output:					
Rated Electrical Power	kW	5	10	10	10
Electrical efficiency (net of machine consumption)*	% LHV (HHV)	23.7 (21.4)	25.5 (23.0)	25.5 (23.0)	25.5 (23.0)
Thermal output (35°C return temperature) *	kW	16.4	30.9	30.9	30.9
Thermal output (70°C return temperature)*	kW	14.1	27.0	27.0	27.0
Thermal efficiency (35°C return temperature)*	% LHV (HHV)	77.9 (70.5)	79.4 (71.7)	79.4 (71.7)	79.4 (71.7)
Thermal efficiency (70°C return temperature)*	% LHV (HHV)	70.0 (60.5)	69.2 (62.5)	69.2 (62.5)	69.2 (62.5)
Total efficiency (35°C return temperature)*	% LHV (HHV)	101.5 (91.6)	105.0 (94.8)	105.0 (94.8)	105.0 (94.8)
Total efficiency (70°C return temperature)*	% LHV (HHV)	90.3 (81.5)	94.4 (85.2)	94.4 (85.2)	94.4 (85.2)

DIMENSIONS AND WEIGHTS					
h x w x l (rigged up with panels - standard version without feet)	mm	1,283x795x1,924			1,283x2,390x1,924
Weight Full	kg	720	780	780	1560

HYDRAULIC CIRCUIT					
Maximum inlet water temperature	°C	70			
Maximum outlet water temperature	°C	80			
Rated water flow	l/h	2,500	4,000	5,000	10,000
Maximum pressure drop through unit	kPa	60			
Maximum working pressure	bar	10			

ASYNCHRONOUS GENERATOR		
Operation		In parallel with grid
Three phase voltage/Frequency	V/Hz	400/50
Engine starter		Starter motor
Electrical generator connection		3 phase and neutral

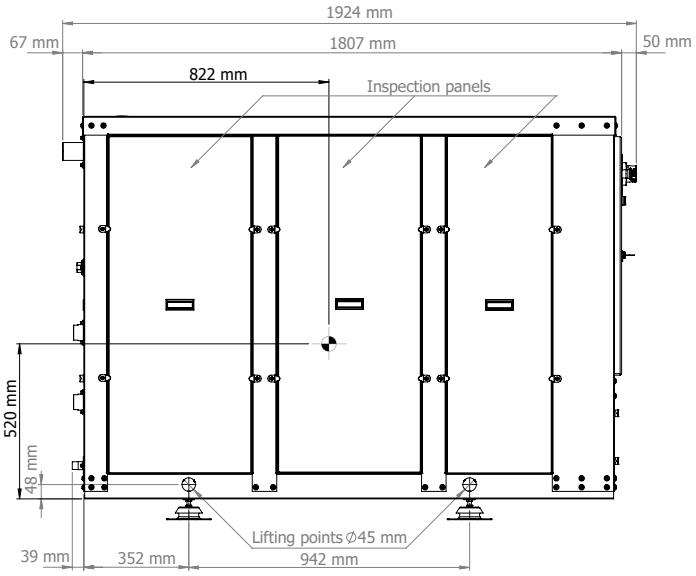
WORKING CONDITIONS					
Max Ambient Conditions (temperature/relative humidity)	°C/RH	40/75%			
Acoustic impact Lp					
@ 1 m distance in open field	dB(A)	56.7	61.1	61.1	64.1
Exhaust emission					
NO_X Emissions @ 5% O_2	mg/Nm^3	<10	<10	<10	<10
NO_X Emissions @ 0% O_2	mg/kWh	<12	<12	<12	<12
CO Emissions @ 5% O_2	mg/Nm^3	<10	<10	<10	<10
Max flue gas temperature (normal conditions)	°C	77			
Max flue gas temperature (fault condition)	°C	100			
Flue gas mass flow rate	kg/h	55	100	125	250
Condensate mass flow rate (35°C return temperature)*	kg/h	1.37	3.04	3.14	6.28
Max flue system pressure drop	Pa	500			
Max flue run (80mm PP flue) Total Equivalent Length*	m	32	23	23	23
Flue material specification		T120 and H1			
Asynchronous three-phase alternator					
Rated power*	kW	10.10	20.09	25.06	50.12
Frequency	Hz	50			
Rated voltage	V	400			
Poles		4	2	2	2
Insulation Class		F			
Efficiency Class		IE3			
Power Factor		0.962			

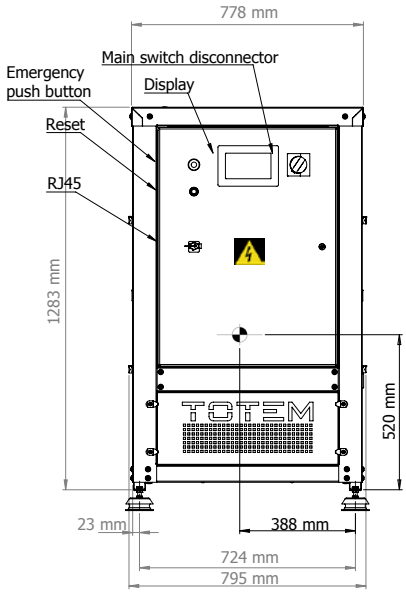
* Values from independent testing at Milan Technical University and verified by TÜV Rheinland. Unit certified by TÜV Rheinland.

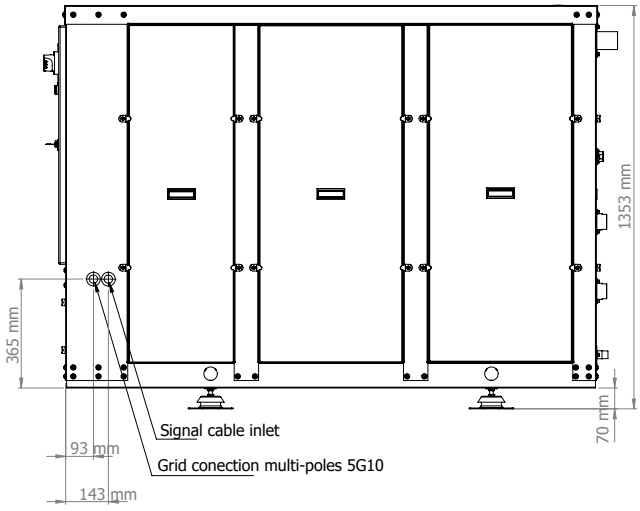
** Heat to Power ratio must be input into SBEM calculations alongside Maximum Gross (HHV) Total Efficiency. For normally stated net efficiencies, divide by 1.1 to calculate gross efficiency.

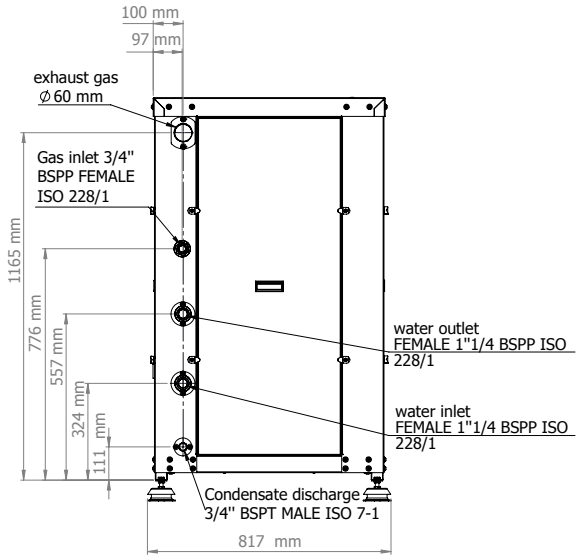
† As defined by EU No. 811/2013, EN 50465/2015

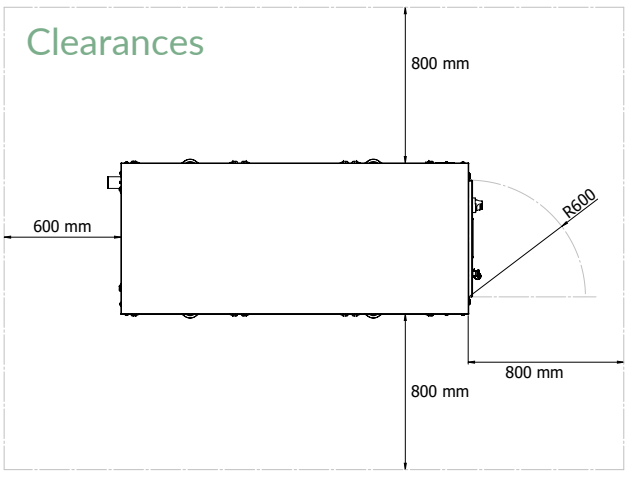
Technical drawings











Options and Ancillaries

- System buffer vessels
- Primary and secondary pumps: single or twin head with controls to share load
- Installation kits for the CHP system and buffer vessel accounting for all fittings and components
- Submetering available for gas, electric and heat
- Expansion vessels and pressurisation units
- G59/G83 interface protection panels
- Commissioning and witness testing
- G59 application assistance
- Maintenance plans

Buffer Vessel Options

- Carbon steel buffers from 500L to 10000L
- High and low level flow and return connections
- Extra tappings for use with multiple heat sources, low and high grade heat sources, varying return temperatures or glycol-filled primary loops.
- Vessels up to 5000L can mount up to two high-capacity internal heat exchange coils for use with indirect heat sources
- 5 bar working pressure
- 100mm flexible polyurethane insultation with removable outer PVC jacket
- Bespoke options available upon request

Adveco also offer the following products and services:

- Bespoke system design
- Maintenance and service packages
- Buffer tanks
- Indirect and direct hot water systems
- Off-site manufacturing of skids and plant rooms
- Controls systems
- Packaged plate heat exchangers
- Solar thermal systems
- Gas fired heating systems
- Combined heat & power cogeneration systems

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