ENERGY REPORT – AS DESIGNED
FOR
STUDENT ACCOMMODATION

AT

BRITANNIA STREET
LONDON WC1X 9JP

April 2013 – Issue 1
June 2013 – Issue 2
(Reference included to Section 106 Agreement in Section 2.0 of this Report)

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1.0 INTRODUCTION

CDP Ltd have been appointed by Watkin Jones & Son Ltd to review the GDM Energy Strategy for the proposed Student Accommodation project at Britannia Street, London and to comment on the suitability of the original heating and hot water strategy proposed by GDM as part of the original planning application to serve the student accommodation.

The relevant documentation that was submitted with the original planning application is as follows:

- Iceni Projects Ltd Sustainability Plan dated 30th May 2012, incorporating Iceni Projects Ltd Sustainability Statement & BREEAM Pre-Assessment dated 30th May 2012
- Iceni Projects Ltd Renewable Energy & Energy Efficiency Plan dated 12th December 2012, incorporating GDM Energy statement dated May 2012

2.0 BACKGROUND INFORMATION

The development comprises the partial demolition, rebuilding and extension of 15-27 Britannia Street in connection with the re-use of the site as student accommodation with the provision of communal areas and an external courtyard, the creation of office space, the development and change of use of properties on Wicklow Street to residential accommodation (two studio apartments) and a performance space/gallery area.

Planning was awarded on 11th September 2012 with 21 Conditions attached to the approval. Condition 20 states:

20. The development hereby permitted shall be carried out in accordance with the following approved plans- (00) 001A; (20) 000B, 001C (accessible rooms plan), 001C (proposed ground floor plan), 002B, 003D, 004D, 005C, 006C, 007E, 008B,100D, 101C, 104A, 102A, 103A, 200B, 201C; (25) 000B; Design and Access Statement by Carey Jones; Construction Management Plan by Watkin Jones; Ecological Assessment by Greengage; Energy Statement by GDM; Noise and Vibration Assessment by PDA; Phase One Preliminary Risk Assessment by Tier Consult; Service Management Plan by ADL Transport; Student Management Plan by Fresh Student Living; Sustainability Statement and BREEAM Pre-assessment by Iceni; Transport Statement by ADL Transport; Travel Plan by ADL Transport.

Reason: For the avoidance of doubt and in the interest of proper planning.

In addition to the above, the Section 106 Agreement for the development makes clear reference under Section 2.36 *'The Renewable Energy and Energy Efficiency Plan'* to *'target a reduction of at least 20% in carbon emissions', 'separate metering of all low and zero carbon technologies', building management system'* to allow monitoring of the energy systems, *'measures to enable future connection*

to a local energy network', 'measures to secure a post construction review of the Development' to certify that the stated systems have been incorporated, and *'identifying means of ensuring the provision of information to the Council.'*

The Section 106 Agreement for the development also makes clear reference under Section 2.46 *'The Sustainability Plan'* to ensure that the development achieves *'BREEAM Very Good, Excellent or Outstanding rating and attaining at least 60% of the credits in each of the Energy and Water and 40% of the credits in Materials categories'*. It is also a requirement for a *'pre-implementation review'* and a *'post-construction review'* to ensure that measures incorporated *'are achievable'*, prior to construction, and also *'have been achieved'*, post-construction.

3.0 SUMMARY OF REQUIREMENTS IN TERMS OF ENERGY

The energy requirements for the development, in terms of overall Building Regulations and Planning compliance can be summarised as follows:

- Development to achieve carbon reduction of 25% over 2010 Part L
- Development to achieve carbon reduction of 20% from renewables (if feasible). This is included within the overall 25% reduction requirement
- Development to achieve 60% of the available BREEAM Energy and Water credits

4.0 SUMMARY FINDINGS OF ENERGY STATEMENT WITH COMMENTS

The Energy Statement prepared by GDM dated May 2012 considers various site-wide energy strategies and concludes that the heating and hot water demands for the development would be best met by the use of air source heat pumps linked to a wet heating distribution system and central hot water provision. An option is provided for the future connection of 'Off-site Gas District Heating CHP'.

Whilst the Energy Statement considers the use of micro CHP for the generation of heating and hot water, no mention is made of the use of local electric heating in conjunction with gas-fired CHP for hot water production only. In addition, no mention is made of proven energy inefficiencies associated with a central plant wet heating system serving student rooms that may be rarely occupied. This is discussed later in this report.

CHP is therefore dismissed within the Energy Statement as a viable option; mainly due to the concern that CHP load profiles will not allow the CHP unit to operate for sufficient hours to meet the required energy demand. This is primarily due to the fact that the proposed CHP unit would be used to provide heating to the development as well as meeting the hot water demand.

The table below details the summary findings of the report.

		1 Site wide energy kWhr/sqm.year	2 Site wide carbon CO2.kg/year	3 Site wide energy contribution from LZC technology	4 Site wide carbon saving contribution from LZC technology	5 TER resi SAP results kgCO2.sqm	6 DER resi SAP results kgCO2.sqm	7 TER non resi SBEM results	8 BER non resi SBEM results	9 Whole Building regulated TER	10 Whole Building regulated BER /TER	11 Is carbon reduction 25% better than 2010 Building Regulations?	12 Draft EPC rating
A	**Gas baseline including energy efficiency measures**	166.66	410,562	N/A	N/A	Baseline 32.16	Baseline 37.46	Baseline 11.8	Baseline 11.6	Baseline 21.74	Baseline 24.23	No	N/A
B	**Option 1: Preferred LZC solution** Air Source Heat Pump serving heating and hot water + energy efficiency measures	75.2	295,989	22% (includes energy for pumps)	22.6% (includes carbon for pumps)	53.96	29.08	10.8	10.2	31.87	19.08	Yes	29
C	**Option 2: Preferred LZC solution:** Off Site gas District Heating CHP (potential connection to wet side of ASHP system when near off site connection is available)	115.19	306,484	31%	25%	32.16	23.08	21.4	16.6	26.65	19.74	Yes	37-39
	Not recommended for this project												
D	On Site gas fired micro CHP	130.65	347,653	22%	15%	32.16	32.81	11.8	10	21.74	21.14	No	N/A
E	On Site Gas boiler, Micro CHP, Biomass boiler	125.13	309,917	25%	25%	32.16	26.82	21.4	18.1	26.65	22.36	Yes with higher contribution from biomass boilers	N/A
F	Gas boilers + Micro CHP + solar PV (700sqm)	122.13	306,484	26%	25%	32.16	21.83	11.8	7.5	21.74	14.5	Yes	N/A
G	Gas boilers + solar thermal (900sqm)	139.1	360,760	17%	12%	32.16	28.57	21.4	21.6	26.65	25	No	N/A
H	Ground Source Heat Pump	68.3	232,543	19.40%	15%	53.96	29.78	14.7	7.3	33.87	18.28	Yes	N/A
I	Biomass (heating and hot water)	137.7	221,882	17%	46%	32.16	7.2	4.8	4.3	18.16	5.72	Yes	N/A

PERFORMANCE TARGETS

Carbon reduction of 25% over 2010 Part L Building Regulations (see column 11)

Carbon reduction of 20% from renewables (if feasible). 20% target is within the overall 25% improvement over 2010 Building Regs (see column 2)

5.0 DESIGN PROGRESSION

In order to ensure compliance with Planning, it is necessary to demonstrate that the baseline position for the development (in terms of energy) must exceed the minimum requirements necessary for Part L compliance, in addition to meeting the further measures detailed above relevant to this project.

The proposed building fabric is as follows:

Existing Walls with insulation added – 0.5 W/m^2K
New Walls – 0.25 W/m^2K
Roof – 0.15 W/m^2K
Ground Floor – 0.2 W/m^2K
Glazing – 1.5 W/m^2K (g = 0.64, soft, low E, argon filled)

From the developer's extensive experience of student accommodation, the most appropriate means of heating and hot water provision has been determined to be:

- Heating within all student clusters and studios to be by push-button (adjustable 1, 2 or 3 hours) thermostatically controlled electric panel radiators, with 'frost' (minimum heat setting) protection
- No heating to be provided in staircases and circulation areas
- Hot water by gas-fired CHP with buffer storage feeding unvented hot water cylinders, with gas-fired boiler back-up. It is currently proposed that 80% of the hot water demand will be met by operation of the CHP unit (as opposed to the boilers). This will be achieved by the provision of sufficient buffer storage with the CHP and hot water storage within the cylinders to allow the CHP plant to meet 80% of the hot water demand. The CHP plant will be sized such that operation will not be dictated by the base electrical load; ie the CHP size will be small such that the base electrical load will always be available when there is a hot water demand.

SAP reports have been prepared on the basis of the above and it can be clearly demonstrated that the CO_2 savings are greater than those proposed with the use of air source heat pumps within the Energy Statement. This is summarised as follows:

Design Assessment Stage	**Total Emissions ($kgCO_2$.sqm)**	**Total Saving over baseline (%)**
Baseline including energy efficiency measures	37.46	-
GDM Option 1 (Air Source Heat Pump serving heating & hot water & energy efficiency measures)	29.08	22.37%
CDP Option (Electric heating, hot water by gas-fired CHP & gas boiler back-up)	28.35	24.32%

The proposed use of air source heat pumps as the means of heat generation will dictate the need for a 'high-temperature' system; for instance Daikin Altherma, as mentioned in the Energy Statement. This system effectively operates as a twin-system where the additional temperature generation (up to 80degC) is achieved by the use of a second internal heat pump. This means that the efficiency of the system is considerably less than a traditional air source heat pump and the COP (Coefficient of Performance) can be as low as 2.0, as compared to a COP of approximately 4.0 with a traditional low-temperature air source heat pump system. Whilst the SAP is an effective means of comparing energy usage, in practice the energy usage of the system will be higher due to the need for heating water to be generated at high temperature throughout the year to meet both heating and hot water demands. There is therefore some doubt as to the extent of CO_2 savings suggested within the SAP with the use of that system.

6.0 REAL LIFE SITE ANALYSIS FOR STUDENT ACCOMMODATION ENERGY / EMISSIONS

Issues with the use of 'wet heating' systems

The Developer has extensive knowledge of student accommodation and has found the following issues with wet heating, generated by central plant:

- Main distribution pipework causes heat gains within the building. In partial load conditions (most of the time) heat is still distributed around the building which causes excessive gains in distribution routes (corridors mainly).

- The nature of student living dictates that a heating system should provide heat on demand and only when needed. It therefore makes little sense to provide a heating system that maintains design conditions even when the space is unoccupied. Students may only be in their rooms for, say, 30 minutes in the afternoon and then overnight. It is unlikely that students would turn radiator valves down on leaving their rooms which would then mean that the heating would be on for considerable periods of time with rooms unoccupied.

- Radiators have thermal lag due to the water content, which means that once the thermostat turns the heater off at set temperature the heater continues to emit which can cause overheating within the space. This also works in reverse at it takes time for the emitter to heat up. This results in inefficiency, particularly with student accommodation where heating may only be required for a short period of time.

- Experience has shown that students tend to open windows and leave heating on, particularly when they are not paying for their actual energy usage.

- It would not be practical to meter the heat usage within an individual room if wet heating is used.

Proposed locally controlled electric panel heaters

The proposed wall-mounted electric panel heaters operate via a user controlled boost switch (1, 2 or 3 hrs). When the heater is not manually turned on it will be off unless the temperature in the room falls below the frost setting (typically 12 deg). This makes it impossible to leave the heaters on all day. In addition, when the space is occupied and the timer runs out, the heater will turn off. The occupant will need to then activate the heater push-button controller. The gains in the space will generally be sufficient to maintain the temperature so it is likely that the occupant will not notice the heater is off and will not activate it again. This is again likely to result in energy savings.

The heating loads are so small that the heaters will take little time to heat the room and can then cycle to maintain comfort conditions.

As the heater is wired locally from the electrical supply it is comparatively easy to meter. This gives the Developer the opportunity to incentivise the occupants to run the heating economically.

Real site data

To substantiate the statement that electric panel heaters are more appropriate for student accommodation, the Developer has provided actual energy usage data

from a selection of student accommodation projects installed with various heating and hot water systems (see appendix B for summary).

- Fountain North is a 314 bed student scheme with gas heating and hot water production.
- Collegelands is a 598 bed student scheme with electric panel heaters and gas fired hot water plus CHP.
- Logie Green block B is 206 bed scheme with electric heating and electric hot water.
- Logie Green block C is 150 bed scheme with electric heating with gas fired hot water plus CHP.

A summary of the findings are:

Location	**Emissions kgCO_2/bed/Annum**
Fountain North	1,427.00
Collegelands	1,259.00
Logie Green Block B	1,260.00
Logie Green Block C	982.25

Fountain North is the residence with gas heating and hot water and that has the highest energy use and hence highest emissions.

The preferred installation would be comparable to either Collegelands or Logie Green Block C, both of which have proved to be between 12-31% more energy efficient (in terms of CO_2 emissions) than a traditional wet system.

See appendix B for summary of the fuel bills; please note that statutory bills can be provided if required.

In summary, SAP calculations have been carried out for electric heating in the student accommodation and the results pass and provide the required savings for the scheme to achieve an improvement over the CO_2 emissions stated in the Energy Statement. Review of the actual installed systems at various developments also shows that, in practice, electric heating with user push-button control has low energy use.

We would therefore propose that for the student accommodation the most appropriate means of heating and hot water provision for the development is CHP plant supplemented with gas-fired boilers for hot water production and local push-button thermostatically controlled electric panel heating for the student rooms. Staircases and circulation spaces will be unheated. The plant arrangement is indicated on the drawings included within Appendix C.

7.0 CONCLUSION

The proposed heating and hot water systems for the student accommodation provide a lower carbon and more energy efficient system than originally proposed in the Energy Statement.

A centralised plant room for the student accommodation development will provide energy efficient hot water. This will allow the development to be compatible for future conversion to a neighbourhood district heating system should this become available.

Heating within the student accommodation rooms will be provided by electric panel heaters which are a proven energy efficient solution for this building type.

The student accommodation development will benefit from operation of CHP supplemented with high efficiency gas condensing boilers. This is in compliance with The London Plan SPG which promotes the use of CHP.

The above measures will result in a carbon reduction of 24.32% over the Baseline which is an improvement on the air source heat pump system proposed in the original Energy Statement.

It is our firm view that this strategy put forward represents a pragmatic approach to achieving a low carbon development, that complies with the energy policies of the Local Authority, whilst also providing a solution that is ‘future proofed’ in respect of connection to a district heating network, should the opportunity arise in the future.

Appendix A

Student Residence SAP Block Compliance Report

Block Compliance

Property Reference: Cluster A (1st) Rev A
Survey Reference: Cluster A (1st)
Property: Cluster A (1st), Britannia Street

Issued on Date: 16/04/2013
Prop Type Ref:

SAP Rating:	70 C	CO2 Emissions (t/year):	4.27	DER: 26.99 Fail	Reduction: -25.7%	FEE: 50.5	ZC8:	0.00
Environmental:	74 C	General Requirements Compliance: Fail		TER: 21.48		HLP: 1.16	Energy cost:	£ 1173

CfSH Results	Version:	ENE1 Credits: N/A	ENE2 Credits: N/A	ENE7 Credits: N/A		CfSH Level:	N/A

Surveyor: Ian Carpenter, Tel: 01745 814800 Surveyor ID: E288-0002
Address: High Street, Denbigh, Denbighshire, LL16 3SD
Client: Watkin Jones WJC

Software Version: Elmhurst Energy Systems SAP2009 Calculator (Design System) version 3.08r12
SAP version: SAP 2009, Regs Region: England and Wales (Part L1A 2010), Calculation Type: New Dwelling As Designed

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Block Compliance Report

Property-Survey Reference	Multiplier (M)	Floor Area (F)	DER (D)	TER (T)	F x M	D x F x M	T x F x M
Cluster A (1st) Rev A-Cluster A (1st)	1	179.1	26.99	21.48	179.10	4,833.91	3,847.07
Cluster B (1st) Rev A-Cluster B (1st)	1	148.6	27.53	22.61	148.60	4,090.96	3,359.85
Cluster C (1st) Rev A-Cluster C (1st)	1	125.7	42.06	31.27	125.70	5,286.94	3,930.64
Cluster D (1st) Rev A-Cluster D (1st)	1	130.2	27.73	24.38	130.20	3,610.45	3,174.28
Cluster E (1st) Rev A-Cluster E (1st)	1	153.6	24.99	22.12	153.60	3,838.46	3,397.63
Studio 01.S01 Rev A-Studio 01.S01	1	17.2	40.93	60.62	17.20	704.00	1,042.66
Studio 01.S02 Rev A-Studio 01.S02	1	26.1	39.68	46.21	26.10	1,035.65	1,206.08
Studio 01.S03 Rev A-Studio 01.S03	1	19.8	38.06	55.23	19.80	753.59	1,093.55
Studio 01.S12 Rev A-Studio 01.S12	1	24	44.52	52.59	24.00	1,068.48	1,262.16
Studio 01.S11 Rev A-Studio 01.S11	1	18.3	35.19	56.34	18.30	643.98	1,031.02
Studio 01.S10 Rev A-Studio 01.S10	1	19.1	35.39	54.43	19.10	675.95	1,039.61
Studio 01.S09 Rev A-Studio 01.S09	1	36.3	43.72	43.51	36.30	1,587.04	1,579.41
Studio 01.S04 Rev A-Studio 01.S04	1	18.5	33.12	55.58	18.50	612.72	1,028.23
Studio 01.S05 Rev A-Studio 01.S05	1	18.5	34.02	56.54	18.50	629.37	1,045.99
Studio 01.S06 Rev A-Studio 01.S06	1	17.9	41.52	59.44	17.90	743.21	1,063.98
Studio 01.S07 Rev A-Studio 01.S07	1	18.2	39.39	58.76	18.20	716.90	1,069.43
Studio 01.S08 Rev A-Studio 01.S08	1	18.6	34.68	56.53	18.60	645.05	1,051.46
Cluster F (1st) Rev A-Cluster F (1st)	1	152.6	29.21	23.61	152.60	4,457.45	3,602.89
Studio 05.S01 Rev A-Studio 05.S01	1	17.4	42.61	64.56	17.40	741.41	1,123.34

Studio 05.S02 Rev A-Studio 05.S02	1	17.5	35.54	60.72	17.50	621.95	1,062.60
Studio 05.S03 Rev A-Studio 05.S03	1	16.9	35.67	62.13	16.90	602.82	1,050.00
Studio 05.S04 Rev A-Studio 05.S04	1	18.7	35.07	58.29	18.70	655.81	1,090.02
Studio 05.S05 Rev A-Studio 05.S05	1	14.8	37.08	67.88	14.80	548.78	1,004.62
Studio 05.S06 Rev A-Studio 05.S06	1	16.6	36.27	62.72	16.60	602.08	1,041.15
Studio 05.S07 Rev A-Studio 05.S07	1	19	35.96	57.59	19.00	683.24	1,094.21
Studio 05.S08 Rev A-Studio 05.S08	1	16.5	43.80	67.05	16.50	722.70	1,106.33
Studio 05.S09 Rev A-Studio 05.S09	1	17.2	43.71	64.08	17.20	751.81	1,102.18
Studio 05.S10 Rev A-Studio 05.S10	1	17.3	33.30	58.78	17.30	576.09	1,016.89
Studio 05.S11 Rev A-Studio 05.S11	1	23	33.78	49.23	23.00	776.94	1,132.29
Studio 05.S12 Rev A-Studio 05.S12	1	16.8	34.21	60.26	16.80	574.73	1,012.37
Studio 05.S13 Rev A-Studio 05.S13	1	17.7	43.56	62.74	17.70	771.01	1,110.50
Cluster A (GF) Rev A-Cluster A (GF)	1	152.6	29.51	23.55	152.60	4,503.23	3,593.73
Studio 00.S01 Rev A-Studio 00.S01	1	17.9	35.93	57.34	17.90	643.15	1,026.39
Studio 00.S02 Rev A-Studio 00.S02	1	24.5	35.62	46.93	24.50	872.69	1,149.79
Studio 00.S03 Rev A-Studio 00.S03	1	19.3	55.95	61.97	19.30	1,079.84	1,196.02
Studio 00.S04 Rev A-Studio 00.S04	1	16.74	66.02	72.64	16.74	1,105.17	1,215.99
Studio 00.S05 Rev A-Studio 00.S05	1	16.4	46.66	66.53	16.40	765.22	1,091.09
Studio 00.S06 Rev A-Studio 00.S06	1	20.6	58.10	63.98	20.60	1,196.86	1,317.99
Studio 00.S07 Rev A-Studio 00.S07	1	27.8	54.36	55.31	27.80	1,511.21	1,537.62
Studio 00.S08 Rev A-Studio 00.S08	1	17.9	57.68	69.33	17.90	1,032.47	1,241.01
Studio 00.S09 Rev A-Studio 00.S09	1	18.4	57.00	68.04	18.40	1,048.80	1,251.94
Studio 00.S10 Rev A-Studio 00.S10	1	18.9	44.91	61.55	18.90	848.80	1,163.30
Studio 00.S11 Rev A-Studio 00.S11	1	18.8	45.06	61.81	18.80	847.13	1,162.03
Studio 00.S12 Rev A-Studio 00.S12	1	26.5	35.41	46.05	26.50	938.37	1,220.33
Studio 00.S13 Rev A-Studio 00.S13	1	21.9	46.28	54.63	21.90	1,013.53	1,196.40
Studio 00.S14 Rev A-Studio 00.S14	1	23.9	36.99	49.17	23.90	884.06	1,175.16
Studio 00.S15 Rev A-Studio 00.S15	1	22.8	33.22	48.89	22.80	757.42	1,114.69
Studio 00.S16 Rev A-Studio 00.S16	1	19.8	32.96	53.15	19.80	652.61	1,052.37
Cluster A (2nd) Rev A-Cluster A (2nd)	1	179.1	17.54	17.60	179.10	3,141.41	3,152.16
Cluster B (2nd) Rev A-Cluster B (2nd)	1	148.6	18.61	18.80	148.60	2,765.45	2,793.68

Cluster C (2nd) Rev A -Cluster C (2nd)	1	161.9	22.88	19.99	161.90	3,704.27	3,236.38
Cluster D (2nd) Rev A -Cluster D (2nd)	1	130.2	19.20	20.62	130.20	2,499.84	2,684.72
Cluster E (2nd) Rev A -Cluster E (2nd)	1	153.6	17.79	18.95	153.60	2,732.54	2,910.72
Cluster F (2nd) Rev A-Cluster F (2nd)	1	152.6	19.82	19.75	152.60	3,024.53	3,013.85
Studio 02.S01 Rev A-Studio 02.S01	1	17.2	25.11	55.29	17.20	431.89	950.99
Studio 02.S02 Rev A-Studio 02.S02	1	26.1	31.66	45.10	26.10	826.33	1,177.11
Studio 02.S03 Rev A-Studio 02.S03	1	19.8	27.48	51.45	19.80	544.10	1,018.71
Studio 02.S04 Rev A-Studio 02.S04	1	18.5	22.11	51.49	18.50	409.04	952.57
Studio 02.S05 Rev A-Studio 02.S05	1	18.5	23.61	52.16	18.50	436.79	964.96
Studio 02.S06 Rev A-Studio 02.S06	1	17.9	28.60	54.61	17.90	511.94	977.52
Studio 02.S07 Rev A-Studio 02.S07	1	18.2	25.28	54.36	18.20	460.10	989.35
Studio 02.S08 Rev A-Studio 02.S08	1	18.6	24.68	52.75	18.60	459.05	981.15
Studio 02.S09 Rev A-Studio 02.S09	1	36.3	31.24	37.94	36.30	1,134.01	1,377.22
Studio 02.S10 Rev A-Studio 02.S10	1	19.1	25.19	50.25	19.10	481.13	959.78
Studio 02.S11 Rev A-Studio 02.S11	1	18.3	23.80	52.11	18.30	435.54	953.61
Studio 02.S12 Rev A-Studio 02.S12	1	24	33.76	48.19	24.00	810.24	1,156.56
Cluster A (3rd) Rev A-Cluster A (3rd)	1	172	27.89	22.07	172.00	4,797.08	3,796.04
Cluster B (3rd) Rev A-Cluster B (3rd)	1	148.6	18.63	18.80	148.60	2,768.42	2,793.68
Cluster C (3rd) Rev A-Cluster C (3rd)	1	161.9	22.86	19.99	161.90	3,701.03	3,236.38
Cluster D (3rd) Rev A-Cluster D (3rd)	1	130.2	19.99	20.62	130.20	2,602.70	2,684.72
Cluster E (3rd) Rev A-Cluster E (3rd)	1	153.6	18.84	18.95	153.60	2,893.82	2,910.72
Cluster F (3rd) Rev A-Cluster F (3rd)	1	152.6	19.90	19.75	152.60	3,036.74	3,013.85
Studio 03.S01 Rev A-Studio 03.S01	1	23	33.94	50.04	23.00	780.62	1,150.92
Studio 03.S02 Rev A-Studio 03.S02	1	20.9	34.04	53.26	20.90	711.44	1,113.13
Studio 03.S03 Rev A-Studio 03.S03	1	17.6	32.10	57.90	17.60	564.96	1,019.04
Studio 03.S04 Rev A-Studio 03.S04	1	17.5	30.36	57.29	17.50	531.30	1,002.58
Studio 03.S05 Rev A-Studio 03.S05	1	17.9	28.60	54.61	17.90	511.94	977.52
Studio 03.S06 Rev A-Studio 03.S06	1	18.2	25.28	54.36	18.20	460.10	989.35
Studio 03.S07 Rev A-Studio 03.S07	1	18.6	24.68	52.75	18.60	459.05	981.15
Studio 03.S08 Rev A-Studio 03.S08	1	19.1	24.76	50.25	19.10	472.92	959.78
Studio 03.S09 Rev A-Studio 03.S09	1	18.3	23.63	52.11	18.30	432.43	953.61

Block Compliance

Studio 03.S10 Rev A-Studio 03.S10	1	24	40.04	52.03	24.00	960.96	1,248.72
Studio 03.S11 Rev A-Studio 03.S11	1	36.3	34.57	39.45	36.30	1,254.89	1,432.04
Cluster B (4th) Rev A-Cluster B (4th)	1	161.9	32.22	24.58	161.90	5,216.42	3,979.50
Cluster C (4th) Rev A-Cluster C (4th)	1	130.2	21.64	21.52	130.20	2,817.53	2,801.90
Cluster D (4th) Rev A-Cluster D (4th)	1	153.6	19.60	19.40	153.60	3,010.56	2,979.84
Cluster E (4th) Rev A-Cluster E (4th)	1	152.6	21.17	20.22	152.60	3,230.54	3,085.57
Studio 04.S01 Rev A-Studio 04.S01	1	19.1	33.56	54.24	19.10	641.00	1,035.98
Studio 04.S02 Rev A-Studio 04.S02	1	18.3	32.48	56.08	18.30	594.38	1,026.26
Studio 04.S03 Rev A-Studio 04.S03	1	24	55.78	60.39	24.00	1,338.72	1,449.36
Studio 04.S04 Rev A-Studio 04.S04	1	18.6	26.22	53.48	18.60	487.69	994.73
Studio 04.S05 Rev A-Studio 04.S05	1	18.2	31.20	57.12	18.20	567.84	1,039.58
Studio 04.S06 Rev A-Studio 04.S06	1	22	40.83	54.92	22.00	898.26	1,208.24
Studio 04.S07 Rev A-Studio 04.S07	1	24.5	46.46	52.31	24.50	1,138.27	1,281.60
Cluster A (4th) Rev A-Cluster A (4th)	1	148.6	29.40	24.24	148.60	4,368.84	3,602.06
Studio M.S01 Rev A-Studio M.S01	1	31.4	50.88	48.68	31.40	1,597.63	1,528.55
Studio Flat (1st) Rev A-Studio Flat (1st)	1	29.6	61.02	55.51	29.60	1,806.19	1,643.10
Studio Flat (2nd) Rev A-Studio Flat (2nd)	1	29.6	48.81	53.29	29.60	1,444.78	1,577.38
Studio M.S02 Rev A-Studio M.S02	1	16.3	54.79	70.36	16.30	893.08	1,146.87
Studio M.S03 Rev A-Studio M.S03	1	16.4	46.20	66.49	16.40	757.68	1,090.44
Studio M.S04 Rev A-Studio M.S04	1	23.9	53.94	58.08	23.90	1,289.17	1,388.11
Totals:	101	5224.04	3,505.62	4,824.70	5,224.04	148,111.17	164,851.62
Average DER = 28.35				PASS			
Average TER = 31.56							

Appendix B

Energy data from existing sites (Summary)

Logie Green Rd, Edinburgh

Utility consumption

	Electric									Gas
	Block B 206 units					Block C				Block C - 150 units
	Day	Night	Total			Day	Night	Total		
Sep-11	24494	9161	33655			14261	3139	17400		
Oct-11	33277	12471	45748			19527	4226	23753		40135
Nov-11	36056	14170	50226					0		27646
Dec-11	35649	13364	49013			21927	6034	27961		16032
Jan-12	43511	13977	57488			26760	6669	33429		29501
Feb-12	46192	15640	61832					0		
Mar-12	39556	14315	53871			21012	4969	25981		33460
Apr-12	33416	11948	45364			15538	4169	19707		31135
May-12	31208	11697	42905			18124	4435	22559		
Jun-12	16054	6574	22628			10692	2972	13664		53450
Jul-12	2108	963	3071			187	536	723		8064
Aug-12	2108	963	3071	#				0		
Sep-12	2108	963	3071	#				0		
Total:			**471943**					**185177**		**239423**

 # Assumed reading

To convert kWh to CO for eletric x 0.55
To convert kWh to CO for Gas x 0.19

Collegelands, Glasgow

Utility consumption

	Electric				Gas	
	Day	**Night**	**Total**			
Jul-11						
Aug-11						
Sep-11	53823	11689	65512			
Oct-11	80980	15858	96838			
Nov-11	87071	20974	108045			412618
Dec-11	94626	25944	120570			
Jan-12	99618	26893	126511			
Feb-12	93826	24425	118251			
Mar-12	80887	20810	101697			82867
Apr-12	72598	18184	90782			66679
May-12	68924	18288	87212			48584
Jun-12	47839	12890	60729			44689
Jul-12	37010	10478	47488			33841
Aug-12	37010	10478	47488	#		34282
Sep-12	37010	10478	47488	#		
Total:			**1118611**			**723560**

Assumed reading

To convert kWh to CO for eletric x 0.55
To convert kWh to CO for Gas x 0.19

Fountain north, Edinburgh

Utility consumption

	Electric					Gas
	Day	Night	Total			
Aug-11	17401	5347	22748			61732
Sep-11	27048	6157	33205			6155
Oct-11	31325	7461	38786			10394
Nov-11	30680	7454	38134			74910
Dec-11	25520	7072	32592			187658
Jan-12	28106	7230	35336			101116
Feb-12	28106	7230	35336	#		150354
Mar-12	30992	7560	38552			130557
Apr-12	26247	6869	33116			99237
May-12	29186	8215	37401			113181
Jun-12	22534	6839	29373			80061
Jul-12	19435	6217	25652			45507
Aug-12	17990	6023	24013			
Sep-12	17990	6023	24013	#		
Total			**448257**			**1060862**

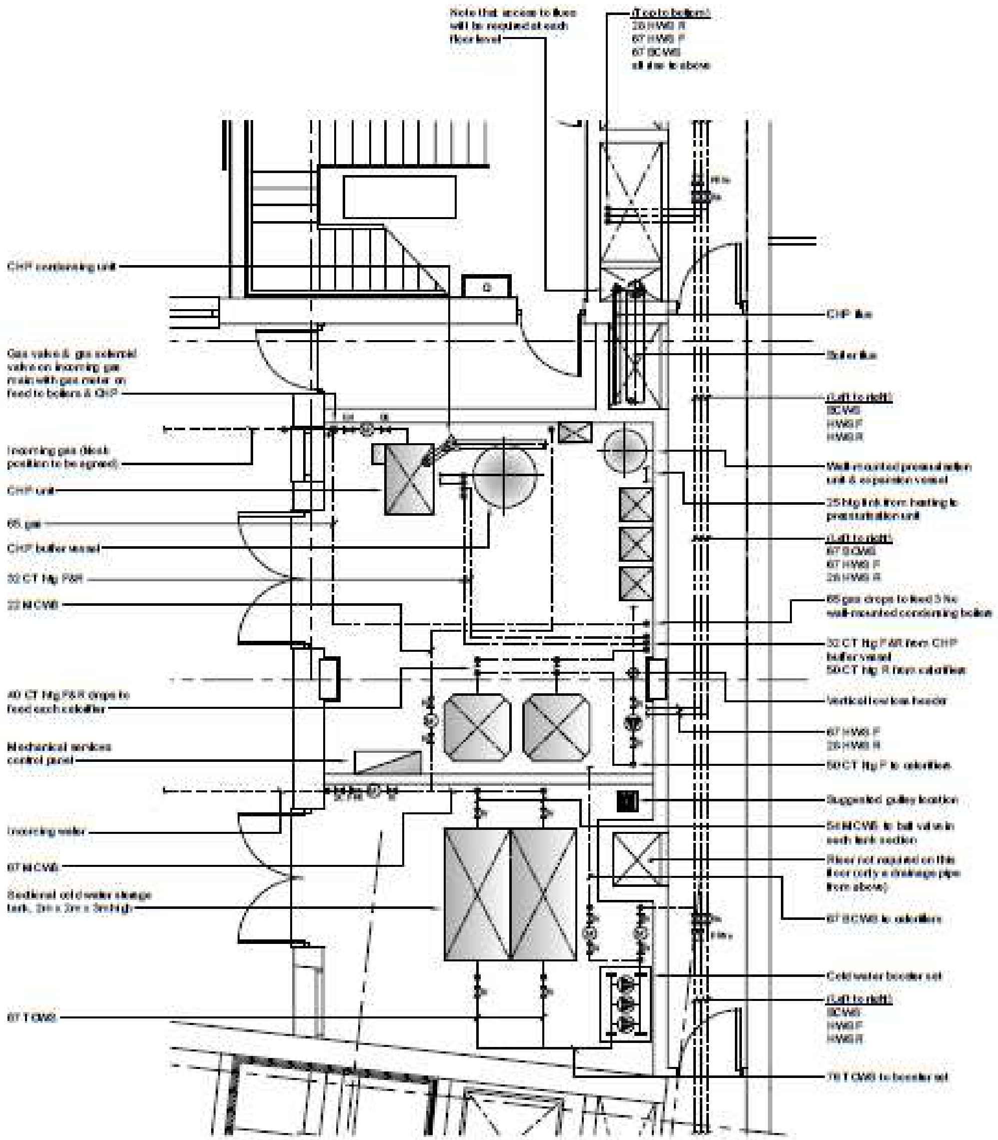
Assumed

To convert kWh to CO for eletric x 0.55
To convert kWh to CO for Gas x 0.19

Appendix C

CDP Drawings:

P1495/M01/P1 – Boiler Room and Tank Room Mechanical Services Plan
P1495/M02/P1 – Mechanical Services Schematics



LEGEND & ABBREVIATIONS

SYMBOL	DESCRIPTION
	Pipework underfloor
	Pipework at low level
	Pipework at high level
	Pipework above ceiling
	Pipework rise or drop
	Pump
IV	Isolation valve
M	Meter
PRV	Pressure regulating valve
GV	Gas valve

1. Do not scale from this drawing.
2. This drawing is to be read in conjunction with the mechanical specification for this contract.

REV	DATE	DETAILS	CHK
P1	05.04.13	Preliminary - issued for comment	IC

ISSUED FOR COMMENT

CLIENT
WATKIN JONES CONSTRUCTION

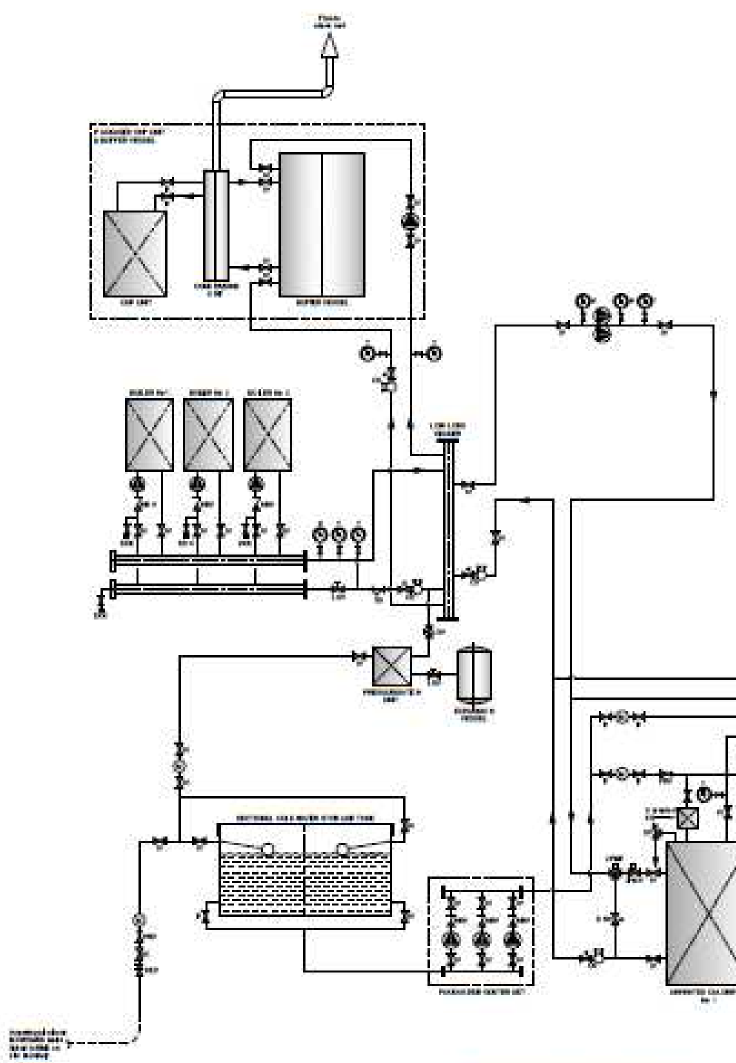
PROJECT
STUDENT ACCOMMODATION DEVELOPMENT
BRITANNIA STREET
CAMDEN

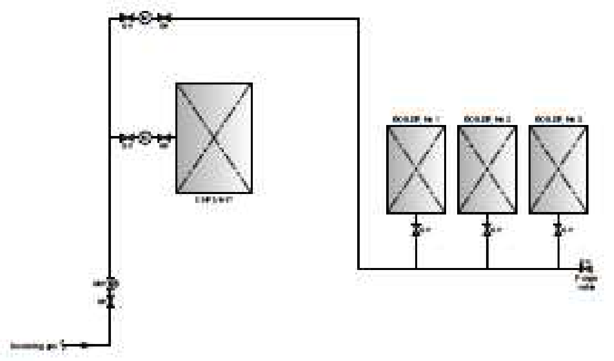
DRAWING TITLE
BOILER ROOM & TANK ROOM
MECHANICAL SERVICES PLAN

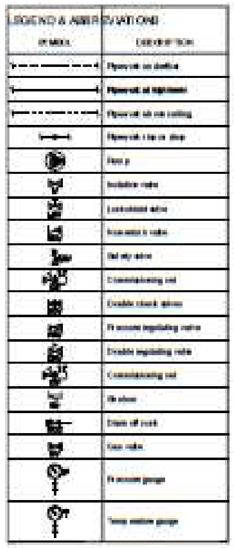
CDP
Carpenter Davies Partnership LTD
53 HIGH STREET
DENBIGH DENBIGHSHIRE LL16 3JD
Tel 01745 814 800 Fax 01745 814 801
E-Mail cdp@carpenterdavies.co.uk

SCALE	DRAWN	CHECKED
1:50 @ A2	Gee	IC
	DATE 01.04.13	DATE 05.04.13

DRAWING NUMBER: P1495/M01
REVISION: P1







ISSUED FOR COMMENT

WATKIN JONES CONSTRUCTION

STUDENT ACCOMMODATION
DEVELOPMENT
BRITANNIA STREET
CAMDEN

MECHANICAL SERVICES
SCHEMATICS

CDP
Carpenter Davies Partnership

P1495/M02

P1