### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.84
0.84 is the overall limiting efficien For a multiple boiler system the li	cy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	3.4	20
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

### Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

|--|

### Criterion 4: The performance of the building, as built, is consistent with the BER

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

### 4.4 Design air permeability

Beergin am perimeasinity		
Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	10

4	4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
	4.6	Has commissioning been completed satisfactorily?	Separate submission
4	4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

### **Criterion 5: Providing information**

5.1	Has a suitable building log-book been prepared?	Separate submission

## Technical Data Sheet (Actual vs. Notional Building)

**HVAC Systems Performance** 

### **Building Global Parameters**

	Actual	Notiona
Area (m2)	67495	67495
External area (m2)	52245	52245
Weather	LON	NOJ
Infiltration (m3/hm2 @ 50Pa)	10	10
Average conductance (W/K)	31580.6	21403.7
Average U-value (W/m2K)	9.0	0.41
Alpha value (%)	5.79	9

67495	29
52245	52
LON	2
10	10
31580.6	21
9.0	0.
5.79	9
52245 LON 10 31580.6 5.79	

		Actual	Notional	System Type	Heat dem	Cool dem	Heat con	Cool con	Aux con	Heat	Cool	Heat gen	Cool gen	
Area (m2)	(	67495	67495	,	MU/m2	MJ/m2	kWh/m2		kWh/m2		SSEER	ш	SEER	
External area (m2)	агеа (m2)	52245	52245	ST] Constant volume	volume sys	system (variable fresh air rate), [HS]	le fresh air		LTHW boiler, [HFT]		Natural Gas, [	[CFT] Grid S	Supplied Electric	ctric
Weather		LON	NO	Actual	1.8	160.4	0.5	20.7	9.2	1.04	2.15	0.84	4.1	
Infiltration	Infiltration (m3/hm2 @ 50Pa)	10	10	Notional	22.2	145	7.4	24.1	23.7	0.83	1.67	-	-	
Average c	Average conductance (W/K)	31580.6	21403.7	[ST] Single-duct VAV,	ct VAV, [HS	[HS] LTHW boiler, [HFT]	ler, [НFT] N	Natural Gas,	[CFT] Grid	I Supplied Electricity	<b>Electricity</b>			
Average l	Average U-value (W/m2K)	9.0	0.41	Actual	5.5	200.3	2.1	20.2	8.4	0.73	2.75	0.84	4.1	
Alpha value (%)	(%) an	5.79	10	Notional	10.6	197.9	3.6	32.9	23.7	0.83	1.67			
Diff	Building Hee			[ST] Fan coil systems,	ystems, [H	[HS] LTHW boiler, [HFT]		Natural Gas	Gas, [СFT] Gri	<b>Grid Supplied</b>	Electricity			
	aeo Silin			Actual	0	15378.9	0	335.1	5.6	92.0	12.75	0.84	20	
% area	<b>Building Type</b>			Notional	0	15092	0	2510.3	21.7	0.83	1.67	-		
	Office			ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT]	ystems, [H	ы LTHW bo	iler, [HFT] I	Vatural Gas	, [CFT] Gri	<b>Grid Supplied Electricity</b>	Electricity			
	Secondary school			Actual	94.4	219	34.7	23.3	6.1	92'0	2.61	0.84	4.1	
	Further education universities	/ersities		Notional	90.6	118.8	30.3	19.8	21.9	0.83	1.67	-	-	
	Primary health care buildings Nursing residential homes and hostels	uildings mes and hostels		[ST] Constant volume	volume sys	system (variable fresh air rate), [HS]	le fresh air		LTHW boiler, [HFT]	er, [HFT] N	Natural Gas, [	[CFT] Grid S	Grid Supplied Electric	ctric
	Hospital			Actual	1.7	232.6	0.4	30	9.2	1.04	2.15	0.84	4.1	
	Hotel			Notional	4.9	251.2	1.6	41.8	23.7	0.83	1.67	1	-	
	Restaurant/public house	Se		ST] Constant volume		system (variable fresh air rate), [HS]	le fresh air		LTHW boiler, [HFT]		Natural Gas, [	[CFT] Grid S	Grid Supplied Electric	ctric
	Sports ground arena			Actual	126.7	6.07	33.7	9.1	6.6	1.04	2.15	0.84	4.1	
	Retail			Notional	131.3	47.5	43.9	7.9	20.3	0.83	1.67			
-	Warehouse and storage Theatres/cinemas/music halls and auditoria	ge usic halls and au	ditoria	[ST] Constant volume	volume sys	system (variable fresh air rate),	le fresh air	[HS]	LTHW boiler, [HFT]	er, [HFT] N	Natural Gas, [	[CFT] Grid S	Supplied Electric	ctric
	Social clubs			Actual	0.8	189.6	0.2	24.4	9.2	1.04	2.15	0.84	4.1	
	Community/day centre	0		Notional	19.6	166.7	6.6	27.7	23.7	0.83	1.67	-	-	
	Prisons Prisons			ST] Constant volume		system (variable fresh air rate), [HS]	le fresh air		LTHW boile	er, [HFT] N	LTHW boiler, [HFT] Natural Gas, [	[CFT] Grid S	Supplied Electric	ctric
	Emergency services			Actual	14.8	81.9	3.9	10.6	9.2	1.04	2.15	0.84	4.1	
	Crown and county courts	ırts		Notional	46.7	88.1	15.6	14.6	23.7	0.83	1.67	-		
	Bus station/train station/seaport terminal	in/seaport termina		ST] Constant volume		tem (variat	le fresh air	rate), [HS]	LTHW boile	er, [HFT] N	system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT]	[CFT] Grid S	<b>Grid Supplied Electric</b>	ctric
	Workshops/maintenance depot	nce depot		Actual	0	261.1	0	30.6	9.7	0.99	2.37	0.84	4.1	
55	l elephone exchanges Indiistrial process building	ilding		Notional	2.4	227.6	0.8	37.9	21.5	0.83	1.67	-	-	
e e	Launderette	n		[ST] Constant volum	a)	system (variable fresh air rate), [HS]	le fresh air	rate), [HS]	LTHW boiler, [HFT]	er, [HFT] N	Natural Gas, [	[CFT] Grid S	Supplied Electric	ctric
	Dwelling			Actual	93.8	26.5	25	3.4	27.4	1.04	2.15	0.84	4.1	
-	Retall Warehouses  Miscellaneous 24hr activities	activities		Notional	323.5	24.3	108.3	4	46.6	0.83	1.67	-	-	

	HVAC Syst		ems Performance	rmanc	e (cont.)	t.)					
Sy	System Type Heat dem Cool dem Heat MJ/m2 MJ/m2 KWh/i	Heat dem MJ/m2	Cool dem MJ/m2	n2	Cool kWh/m2	Cool Aux Heat KWh/m2 SSEEF	Heat SSEEF	Cool SSEER	Heat G SEFF	Cool G SEER	
<u> S </u>	IST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electric	volume sys	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas, [	CFT] Grid \$	Supplied El	ctric
	Actual	0	619.5	0	79.9	14.3	1.04	2.15	0.84	4.1	
	Notional	0	616.2	0	102.5	37	0.83	1.67			
<u> S </u>	IST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	ct VAV, [HS	] LTHW boi	ler, [HFT] N	atural Gas,	[CFT] Grid	Supplied E	:lectricity			
	Actual	0	0	0	0	4.5	0.72	2.8	0.84	4.1	
	Notional	0	0	0	0	17.2	0.83	1.67			
<u>လ</u>	IST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	ct VAV, [HS	] LTHW boi	ler, [HFT] N	atural Gas,	CFT] Grid	Supplied E	<b>Electricity</b>			
	Actual	17.6	8.7	6.8	0.9	0.8	0.72	2.8	0.84	4.1	
	Notional	9.6	10	3.3	1.7	34.4	0.83	1.67			
											_

### Key to terms

- Alpha value (%)
  Heat dem (MJ/m2)
  Cool dem (MJ/m2)
  Heat con (KWh/m2)
  Aux con (KWh/m2)
  Heat SSEF
  Cool SSER
  Heat gen SSEFF
  Cool gen SSEFR
  ST
  HS
  HFT
- = percentage of the building's average heat transfer coefficient which s due to thermal bridging
  = Heating energy demand
  = Cooling energy demand
  = Heating energy consumption
  = Auxiliary energy consumption
  = Auxiliary energy consumption
  = Heating system seasonal efficiency
  = Cooling system seasonal efficiency
  = Cooling generator seasonal efficiency ratio
  = System type
  = Heat source
  = Heating fuel type
  = Cooling fuel type
  = Cooling fuel type

### **BRUKL Output Document**



Compliance with England and Wales Building Regulations Part L

### **Project name**

UKCMRI 'Be Lean' Scheme

As designed

**Date:** Tue Jul 27 16:55:02 2010

### Administrative information

**Building Details** 

Address: London, NW1

**Certification tool** 

Calculation engine: Apache **Calculation engine version:** 6.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.0.6

BRUKL compliance check version: v3.5.a.0

**Owner Details** 

Name: Owner

Telephone number: Phone

Address: , , Postcode

Certifier details

Name: URS

Telephone number: Phone

Address: Street Address, City, Postcode

### Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	54.2 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	39.1 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	34.9 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

### Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	Ua-Limit	Ua-Calc	Ui-Limit	U <sub>i-Calc</sub>	Surface where this maximum value occurs*
Wall**	0.35	0.18	0.7	0.58	B2ML0006:Surf[4]
Floor	0.25	0.2	0.7	0.25	B2ML0009:Surf[0]
Roof	0.25	0.16	0.35	0.16	B1CR0004:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.68	3.3	2.23	L0CR0026:Surf[3]
Personnel doors	2.2	0	3	0	No Personnel doors in building
Vehicle access & similar large doors	1.5	0	4	0	No Vehicle access doors in building
High usage entrance doors	6	0	6	0	No High usage entrance doors in building

Ua-Limit = Limiting area-weighted average U-values [W/(m2K)] Ua-Calc = Calculated area-weighted average U-values [W/(m2K)]

U<sub>i-Limit</sub> = Limiting individual element U-values [W/(m2K)]

### 2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

### 2.3 Are all building services standards acceptable?

2.3a-1 BRF CV system

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building		
Heat source efficiency	0.84	0.85		
0.84 is the overall limiting efficien For a multiple poller system the li	0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.  2.30- No HVS in project, or hot water is provided by HVAC system"  Efficiency check Limiting Cooling Nominal efficiency This building			
Efficiency check	Limiting Cooling Nominal efficiency	This building		
Cooling efficiency	2.25	7.2		
Efficiency check	Limiting Specific Fan Power	This building		
SFP	2.5	2.5		

### 2.3a-2 CL3+ CV System

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-3 General CV system - Atrium, Writeup, Tertiary Area

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building	
Heat source efficiency	0.84	0.85	
0.84 is the overall limiting efficien	0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building	
Cooling efficiency	2.25	7.2	
Efficiency check	Limiting Specific Fan Power	This building	
SFP	2.5	2.5	

### 2.3a-4 Plantroom Mech System

Efficiency check	Limiting heat source seasonal efficiency	This building	
Heat source efficiency	0.84	0.85	
0.84 is the overall limiting efficier For a multiple boiler system the li	0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building	
Cooling efficiency	2.25	7.2	
Efficiency check	Limiting Specific Fan Power	This building	
SFP	2	2	

Ui-Calc = Calculated individual element U-values [W/(m2K)]

<sup>\*</sup> There might be more than one surface exceeding the limiting standards.

<sup>\*\*</sup> Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.

<sup>\*\*\*</sup> Display windows and similar glazing are not required to meet the standard given in this table.

### 2.3a-5 Primary/Secondary Lab- single duct VAV

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building	
Heat source efficiency	0.84	0.85	
0.84 is the overall limiting efficier For a multiple boiler system the I	0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building	
Cooling efficiency	2.25	7.2	
Efficiency check	Limiting Specific Fan Power	This building	
SFP	2.5	2.3	

### 2.3a-6 BRF Tertiary CV system

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building	
Heat source efficiency	0.84	0.85	
0.84 is the overall limiting efficien For a multiple boiler system the li	0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building	
Cooling efficiency	2.25	7.2	
Efficiency check	Limiting Specific Fan Power	This building	
SFP	2.5	2.5	

### 2.3a-7 General FCU system - Offices, Meeting Rooms, Restaurant/SEE/stem standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building		
Heat source efficiency	0.84	0.85		
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.				
Efficiency check	Limiting Cooling Nominal efficiency	This building		
Cooling efficiency	2.25	7.2		
Efficiency check	Limiting Specific Fan Power	This building		
SFP	2	2		

### 2.3a-8 Imaging CV System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building	
Heat source efficiency	0.84	0.85	
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.			
Efficiency check	Limiting Cooling Nominal efficiency	This building	
Cooling efficiency	2.25	7.2	
Efficiency check	Limiting Specific Fan Power	This building	
SFP	2.5	2.5	

### 2.3a-9 Lecture Theatre - CV System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building	
Heat source efficiency	0.84	0.85	
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.			
Efficiency check	Limiting Cooling Nominal efficiency	This building	
Cooling efficiency	2.25	7.2	
Efficiency check	Limiting Specific Fan Power	This building	
SFP	2.5	2.5	

### 2.3a-10 Kitchen CV system

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

### 2.3a-11 Loading Bay Mech System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficier For a multiple boiler system the I	ncy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

### 2.3a-12 CL3 CV System

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	3.4	20
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

### Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

|--|

### Criterion 4: The performance of the building, as built, is consistent with the BER

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

### 4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

### **Criterion 5: Providing information**

5.1	Has a suitable building log-book been prepared?	Separate submission

## Technical Data Sheet (Actual vs. Notional Building)

**HVAC Systems Performance** 

### **Building Global Parameters**

	Actual	Notiona
Area (m2)	67495	67495
External area (m2)	52245	52245
Weather	LON	NOJ
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	26066.7	21403.7
Average U-value (W/m2K)	0.5	0.41
Alpha value (%)	7.01	10

C.O.	7.01		
Average O-value (vvilitzh)	Alpha value (%)	<b>Building Use</b>	Owy Touibling Type

Building Type	Office	Primary school
% area		
	Building Typ	Building Typ

	System Type			Heat con	Cool con	Aux con	Heat	Cool	Heat gen	Cool gen
		IVD/m2	MD/m2	KWh/m2	kWh/m2	kwh/m2	SSEEF	SSEER	SEFF	SEER
	[ST] Constan	STI Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas,	[CFT] Grid \$	Supplied E
	Actual	0.2	191.4	0.1	9.7	9.2	9.0	5.5	0.85	6.8
	Notional	22.2	145	7.4	24.1	23.7	0.83	1.67		
	[ST] Single-d	ST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	J LTHW boi	ler, [HFT] N	latural Gas	, [CFT] Grid	Supplied E	lectricity		
	Actual	2.5	239.4	0.9	12.1	8.4	0.8	5.5	0.85	6.8
	Notional	10.6	197.9	3.6	32.9	23.7	0.83	1.67	-	
	ST] Fan coil	ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT]	S] LTHW bo	iler, [HFT] I	Natural Gas	, [CFT] Grid	<b>Grid Supplied Electricity</b>	Electricity		
	Actual	0	15606.3	0	788.2	5.6	0.8	5.5	0.85	20
	Notional	0	15092	0	2510.3	21.7	0.83	1.67	-	
	ST] Fan coil	ST] Fan coil systems, [HS] LTHW boiler, [HFT]	S] LTHW bo	iler, [HFT] I	Natural Gas	; [CFT] Grid	Natural Gas, [CFT] Grid Supplied Electricity	Electricity		
	Actual	9.69	181.3	24.2	9.2	6.1	8.0	5.5	0.85	6.8
	Notional	90.6	118.8	30.3	19.8	21.9	0.83	1.67	-	-
<u> </u>	ST] Constan	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas,	CFT] Grid \$	Supplied E
	Actual	0	298.7	0	15.1	9.2	8.0	5.5	0.85	6.8
	Notional	4.9	251.2	1.6	41.8	23.7	0.83	1.67		
	[ST] Constan	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT]	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas,	[CFT] Grid \$	Grid Supplied E
	Actual	84.7	55.8	29.4	2.8	9.9	8.0	5.5	0.85	6.8
	Notional	131.3	47.5	43.9	7.9	20.3	0.83	1.67		
	ST] Constan	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [СFT] Grid Supplied E	tem (variab	le fresh air	rate), [HS]	LTHW boile	эг, [НFТ] Na	tural Gas,	[CFT] Grid 9	Supplied E
	Actual	0	236.8	0	12	9.2	0.8	5.5	0.85	6.8
	Notional	19.6	166.7	6.6	27.7	23.7	0.83	1.67		
	[ST] Constan	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas,	[CFT] Grid 9	Supplied E
	Actual	5.8	104.6	2	5.3	9.2	9.0	5.5	0.85	6.8
	Notional	46.7	88.1	15.6	14.6	23.7	0.83	1.67	-	1
	ST] Constan	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas,	[CFT] Grid \$	Supplied E
	Actual	0	292.6	0	14.8	9.7	0.8	5.5	0.85	6.8
	Notional	2.4	227.6	0.8	37.9	21.5	0.83	1.67		-
	[ST] Constan	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [СFT] Grid Supplied E	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas,	[CFT] Grid \$	Supplied E
	Actual	53.2	32.2	18.5	1.6	27.4	8.0	5.5	0.85	6.8
	Notional	303 5	27.3	1083	7	76.6	0.83	1 67		

	HVAC Syst		ems Performance	rmanc	e (cont.)	t.)					
Sy	System Type Heat dem Cool dem Heat MJ/m2 MJ/m2 kWh/i	Heat dem MJ/m2	Cool dem MJ/m2	n2	Cool kWh/m2	Cool Aux kWh/m2 kWh/m2	Heat SSEEF	Cool SSEER	Heat G SEFF	Cool G SEER	
IST	IST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electric	volume sys	tem (variab	le fresh air	rate), [HS]	LTHW boile	≥r, [HFT] Na	tural Gas, [	CFT] Grid 9	Supplied Ele	ctric
	Actual	0	700.3	0	35.4	14.3	8.0	5.5	0.85	6.8	
	Notional	0	616.2	0	102.5	37	0.83	1.67			
ISI	IST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	ct VAV, [HS	i] LTHW boi	ler, [HFT] N	atural Gas,	[CFT] Grid	Supplied E	:lectricity			
	Actual	0	0	0	0	4.5	8.0	5.5	0.85	6.8	
	Notional	0	0	0	0	17.2	0.83	1.67			
IS]	[ST] Single-duct VA	ct VAV, [HS	V, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	ler, [HF∏ N	atural Gas,	[CFT] Grid	Supplied E	:lectricity			
	Actual	1.1	17.2	0.4	0.9	0.8	8.0	5.5	0.85	6.8	
	Notional	9.9	10	3.3	1.7	34.4	0.83	1.67			

- = percentage of the building's average heat transfer coefficient which s due to thermal bridging
  = Heating energy demand
  = Cooling energy demand
  = Heating energy consumption
  = Auxiliary energy consumption
  = Heating system seasonal efficiency
  = Cooling system seasonal efficiency
  = Cooling generator seasonal energy efficiency ratio
  = Heating generator seasonal energy efficiency ratio
  = System type
  = Heating fuel type
  = Cooling fuel type
  = Cooling fuel type

- Alpha value (%)
  Heat dem (MJ/m2)
  Cool dem (MJ/m2)
  Cool con (KWh/m2)
  Aux con (KWh/m2)
  Heat SSEFF
  Cool SSEER
  Heat gen SSEFF
  Cool gen SSEER
  ST
  HS
  HFT
  COFT

### **BRUKL Output Document**



Compliance with England and Wales Building Regulations Part L

### **Project name**

UKCMRI 'Be Clean' Scheme

As designed

Date: Fri Jul 30 00:52:52 2010

### Administrative information

**Building Details** 

Address: London, NW1

**Certification tool** 

Calculation engine: Apache

**Calculation engine version:** 6.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.0.6

BRUKL compliance check version: v3.5.a.0

**Owner Details** 

Name: Owner

Telephone number: Phone Address: , , Postcode

Certifier details

Name: URS

Telephone number: Phone

Address: Street Address, City, Postcode

### Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	54.2 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	39.1 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	21.1 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

### Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	Ua-Limit	Ua-calc	U <sub>i-Limit</sub>	U <sub>i-Calc</sub>	Surface where this maximum value occurs*
Wall**	0.35	0.18	0.7	0.58	B2ML0006:Surf[4]
Floor	0.25	0.2	0.7	0.25	B2ML0009:Surf[0]
Roof	0.25	0.16	0.35	0.16	B1CR0004:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.68	3.3	2.23	L0CR0026:Surf[3]
Personnel doors	2.2	0	3	0	No Personnel doors in building
Vehicle access & similar large doors	1.5	0	4	0	No Vehicle access doors in building
High usage entrance doors	6	0	6	0	No High usage entrance doors in building

Ua-Limit = Limiting area-weighted average U-values [W/(m2K)] Ua-Calc = Calculated area-weighted average U-values [W/(m2K)]

Ui-Limit = Limiting individual element U-values [W/(m2K)]

### 2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

### 2.3 Are all building services standards acceptable?

2.3a-1 BRF CV system

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien	cy for a single or a multiple boiler system. miting efficiency for any individual policy is 0.80.	
Efficiency check	miting efficiency for any individual boiler is 0.80. If hot water is provided by HVAC system" Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-2 CL3+ CV System

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
	ncy for a single or a multiple boiler system. Imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-3 General CV system - Atrium, Writeup, Tertiary Area

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien	cy for a single or a multiple boiler system. miting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-4 Plantroom Mech System

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien For a multiple boiler system the li	ncy for a single or a multiple boiler system. Imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

Ui-Calc = Calculated individual element U-values [W/(m2K)]

<sup>\*</sup> There might be more than one surface exceeding the limiting standards.

<sup>\*\*</sup> Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.

<sup>\*\*\*</sup> Display windows and similar glazing are not required to meet the standard given in this table.

### 2.3a-5 Primary/Secondary Lab- single duct VAV

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building				
Heat source efficiency	0.84	0.85				
0.84 is the overall limiting efficier For a multiple boiler system the I	0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.					
Efficiency check	Limiting Cooling Nominal efficiency	This building				
Cooling efficiency	2.25	7.2				
Efficiency check	Limiting Specific Fan Power	This building				
SFP	2.5	2.3				

### 2.3a-6 BRF Tertiary CV system

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien For a multiple boiler system the li	icy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-7 General FCU system - Offices, Meeting Rooms, Restaurant/SEE/stem standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
	icy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency 2.25		7.2
Efficiency check Limiting Specific Fan Power		This building
SFP	2	2

### 2.3a-8 Imaging CV System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-9 Lecture Theatre - CV System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-10 Kitchen CV system

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien For a multiple boiler system the li	ncy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

### 2.3a-11 Loading Bay Mech System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficier For a multiple boiler system the I	ncy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

### 2.3a-12 CL3 CV System

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	3.4	20
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

### Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

|--|

### Criterion 4: The performance of the building, as built, is consistent with the BER

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

### 4.4 Design air permeability

Doog. an pormoutinty		
Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	Has commissioning been completed satisfactorily?	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

### **Criterion 5: Providing information**

5.1	Has a suitable building log-book been prepared?	Separate submission

## Technical Data Sheet (Actual vs. Notional Building)

### **Building Global Parameters**

	Actual	Notiona
Area (m2)	67495	67495
External area (m2)	52245	52245
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	26066.7	21403.7
Average U-value (W/m2K)	0.5	0.41
Alpha value (%)	7.01	10

	Actual	Z
Area (m2)	67495	0
External area (m2)	52245	Ωí
Weather	LON	ĭ
Infiltration (m3/hm2 @ 50Pa)	5	7
Average conductance (W/K)	26066.7	7
Average U-value (W/m2K)	0.5	o
Alpha value (%)	7.01	7

	oe.	
ling Use	Building Typ	Office
Build	% area	

**HVAC Systems Performance** 

ું જે	System Type	Heat dem	Cool dem	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool	Heat gen SEFF	Cool gen
<u>s</u>	ST] Constant	>	tem (variab	le fresh air	rate), [HS]	LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied El
	Actual	0.2	191.4	0	9.7	9.2	0.8	5.5	0.85	6.8
	Notional	22.2	145	7.4	24.1	23.7	0.83	1.67	-	
<u> </u>	[ST] Single-du	uct VAV, [HS	[HS] LTHW boiler, [HFT]	ler, [HFT] N	Natural Gas,	FF	<b>Grid Supplied Electricity</b>	≣lectricity		
	Actual	2.5	239.4	0.3	12.1	8.4	0.8	5.5	0.85	6.8
	Notional	10.6	197.9	3.6	32.9	23.7	0.83	1.67	-	-
<u> </u>	ST] Fan coil s	systems, [HS	[HS] LTHW boiler, [HFT]		Natural Gas	Gas, [CFT] Gric	<b>Grid Supplied</b>	Electricity		
	Actual	0	15606.3	0	788.2	5.6	0.8	5.5	0.85	20
	Notional	0	15092	0	2510.3	21.7	0.83	1.67	-	
<u>s</u>	ST] Fan coil s	systems, [HS	[HS] LTHW boiler, [HFT]		Natural Gas, [CFT]		<b>Grid Supplied</b>	Electricity		
	Actual	9.69	181.3	5.9	9.2	6.1	0.8	5.5	0.85	6.8
	Notional	90.6	118.8	30.3	19.8	21.9	0.83	1.67	-	
<u>s</u>	ST] Constant	it volume sys	system (variable fresh air rate),	le fresh air	[HS]	LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied El
	Actual	0	298.7	0	15.1	9.2	0.8	5.5	0.85	6.8
	Notional	4.9	251.2	1.6	41.8	23.7	0.83	1.67	-	-
<u>s</u>	ST] Constant	t volume sys	system (variable fresh air rate),	le fresh air	[HS]	LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied Eld
	Actual	84.7	55.8	8	2.8	6.6	0.8	5.5	0.85	6.8
	Notional	131.3	47.5	43.9	7.9	20.3	0.83	1.67	1	-
<u>s</u>	ST] Constant	t volume sys	system (variable fresh air rate),	le fresh air	[HS]	LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied Ele
	Actual	0	236.8	0	12	9.2	0.8	5.5	0.85	6.8
	Notional	19.6	166.7	6.6	27.7	23.7	0.83	1.67	-	
<u>s</u>	ST] Constant	t volume sys	system (variable fresh air rate),	le fresh air	[HS]	LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied El
	Actual	5.8	104.6	0.8	5.3	9.2	0.8	5.5	0.85	6.8
	Notional	46.7	88.1	15.6	14.6	23.7	0.83	1.67		
<u>ស</u>	ST] Constant	t volume sys	system (variable fresh air rate), [HS]	le fresh air		LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied El
	Actual	0	292.6	0	14.8	9.7	0.8	5.5	0.85	6.8
	Notional	2.4	227.6	0.8	37.9	21.5	0.83	1.67	-	-
<u>s</u>	ST] Constant	t volume sys	system (variable fresh air rate), [HS] LTHW boiler, [HFT]	le fresh air	rate), [HS]	LTHW boile	ir, [HFT] Na	Natural Gas,	[CFT] Grid	Grid Supplied El
	Actual	53.2	32.2	1.6	1.6	27.4	0.8	5.5	0.85	6.8

Syst	em Type	System Type Heat dem Cool dem Heat MJ/m2 MJ/m2 KWh/i	Cool dem MJ/m2	n2	Cool kWh/m2	Cool Aux kWh/m2 kWh/m2	Heat SSEEF	Cool SSEER	Heat G SEFF	Cool G SEER	
STI	Constant	IST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied El <mark>e</mark> ctric	tem (variab	le fresh air	rate), [HS]	LTHW boile	ır, [HFT] Na	tural Gas, [	CFT] Grid &	Supplied Ele	ctric
7	Actual	0	200.3	0	35.4	14.3	8.0	5.5	0.85	6.8	
	Notional	0	616.2	0	102.5	28	0.83	1.67			
[ST]	Single-du	IST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	J LTHW boi	ler, [HFT] N	atural Gas,	[CFT] Grid	Supplied E	:lectricity			
7	Actual	0	0	0	0	4.5	8.0	5.5	0.85	6.8	
	Notional	0	0	0	0	17.2	0.83	1.67			
[ST]	[ST] Single-duct VA	ct VAV, [HS	V, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	ler, [HF∏ N	atural Gas,	[CFT] Grid	Supplied E	:lectricity			
1	Actual	1.1	17.2	0.2	6.0	8.0	8.0	5.5	0.85	6.8	
	Notional 9.9	9.6	10	3.3	1.7	34.4	0.83	1.67			

### Key to terms

- = percentage of the building's average heat transfer coefficient which s due to thermal bridging
  = Heating energy demand
  = Cooling energy demand
  = Heating energy consumption
  = Auxiliary energy consumption
  = Auxiliary energy consumption
  = Heating system seasonal efficiency
  = Cooling system seasonal efficiency
  = Cooling generator seasonal efficiency ratio
  = System type
  = Heat source
  = Heating fuel type
  = Cooling fuel type
  = Cooling fuel type

- Alpha value (%)
  Heat dem (MJ/m2)
  Cool dem (MJ/m2)
  Heat con (KWh/m2)
  Aux con (KWh/m2)
  Heat SSEF
  Cool SSER
  Heat gen SSEFF
  Cool gen SSEFR
  ST
  HS
  HFT

### **BRUKL Output Document**



Compliance with England and Wales Building Regulations Part L

### **Project name**

**UKCMRI** 

'Be Green' Scheme

As designed

Date: Mon Jul 26 17:21:56 2010

### Administrative information

**Building Details** 

Address: London, NW1

Certification tool

**Calculation engine:** Apache **Calculation engine version:** 6.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.0.6

BRUKL compliance check version: v3.5.a.0

Owner Details
Name: Owner

**Telephone number:** Phone **Address:** , Postcode

**Certifier details** 

Name: URS

Telephone number: Phone

Address: Street Address, City, Postcode

### Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	53.7 KgCO2/m2.annum
1.2	Improvement factor	0.2
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	38.7 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	19.9 KgCO2/m2.annum
1.6	Are emissions from building less than or equal to the target?	BER =< TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

### Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? Better than design limits

Element	Ua-Limit	Ua-Calc	U <sub>i-Limit</sub>	U <sub>i-Calc</sub>	Surface where this maximum value occurs*
Wall**	0.35	0.18	0.7	0.58	B2ML0006:Surf[4]
Floor	0.25	0.2	0.7	0.25	B2ML0009:Surf[0]
Roof	0.25	0.16	0.35	0.16	B1CR0004:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.68	3.3	2.23	L0CR0026:Surf[3]
Personnel doors	2.2	0	3	0	No Personnel doors in building
Vehicle access & similar large doors	1.5	0	4	0	No Vehicle access doors in building
High usage entrance doors	6	0	6	0	No High usage entrance doors in building
Սa-Limit = Limiting area-weighted average U-valւ	ies [W/(m2l	K)]	U <sub>i-Limit</sub> =	Limiting inc	ividual element U-values [W/(m2K)]

U<sub>a-Limit</sub> = Limiting area-weighted average U-values [W/(m2K)]
U<sub>a-Calc</sub> = Calculated area-weighted average U-values [W/(m2K)]

Ui-calc = Calculated individual element U-values [W/(m2K)]

### 2.2 Is air permeability no greater than the worst acceptable standard? No greater than worst acceptable standard

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

### 2.3 Are all building services standards acceptable?

2.3a-1 BRF CV system

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien For a multiple poller system the li	cy for a single or a multiple boiler system. miting efficiency for any individual polier is 0.80.	
Efficiency check	miting efficiency for any individual boiler is 0.80. If hot water is provided by HVAC system" Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-2 CL3+ CV System

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
	ncy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-3 General CV system - Atrium, Writeup, Tertiary Area

HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien	cy for a single or a multiple boiler system. miting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-4 Plantroom Mech System

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficier For a multiple boiler system the li	cy for a single or a multiple boiler system. miting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

<sup>\*</sup> There might be more than one surface exceeding the limiting standards.

<sup>\*\*</sup> Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.

<sup>\*\*\*</sup> Display windows and similar glazing are not required to meet the standard given in this table.

### 2.3a-5 Primary/Secondary Lab- single duct VAV

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficier For a multiple boiler system the I	ncy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.3

### 2.3a-6 BRF Tertiary CV system

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien For a multiple boiler system the li	icy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-7 General FCU system - Offices, Meeting Rooms, Restaurant/SEE/stem standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

### 2.3a-8 Imaging CV System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-9 Lecture Theatre - CV System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### 2.3a-10 Kitchen CV system

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficien For a multiple boiler system the li	ncy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

### 2.3a-11 Loading Bay Mech System

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficier For a multiple boiler system the I	ncy for a single or a multiple boiler system. imiting efficiency for any individual boiler is 0.80.	
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

### 2.3a-12 CL3 CV System

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system. For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	2.25	7.2
Efficiency check	Limiting Specific Fan Power	This building
SFP	2.5	2.5

### HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	0.84	0.85
0.84 is the overall limiting efficiency for a single or a multiple boiler system.  For a multiple boiler system the limiting efficiency for any individual boiler is 0.80.		
Efficiency check	Limiting Cooling Nominal efficiency	This building
Cooling efficiency	3.4	20
Efficiency check	Limiting Specific Fan Power	This building
SFP	2	2

2.4	Does fixed internal lighting comply with England and Wales Building Regulations Part L paragraphs 49 to 61?	Separate submission
2.5	Are energy meters installed in accordance with GIL65?	Separate submission

### Criterion 3: The spaces in the building without air-conditioning have appropriate passive control measures to limit the effects of solar gains

|--|

### Criterion 4: The performance of the building, as built, is consistent with the BER

4.1	Have the key features of the design been included (or bettered) in practice?	Separate submission
4.2	Is the level of thermal bridging acceptable?	Separate submission
4.3	Has satisfactory documentary evidence of site inspection checks been produced?	Separate submission

### 4.4 Design air permeability

Air Permeability	Worst acceptable standard	This building (Design value)
m3/(h.m2) at 50 Pa	10	5

4.5	Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?	Separate submission
4.6	· · · · · · · · · · · · · · · · · · ·	Separate submission
4.7	Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?	Separate submission

### **Criterion 5: Providing information**

5.1	Has a suitable building log-book been prepared?	Separate submission

### Technical Data Sheet

### **Building Global Parameters**

	Actual	Notiona
Area (m2)	67495	67495
External area (m2)	52245	52245
Weather	LON	LON
Infiltration (m3/hm2 @ 50Pa)	5	10
Average conductance (W/K)	26066.7	21403.7
Average U-value (W/m2K)	0.5	0.41
Alpha value (%)	7.01	0

uilding Use	Building Type	Office	Primary school	
Buildi	% area			

%	% area	Building Type
		Office
		Primary school
		Secondary school
		Further education universities
		Primary health care buildings
		Nursing residential homes and hostels
		Hospital
		Hotel
		Restaurant/public house
		Sports centre/leisure centre
		Sports ground arena
		Retail
		Warehouse and storage
-		Theatres/cinemas/music halls and auditoria
		Social clubs
		Community/day centre
		Libraries/museums/galleries
		Prisons
		Emergency services
		Crown and county courts
		Airport terminals
		Bus station/train station/seaport terminal
		Workshops/maintenance depot
		Telephone exchanges
92		Industrial process building
N		Launderette
		Dwelling

6	
$\mathbf{C}$	
<u> </u>	
75	
0	
Ĭ	
0	
_	
40	
3	
$\boldsymbol{\omega}$	
2	
<u></u>	
<b>4</b>	
$\overline{}$	

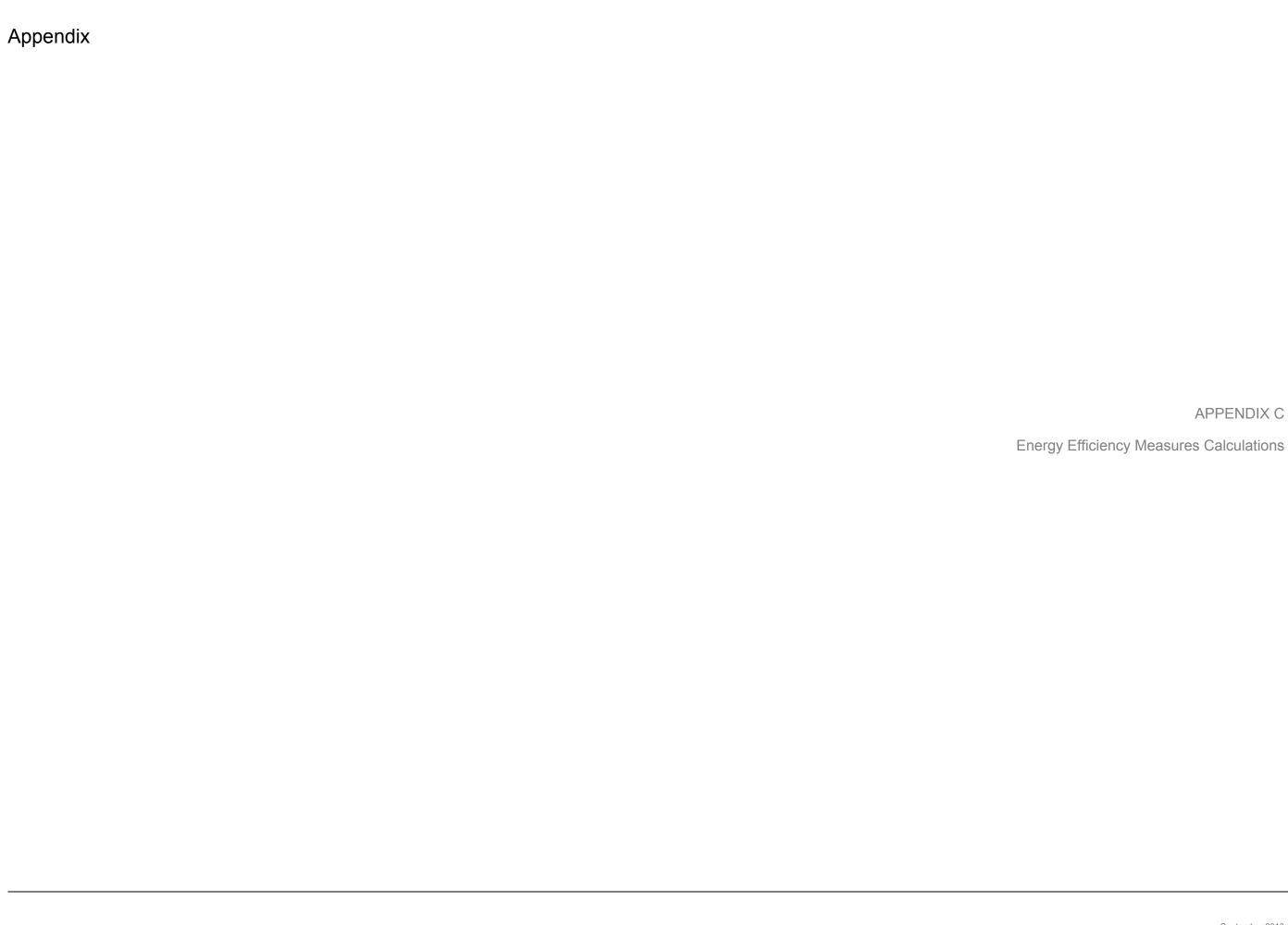
S	System Type	Heat dem		Heat con	Cool con	Aux con	Heat	Cool	Heat gen	Cool gen
9		Zm/Mz	IVD/mz	Kvvn/mz		KWN/mz	- 1			VEEK
[ST]	T] Constant	Constant volume system (variable fresh air rate), [HS]	tem (variab	le fresh air		LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied E
	Actual	0.2	191.4	0	9.7	9.2	0.8	5.5	0.85	8.8
	Notional	22.2	144.8	7.4	24.1	23.7	0.83	1.67		
<u></u>	ST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT]	ct VAV, [HS	J LTHW boi	ler, [НFT] N	latural Gas,		<b>Grid Supplied Electricity</b>	:lectricity		
	Actual	2.5	239.4	0.3	12.1	8.4	0.8	5.5	0.85	6.8
	Notional	12.2	181.7	4.1	30.2	23.7	0.83	1.67	ł	
<u>S</u>	ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT]	ystems, [HS	sj LTHW bo	iler, [HFT] I	Natural Gas	, [CFT] Grid	<b>Grid Supplied Electricity</b>	Electricity		
	Actual	0	15606.3	0	788.2	5.6	0.8	5.5	0.85	20
	Notional	0	14880.7	0	2475.2	21.7	0.83	1.67	ł	
<u>က</u>	ST] Fan coil systems,		[HS] LTHW boiler, [HFT] Natural Gas, [CFT]	iler, [HFT] I	Natural Gas		<b>Grid Supplied Electricity</b>	Electricity		
	Actual	9.69	181.3	5.9	9.2	6.1	0.8	5.5	0.85	6.8
	Notional	101.9	2.36	34.1	15.9	21.9	0.83	1.67		
<u>S</u>	ST] Constant volume system (variable fresh air rate), [HS]	volume sys	tem (variab	le fresh air		LTHW boiler, [HFT] Natural	er, [HFT] Na	Gas,	[CFT] Grid (	Supplied E
	Actual	0	298.7	0	15.1	9.2	0.8	5.5	0.85	6.8
	Notional	6.5	215.1	2.2	35.8	23.7	0.83	1.67		
<u> S</u>	ST] Constant volume system (variable fresh air rate), [HS]	volume sys	tem (variab	le fresh air	rate), [HS]	LTHW boiler, [HFT] Natural Gas,	ir, [HFT] Na	tural Gas,	[CFT] Grid	Grid Supplied E
	Actual	84.7	55.8	8	2.8	6.6	0.8	5.5	0.85	6.8
	Notional	140.8	33.9	47.1	5.6	20.3	0.83	1.67	1	-
<u>S</u>	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied	volume sys	tem (variab	le fresh air	rate), [HS]	LTHW boile	ir, [HFT] Na	tural Gas,	CFT] Grid (	Supplied E
	Actual	0	236.8	0	12	9.2	0.8	5.5	0.85	6.8
	Notional	19.8	165.1	9.9	27.5	23.7	0.83	1.67	-	
<u> S </u>	ST] Constant volume system (variable fresh air rate),	volume sys	tem (variab	le fresh air	[HS]	LTHW boiler, [HFT]	er, [HFT] Na	Natural Gas,	[CFT] Grid \$	Supplied E
	Actual	5.8	104.6	0.8	5.3	9.2	0.8	5.5	0.85	6.8
	Notional	46.8	87.8	15.7	14.6	23.7	0.83	1.67		
[ST]	T] Constant volume	volume sys	system (variable fresh air rate),	le fresh air	[HS]	LTHW boiler, [HFT]		Natural Gas,	[CFT] Grid	Supplied E
	Actual	0	292.6	0	14.8	9.7	0.8	5.5	0.85	6.8
	Notional	2.6	226	6.0	37.6	21.5	0.83	1.67		
<u> S </u>	ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied	volume sys	tem (variab	le fresh air	rate), [HS]	LTHW boile	er, [HFT] Na	tural Gas,	CFT] Grid (	Supplied E
	Actual	53.2	32.2	1.6	1.6	27.4	0.8	5.5	0.85	6.8
		0 000	7 ( (	000	1	000	0	7		

	HVAC Syst		ems Performance (cont.)	rmanc	e (con	t.)					
Sy	System Type	Heat dem	Cool dem		Cool	Aux	Heat	Cool	Heat G	Cool G	
		IVID/mZ	IVD/m2 KVVn/m2	Kwn/mz	KWN/mz	KVVN/MZ KVVN/MZ SSEET	SSEET	SSEEK	SEFF	SEEK	
<u> S</u>	[ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electric	volume sys	tem (variab	le fresh air	rate), [HS]	LTHW boile	ır, [HFT] Na	tural Gas, [	[CFT] Grid \$	Supplied Ele	ctric
	Actual	0	700.3	0	35.4	14.3	8.0	5.5	0.85	6.8	
	Notional	0	607.2	0	101	37	0.83	1.67	-		
<u> S</u>	IST] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	ct VAV, [HS	] LTHW boi	ler, [HFT] N	atural Gas,	, [CFT] Grid	Supplied E	:lectricity			
	Actual	0	0	0	0	4.5	8.0	5.5	0.85	6.8	
	Notional	0	0	0	0	17.2	0.83	1.67			
ls]	[ST] Single-duct VA	ct VAV, [HS]	J LTHW boi	ler, [HFT] N	atural Gas,	CFT] Grid	V, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Grid Supplied Electricity	:lectricity			
	Actual	1.1	17.2	0.2	0.9	0.8	8.0	5.5	0.85	6.8	
	Notional 12.3	12.3	3.2	4.1	0.5	34.4	0.83	1.67			

### Key to terms

- = percentage of the building's average heat transfer coefficient which s due to thermal bridging
  = Heating energy demand
  = Cooling energy demand
  = Heating energy consumption
  = Auxiliary energy consumption
  = Auxiliary energy consumption
  = Heating system seasonal efficiency
  = Cooling system seasonal efficiency
  = Cooling generator seasonal efficiency ratio
  = Heating generator seasonal energy efficiency ratio
  = System type
  = Heating fuel type
  = Cooling fuel type
  = Cooling fuel type

- Alpha value (%)
  Heat dem (MJ/m2)
  Cool dem (MJ/m2)
  Heat con (kWM/m2)
  Aux con (kWM/m2)
  Heat SSEFF
  Cool SSEER
  Heat gen SSEFF
  Cool gen SSEER
  ST
  HFT
  CFT



ENERGY STRATEGY September 2010

### Appendix

### **Energy Efficiency Measures Calculations**

Cooling System - Free Cooling & Water Cooling

Cooming System - Free Cooming & Water Cooming	Standard Air-Cooled Chillers	Free Cooling Air- Cooled Chillers	Water Cooled Chillers
CoP	3.84	4.87	5.94
Energy Usage (kWh/year)	3,230,000	2,560,000	2,080,000
Energy Cost (£/year)	387,000	307,000	250,000
Capital Cost (£)	3,367,250	3,439,750	4,000,000
CO <sub>2</sub> emissions (kgCO <sub>2</sub> /year)	1,363,060	1,080,320	877,760
Energy Saving (kWh/year)	-	670,000	1,150,000
CO <sub>2</sub> Saving (kgCO <sub>2</sub> /year)	-	282,740	485,300

### Variable Volume Systems

	CHW	LTHW
Peak pump load (kWe)	157	29
Annual Constant Volume Load (kWeh/year)	1,375,320	254,040
Annual Pump Load with VSDs (kWeh/year)	131,962	76,708
Annual Cost Saving (£/year)	148,816	30,000
Energy Saving (kWh/year)	1,243,358	177,332
CO <sub>2</sub> Saving (kgCO <sub>2</sub> /year)	524,697	74,834

### Reverse Osmosis (RO) Boiler Feedwater Treatment

	Softened Water	RO
Feedwater TDS (PPM)	338	8
Blowdown Proportion	0.11	0.0027
Blowdown Volume (kg/year)	2,682,648	63,495
Blowdown Energy (kWh/year)	488,249	11,556
Water Saving (m³/year)	-	2,619
Operating Cost (£/year)	-	19,800
Energy Saving (kWh/year)	-	476,693
CO <sub>2</sub> Saving (kgCO <sub>2</sub> /year)	-	92,478

### Data Centre

Water- Cooler Chillers + CRACs	Water- Cooler Chillers + Chilled Cabinets	Cooling Tower Pre- Cooling + AHUs	Air Cooled Data Centre
1,220,000	1,220,000	470,000	230,000
189,000	189,000	37,000	31,000
240.000	240.000	126,000	41.000
	Cooler Chillers + CRACs 1,220,000 189,000	Water-  Cooler   Chillers + Chillers + Chilled   Cabinets	Cooler Chillers + Chilled Cabinets   Cooling Tower Pre-Cooling + AHUS

Tower Fan (kWh/yr)	186,000	186,000	167,000	31,000
AHU Fans (kWh/yr)	-	-	-	1,090,000
Total Power (kWh/yr)	2,500,000	2,470,000	1,900,000	1,430,000
Water (m³/yr)	24,000	24,000	16,600	15,700
Steam (m³/yr)	-	-	-	16,000
Gas (kWh/yr)	-	-	-	1,500,000
Costs				
Annual Power (£/yr)	300,000	296,000	230,000	171,000
Annual Water (£/yr)	29,000	29,000	20,000	18,000
Gas (£/yr)	-	-	-	52,000
Total Utility Cost (£)	330,000	326,000	250,000	242,000
CO <sub>2</sub> Emissions				
Power 2006 CO <sub>2</sub> factor (kgCO <sub>2</sub> /yr)	1,055,000	1,042,340	801,800	603,460
Total (kgCO₂/yr)	1,055,000	1,042,340	801,800	894,460
Energy Saving (kWh/year)	-	30,000	600,000	-430,000
CO₂ Saving (kgCO₂/yr)	-	12,660	253,200	160,540

### **Energy Efficient measures –Summary Table**

	CO₂ S	CO <sub>2</sub> Saving 2006 (kgCO <sub>2</sub> )			Energy Saving (MWh)		
Energy Efficient measure	TOTAL	Gas	Electricity	TOTAL	Gas	Electricity	
Heat recovery on ventilation syst.	2,396,000	1,552,000	844,000	10,000	8,000	2,000	
Free cooling chillers	282,740	0	282,740	670	0	670	
Water cooled chillers	485,300	0	485,300	1,150	0	1,150	
Variable volume chilled water syst.	524,697	0	524,697	1,243	0	1,243	
Variable volume LTHW system	74,834	0	74,834	177	0	177	
Boiler feedwater RO treatment	92,478	92,478	0	477	477	0	
Data centre – Water Cooled Cabs	12,660	0	12,660	30	0	30	
Data centre – Dual Coil CRAC units	253,200	0	253,200	600	0	600	
Data centre – Outside air	160,540	0	160,540	-430	0	-430	
Low grade heat recovery	146,741	33,132	113,609	440	171	269	
Energy efficient lifts	31,650	0	31,650	75	0	75	
Energy efficient lighting	514,236	0	514,236	1,220	0	1,220	
Power Factor Correction	145,590	0	145,590	345	0	345	
Metering and Alarm Limit Targeting	717,400	0	717,400	1,700	0	1,700	

ENERGY STRATEGY September 2010



