07/4107/DD01

AV029 Rivington Street Studio Architecture SBEM Part L2 Analysis Draft

RESTRICTED – COMMERCIAL

SBEM Part L2 Analysis REPORT

FOR

Rivington Street Studio Architecture's

St Marys University College Sports Building

Prepared for:	**Mr David Tucker**	Prepared by:	**Andrew Vane BEng(Hons) CEng MCIBSE**
	54 Rivington Street London EC2A 3QN		**The Green Consultancy Ltd Unit D, Second Avenue Westfield Industrial Estate Radstock Bath BA3 4BH**
To discuss this draft, please phone Andy direct as follows. Landline: 020 8256 1350; mobile: 07774 888975.			
Tel: E-mail:	**0207 739 8945 or 020 77398945 david.tucker@rssa.co.uk**	Contact: Tel: E-mail:	**Louise Brooks 08450 176300 manager@greenconsultancy.com**

Document Reference	**AV029**
Your Order	**C55977**
Date	**18/02/2009**
Status	**DRAFT**

IMPORTANT NOTICE

Whilst reasonable steps have been taken to ensure that the information contained within this report is correct, you should be aware that it could contain errors due to the short period of the survey and any dependence on data supplied to us, which may be incomplete or inaccurate.

Nothing in this report is intended to be or should be interpreted as an endorsement of, or recommendation for, any supplier, service or product.

Contents

Executive Summary

To achieve the Planning requirement of 20% of the buildings carbon emission from renewable sources it is proposed to install the following technologies:-

- Ground Source heat pump serving underfloor heating in all areas except the Strength and Conditioning suite and the Olympic Lifting Platform area.
- Ground Source heat pump serving VRF style heating and cooling in the strength and conditioning suite.
- 100m^2 of solar thermal system to serve the domestic hot water system.
- 180m^2 area of mono-crystalline PV cells connected the power distribution system.

The renewables shall be installed in conjunction with a low energy building design incorporating other features such as lighting control systems etc to reduce the overall building energy use.

A summary of the input data into the calculations is indicated within the report which must be adopted to achieve Planning compliance.

1.0 Instructions

We were instructed by Mr.David Tucker of Rivington Street Studio Architects on 20th January 2009 to carry out an energy/carbon demand assessment on the new build sports hall complex at St Mary's College University.

The development falls within a Metropolitan Open Land zone. As such it is subject to direct inspection from the London Mayors office and has to achieve certain key energy performance criteria. It is a requirement that the development provides 20% of its carbon emissions from renewable sources.

This assessment will provide calculations for planning compliance and supporting evidence for the renewable energy target.

The outline of the design was provided by Rivington Street Studio Architects and Michael Jones & Associated LLP Engineering Consultants. This concept has been input into the carbon calculation software (SBEM).

It should also be noted that the SBEM software is a compliance tool and not a design tool. The building services systems and renewables will require further design to suit the building fabric and requirements.

2.0 Meetings Attended

Andrew Vane and Emma Bushell attended a design team meeting at the office of Rivington Street Studio Architects on 21st January 2009.

3.0 Summary of Input Data

3.1 Building Fabric

Air tightness

The scheme should minimise air infiltration and an air permeability target of $5m^3/hour/m^2$ of building envelope has been set @ 50 Pascals (Building Regulations maximum is 10).

Fabric

The building is to be built to current Building Regulations

Glazing

The Architect has specified argon filled, low-e coated windows with a deeper framing section than normal.

- U-value of 1.96 $W/m^2.k$ has been entered into the carbon assessment software for the glazing.

3.2 Mechanical Building Services

All heating and cooling plant is to be sourced from the Enhanced Capital Allowances list. This provides credits in the SBEM software. The Enhanced Capital Allowance (ECA) scheme is a key part of the Government's programme to manage climate change. It provides businesses with enhanced tax relief for investments in equipment that meets published energy-saving criteria (https://www.eca.gov.uk/etl)

Heating

Ground source heat pumps (GSHP) are to be used in conjunction with underfloor heating throughout the complex. The planned location for external heat pump coils is under a grass training pitch located near the building.

- Effective heat generating seasonal efficiency of GSHP needs to be 3.7 or higher.

Cooling

Cooling and heating will only be provided to the Strength and Conditioning suite and the Olympic Lifting Platform area. This will be provided by a Variable Refrigerant Flow (VRF) system linked to the ground source coils on a separate circuit.

- Energy Efficiency Ratio (EER) of VRF needs to be 2.5 or higher.

Ventilation

Since all the windows within this development will be openable the use of mechanical ventilation is limited. The Architect is to ensure that the window openings comply with Building Regulations. Mechanical ventilation is required in the Strength and Conditioning suite and the Olympic Lifting Platform area. This will be provided by a small air handling with heat recovery.

- Plate heat exchanger in AHU with a target efficiency of 85%
- Target supply and extract fan power (SFP) is 1.5 W/l/s
- Target for local exhaust in toilets is 5 $l/s/m^2$

Hot Water

Hot water to be provided by a dedicated condensing gas fired boiler. The boiler is to have a seasonal efficiency of 85% or greater and be sourced from the ECA list. To assist in the provision of the hot water demand 100m^2 of solar thermal panels are to be fixed at an angle of 30° on the roof above the plant room as this is a South facing roof.

- Condensing boiler with a seasonal efficiency of greater than 85% from ECA list
- 100m^2 of solar thermal paneling fixed on a South facing roof at an angle of 30°
- Storage water volume stated as 1500 litres.

Metering and Controls

All plant shall be monitored by a Monitoring and Targeting system fitted with out of range alarms. The system will also need to have provision for metering.

3.3 Electrical Building Services

Power factor

The power factor is to be corrected to greater than 0.95.

Luminaires

T5 and compact fluorescent luminaires are proposed throughout the project.

- Compact fluorescent luminaires to be used in circulation areas, reception and toilets.
- T5 lamps to be used in all remaining areas

The Architect has specified sun-pipes for the roof of the Sports Hall to deliver a small background daylight element. This has been included in the Part L2A calculations and will reduce the lighting load within that zone.

Lighting control

A range of lighting controls have been proposed throughout the project as follows:-

- Office areas are to have daylight and occupancy sensing.
- Changing rooms are to have daylight and occupancy sensing.
- Strength and conditioning and heavy lifting areas are to have manual switching.
- Circulation areas are to have occupancy sensing.
- Toilets are to have occupancy sensing.
- Sports Hall is to have manual switching.
- Small unoccupied rooms such as storage and plant rooms are to have occupancy controls.

Renewables

- $180m^2$ area of mono-crystalline silicon PV (photovoltaic cells), South facing angled at 30^0.

Metering and Controls

All plant shall be monitored by a Monitoring and Targeting system fitted with out of range alarms. The system will also need to have provision for metering.

4.0 Carbon Assessment Output

A summary of the Carbon Assessment calculations is as follows:-

Actual Energy use (kWh/m^2/year)

Heating	8.15
Cooling	2.23
Auxiliary	15.09
Lighting	35.79
HWS	251.12
Total	**312.37**

BER (Building Emission rate) = 68.23 $kgCO_2/m^2$/year
TER (Target Emission rate) = 101.49 $kgCO_2/m^2$/year

% improvement over Building Regulation 2006 = 30%

Overall Building CO_2 emission = 68.23 $kgCO_2/m^2$/year x 1778m^2
= 121,312.94 $kgCO_2$/year

% Renewables (made up as heating and cooling from GSHP, solar thermal)
= 8.15 + 2.23 + 29.1 = 39.48 kWh/m^2/year

x 1778m^2 = 70,195.44 kWh/year
x 0.194 $kgCO_2$/kWh = 13,617.92 $kgCO_2$/year
(amount of CO_2 offset by using renewables)

Note carbon emission factor of 0.194 is used as this is still used in SBEM rather than the 2008 figure of 0.185

% Renewables (made up from PV) from SBEM calculations (See Appendix B)
= 6 $kgCO_2/m^2$/year
x 1778m^2 = 10,668 $kgCO_2$/year

TOTAL Renewables = 13,617.92 + 10,668 = 24,285.92 $kgCO_2$/year

TOTAL % RENEWABLES = 26,063920 / 121,312.94 = 20%
THEREFORE MEETS PLANNING REQUIREMENT

Note:-

The figure of 29.1 kWh/ m^2/year saving for using solar thermal has been calculated by running the carbon calculations for the building with and without a solar thermal system. This is summarised below.

The actual figure for HWS energy use without solar thermal is 280.22 kWh/ m^2/year (see Appendix C)

The actual figure for HWS energy use with solar thermal is 251.12 kWh/m2/year. Difference is 29.1 kWh/ m^2/year

5.0 Summary of Renewables Strategy

To achieve the Planning requirement of 20% of the buildings carbon emission from renewable sources it is proposed to install the following technologies:-

- Ground Source heat pump serving underfloor heating in all areas except the Strength and Conditioning suite and the Olympic Lifting Platform area.
- Ground Source heat pump serving VRF style heating and cooling in the Strength and Conditioning suite.
- 100m^2 of solar thermal system to serve the domestic hot water system.
- 180m^2 area of mono-crystalline PV cells connected the power distribution system.

Appendix A Carbon Assessment Output

Appendix B Output Sheet Indicating Percentage From Renewables

SBEM only indicates renewables from electricity based renewables such as PV and wind.

The 6 $kgCO_2/m^2$/year is the percentage from PV use only and not from solar thermal, ground source heat pump and PV.

The 6 $kgCO_2/m^2$/year has been added to the GSHP and solar thermal system in the calculations in Section 4.0.

Appendix C Output Sheet Showing HWS Energy Use Without Solar Thermal

England and Wales Building Regulations Part L

HWS ENERGY USE WITHOUT SOLAR THERMAL.

	Heating	Cooling	Auxiliary	Lighting	Hot Water	Total	
Actual	8.15	2.23	15.09	35.79	280.22	341.46	kWh/m2/yr
Notional	85.12	3.77	11.75	58.42	450.97	610.02	kWh/m2/yr

1. CO2 emissions mandatory requirement

			IF	LZC
BER	80.21	kgCO2/m2/yr		
Notional	135.2	kgCO2/m2/yr		
TER	101.49	kgCO2/m2/yr	0.17	0.1
Pass CO2	YES			

2. Additional checks required by approved documents:

View Approved Document Checks

Check Regulation

Click on text below for...

- SBEM Outputs
- Data Reflection - Actual Building
- Data Reflection - Notional Building
- Approved Documents Checks

Click to check object assigments, there are NO CRITICAL un-assigments in the project

SBEM Main Calculation Output Document

Wed Feb 18 13:18:08 2009

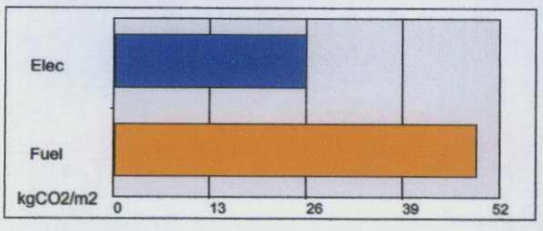
Building name

St Mary's University College

Building type: Sports centre/leisure centre

SBEM is an energy calculation tool for the purpose of assessing and demonstrating compliance with Building Regulations (Part L for England and Wales, Section 6 for Scotland, Part F for Northern Ireland and Part L for Republic of Ireland) and to produce Energy Performance Certificates and Building Energy Ratings. Although the data produced by the tool may be of use in the design process, **SBEM is not intended as a building design tool.**

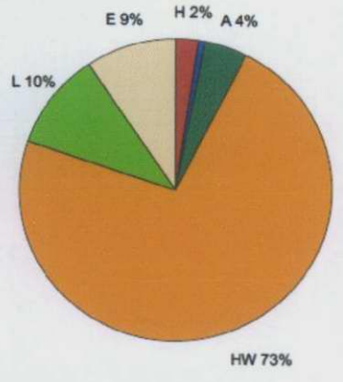
Building Energy Performance and CO2 emissions



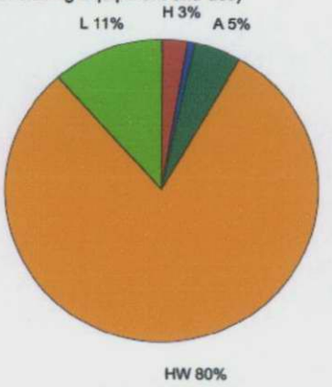
6 kgCO2/m2 displaced by the use of renewable sources.

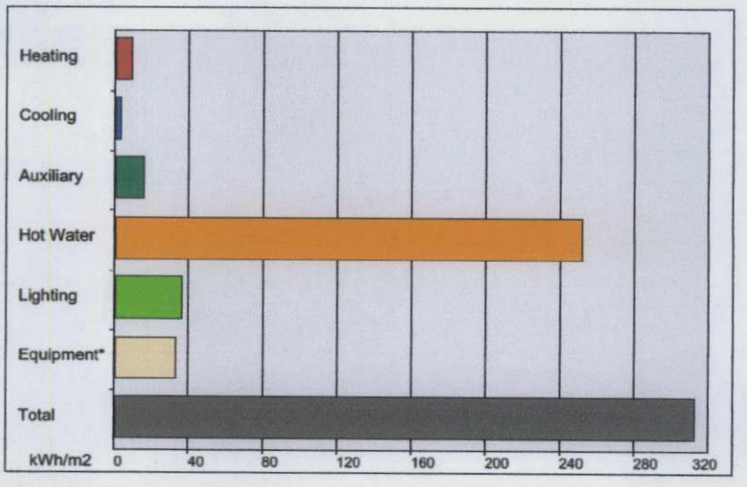
Building area is 1777.59m2

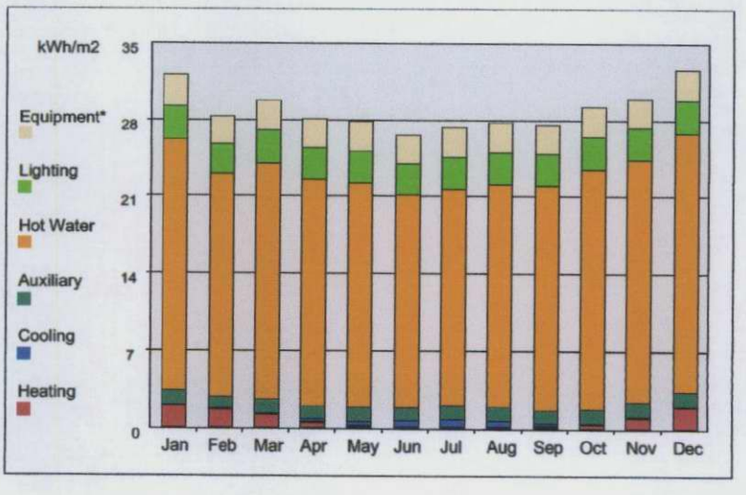
Annual Energy Consumption



(Pie chart excluding Equipment end-use)







(*) Although energy consumption by equipment is shown in the graphs, the CO2 emissions associated with this end-use have not been taken into account when producing the rating.

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L

Project name

St Mary's University

As designed

Date: Wed Feb 18 13:18:43 2009

Administrative information

Building details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v3.2.b

Interface to calculation engine: iSBEM

Interface to calculation engine version: v3.2.b

BRUKL compliance check version: v3.2.b

Occupier details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Informati

Certifier details

Name: Andrew Vane

Telephone number: 020 8256 1350

Address: Courtney House, 62 Jarvis Road, Croydon, Surrey

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

1.1	Calculated CO2 emission rate from notional building	135.2 KgCO2/m2.annum
1.2	Improvement factor	0.17
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	101.5 KgCO2/m2.annum
1.5	Building CO2 Emission Rate (BER)	68.2 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	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface where this maximum value occurs*
Wall**	0.35	0.35	0.7	0.35	Room 2/6 - Wall
Floor	0.25	0.15	0.7	0.25	Room 2/2 - Ext.Floor
Roof	0.25	0.25	0.35	0.25	Room 2/1 - Roof
Windows***, roof windows, and rooflights	2.2	1.96	3.3	1.96	Room 2/6 - Wall/Window 1
Personnel doors	2.2	2.2	3	2.2	Room 20/6 - Wall/Door 1
Vehicle access & similar large doors	1.5	0	4	0	"No Vehicle access doors in project"
High usage entrance doors	6	0	6	0	"No High usage entrance doors in project"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m2K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m2K)]
$U_{i\text{-}Limit}$ = Limiting individual element U-values [W/(m2K)]
$U_{i\text{-}Calc}$ = Calculated individual element U-values [W/(m2K)]

* There might be more than one surface exceeding the limiting standards.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
*** Display windows and similar glazing are not required to meet the standard given in this table.

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 Underfloor heating HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	2	3.7
Limiting efficiency applies to all types of heat pump except absorption and gas engine.		

2.3a-2 Comfort cooling HVAC system standard is acceptable

Efficiency check	Limiting heat source seasonal efficiency	This building
Heat source efficiency	2	3
Limiting efficiency applies to all types of heat pump except absorption and gas engine.		
Efficiency check	**Limiting Cooling Nominal efficiency**	**This building**
Cooling efficiency	2.4	2.5

2.3b-1 Default DHW System for Building HWS standard is acceptable

Efficiency check	Limiting HWS heat source seasonal efficiency	This building
HWS heat source efficiency	0.8	0.85

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

3.1	Method of showing compliance with England and Wales Building Regulations Part L in paragraph 64?	Separate submission

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)

Building Global Parameters

	Actual	Notional
Area (m2)	1778	1778
External area (m2)	4813	4813
Weather	LON	LON
Infiltration	5	10
W/K	1594.53	2988.77
W/m2K	0.33	0.62
Alpha	15.27	10

Building Use

% 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
100	**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
	Industrial process building
	Launderette
	Dwelling
	Retail warehouses
	Miscellaneous 24hr activities

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat kWh/m2	Cool kWh/m2	Aux kWh/m2	Heat SSEEF	Cool SSEER	Heat G SEFF	Cool G SEER
[ST] No Heating or Cooling, [HS] LTHW boiler, [FT] Oil										
	Actual	0	681.3	0	0	0	0	0	0	0
	Notional	0	1033.6	0	0	0	0	0	---	---
[ST] Central heating using water: floor heating, [HS] Heat pump: ground or water source, [FT] Grid Supplied Electricity										
	Actual	111.8	102	8.7	0	9.8	3.48	0	3.7	0
	Notional	163.7	397.2	62.3	0	4.8	0.73	0	---	---
[ST] Split or multi-split system, [HS] Heat pump: air source, [FT] Grid Supplied Electricity										
	Actual	91.1	72.6	8.4	13.1	40.5	2.94	1.5	3	2
	Notional	653.5	133.8	218.7	22.3	47.4	0.83	1.67	---	---