

3.0 RECOMMENDATIONS

Table 6 - Energy Reducing Recommendations

Priority	Recommendations	Ref	Estimated Annual Savings			Estimated Cost	Action
			(£)	KWh	CO2 (tonne)	(£)	
1	Sports Hall	2.3	2,600	80,000	18	N/A	Design Team
2	S&C Suite	2.5	1,800	60,000	13	N/A	Design Team
3	EIS	2.7	800	28,000	6	N/A	Design Team
4	Changing	2.9	3,500	139,000	28	N/A	Design Team
5	Rec, toilets, office	2.8	2,000	58,000	14	N/A	Design Team
	OVERALL TOTALS		21,300	365,000	79	N/A	

Systems with a high cost and/or payback have been excluded in the analysis therefore estimated payback and costs are not relevant, as the objectives are to provide a building that will achieve an excellent BREEME rating and high renewable content.

4.0 FOLLOW THROUGH

4.1 Following the report

The purpose of this report is to help your organisation reduce the carbon impact of this building. Following receipt of the report, the person responsible for commissioning it should discuss the results with relevant colleagues and designers to agree who will be responsible for overseeing the implementation of the recommendations. A timetable should be agreed to monitor progress and establish firm dates by which specific actions should be completed.

4.2 Providing Feedback

Following the receipt of the draft report your Account Manager will be in contact with you to discuss the report and to get your feedback. If you are unavailable to provide feedback at the draft report stage, your Account Manager will then try to contact you again at a later date. The Carbon Trust values all feedback obtained and this will also be an opportunity to discuss what further support may be available to your organisation.

4.3 Impact Assessment

In the future a client manager will contact you to discuss how successful you have been in implementing the Action Plan and the estimated level of energy savings you have achieved overall in order that we can evaluate the effectiveness of our programme. We would be grateful if you could make time to take this call and provide the information we are seeking.

4.4 Envirowise

This report focuses upon energy efficiency, but making optimum use of other resources such as water and raw materials, together with waste minimisation, also offers cost savings for your organisation. The Envirowise programme (funded by the Department of Trade & Industry and the Department for Environment, Food and Rural Affairs) provides a helpline service on environmental issues and publications on waste minimisation, clean technology, water and effluent savings, and more. Further information can be obtained from the Envirowise website <http://www.envirowise.gov.uk> or from the Environment & Energy Helpline 0800 58 57 94 and selecting the Environment option

APPENDIX 1 - BASIC CALCULATIONS

Table 7 - Developments of Benchmarks - Carbon Trust Targets

Table 8 - Developments of Benchmarks - 2002 Building Regulations

Table 9 - Individual Targets

Table 10 - Renewables

Hot Water Demand

Table 7 - Developments of Benchmarks - Carbon Trust Targets

CARBON TRUST TARGETS

ELECTRICITY

space	area m2	lighting kWh/m2	lighting kWh/year	ventilation motors	ventilation motors	pumps	pumps	EQ.Etc	EQ.Etc	BENCHMARK kWh/year/m2	TOTAL kWh/year
Sports Hall	945	26	24570	4	4064	4	3874.5	5	4725	39	37233
S&C Suite	328	41.4	13579	26	8495	6	2000.8	5	1640	78	25715
EIS	150	41.4	6210	26	3885	6	915	5	750	78	11760
Changing	195	29.6	5772	52	10082	6	1189.5	5	975	92	18018
Rec.,toilets , offices	289	41.4	11965	2	578	6	1734	3	867	52	15144
TOTAL	1907									57	107870

GAS

space	area	heating	heating	ventilation	ventilation	BENCHMARK kWh/year/m2	TOTAL kWh/year
Sports Hall	945	76	71820	25	23909	101	95729
S&C Suite	328	111	36408	98	32210	209	68618
EIS	150	111	16650	98	14730	209	31380
Changing	195	103	20066	196	38298	299	58364
Rec.,toilets , offices	289	103	29738	7	1878.5	109	31617
TOTAL	1907					150	285706
							393576

Table 8 - Developments of Benchmarks - 2002 Building Regulations

TYPICAL (2002 B.R.)										23%SAVING (2006 B.R.)		
Electricity												
space	area	lighting	lighting	ventilation	ventilation	pumps	pumps	EQ.Etc	BENCHMARK	TOTAL		
	m2	kWh/m2	kWh/year	motors	motors				kWh/year/m2	kWh/year	kWh/year	
Sports Hall	945	42.9	40540.5	9	8600	7	6615	9450	69	65205	50208	
S&C Suite	328	61.3	20106	49	16072	10	3181.6	3280	130	42640	32833	
EIS	150	61.3	9195	49	7350	10	1455	1500	130	19500	15015	
Changing	195	46	8970	98	19091	13	2554.5	1950	167	32565	25075	
Rec.,toilets , offices	289	61.3	17716	37	10606	10	2803	2890	118	34015	26192	
TOTAL	1907								102	193925	149322	
Gas												
space	area	heating	heating	ventilation	ventilation	BENCHMARK TOTAL						
						kWh/year/m2	kWh/year	kWh/year				
Sports Hall	945	141	133245	83	78813	224	212058	163285				
S&C Suite	328	188	61664	295	96760	483	158424	121986				
EIS	150	188	28200	295	44250	483	72450	55787				
Changing	195	284	55380	983	191685	1267	247065	190240				
Rec.,toilets , offices	289	171	49419	184	53176	355	102595	78998				
TOTAL	1907					416	792592	610296				
							986517	759618.32				

Table 9 - Individual Targets

Savings are based on the difference between the basic Building Regulation 2006 Act Part L2A and the Carbon Trust Target.

This can only be an estimate of the renewable content. The actual figures must be obtained from an official calculation method such as ISBEM.

ENERGY SYSTEM	RECOMMENDATION	2002 B.R. kWh/year	2006 B.R. kWh/year	C.T. TARGET CTT kWh/year	SAVING kWh/year 2006-CTT
Sports Hall :					
Lighting	Light pipe. High eff. Daylight control	40500	31185	25000	6185
Ventilation motors	By PV panels	8600	6622	4000	2622
Heating pumps	Zoning	6600	5082	3900	1182
Equipment Etc.	None	9500	7315	4700	2615
Heating (U_Values)	Heat pump, underfloor	133000	102410	72000	30410
Ventilation	Monodraft stack + PV panel	79000	60830	24000	36830
S&C Suite					
Lighting	High eff. Daylight control	20000	15400	13600	1800
Ventilation motors	PV operated	16000	12320	8500	3820
Heating pumps	Distribution	3200	2464	2000	464
Equipment Etc.	None	3300	2541	1600	941
Heating (U_Values)}	Vent with reclaim + PV on motors	62000	47740	36400	11340
Ventilation }		97000	74690	32200	42490
EIS					
Lighting	High Eff. Daylight control	9200	7084	6200	884
Ventilation motors	High efficiency	7400.0	5698	3900	1798
Heating pumps	Zoning	1500	1155	900	255
Equipment Etc.	None	1500	1155	750	405
Heating (U_Values)	Heat pump, underfloor	61700	47509	16700	30809
Ventilation	Monodraft + PV panel	96800	74536	14700	59836
Changing					
Lighting	High eff.	9000	6930	5800	1130
Ventilation motors	PV operated	19000	14630	10000	4630
Heating pumps	Zoning	2600	2002	1200	802
Equipment Etc.	None	2000	1540	1000	540
Heating (U_Values)	Heat pump vf/heating	55400	42658	20000	22658
Hot Water	50% solar		0		0
Ventilation	Monodraft + PV panel	192000	147840	38300	109540
Recep., Toilets, Off.					
Lighting	High eff.	18000	13860	12000	1860
Ventilation motors	PV operated	10600	8162	600	7562
Heating pumps	Zoning	2800	2156	1700	456
Equipment Etc.	None	2900	2233	900	1333
Heating (U_Values)	Heat pump vf/heating	49400	38038	30000	8038
Ventilation	50% solar	53200	40964	1900	39064
TOTALS					

Table 10 - Renewables

The 2006 Building Regulations requirement for renewables is that 10% of the 23% improvement from Building Regulations 2002 must be renewables. Part L2A Page 14 Table 1

ENERGY SYSTEM	RECOMMENDATION	2002 B.R. kWh/year	2006 B.R. kWh/year	SAVING 2002-2006 kWh/year	RENEWABLES % of saving	RENEWABLES saving kWh/year
Sports Hall :						
Lighting	Light pipe. High eff. Daylight control	40500	31185	9315	10	932
Ventilation motors	By PV panels	8600	6622	1978	90	1780
Heating pumps	Zoning	6600	5082	1518	0	0
Equipment Etc.	None	9500	7315	2185	0	0
Heating (U_Values)	Heat pump, underfloor	133000	102410	30590	10	3059
Ventilation	Monodraft stack + PV panel	79000	60830	18170	100	18170
				63756	TOTAL	23941
S&C Suite						
Lighting	High eff. Daylight control	20000	15400	4600	10	460
Ventilation motors	PV operated	16000	12320	3680	30	1104
Heating pumps	Distribution	3200	2464	736	0	0
Equipment Etc.	None	3300	2541	759	0	0
Heating (U_Values)	Vent with reclaim + PV on motors	62000	47740	14260	0	0
Ventilation		97000	74690	22310	20	4462
					TOTAL	6026
EIS						
Lighting	High Eff. Daylight control	9200	7084	2116	10	212
Ventilation motors	High efficiency	7400.0	5698	1702	90	1532
Heating pumps	Zoning	1500	1155	345	0	0
Equipment Etc.	None	1500	1155	345	0	0
Heating (U_Values)	Heat pump, underfloor	61700	47509	14191	10	1419
Ventilation	Monodraft + PV panel	96800	74536	22264	90	20038
					TOTAL	23200
Changing						
Lighting	High eff.	9000	6930	2070	10	207
Ventilation motors	PV operated	19000	14630	4370	90	3933
Heating pumps	Zoning	2600	2002	598	0	0
Equipment Etc.	None	2000	1540	460	0	0
Heating (U_Values)	Heat pump vf/heating	55400	42658	12742	10	1274
Hot Water	50% solar	31500	24255	7245	30	2174
Ventilation	Monodraft + PV panel	192000	147840	44160	90	39744
					TOTAL	47125

ENERGY SYSTEM	RECOMMENDATION	2002 B.R. kWh/year	2006 B.R. kWh/year	SAVING 2002-2006 kWh/year	RENEWABLES % of saving	RENEWABLES saving kWh/year
Recep, Toilets, Off.						
Lighting	High eff.	18000	13860	4140	10	414
Ventilation motors	PV operated	10600	8162	2438	90	2194
Heating pumps	Zoning	2800	2156	644	0	0
Equipment Etc.	None	2900	2233	667	0	0
Heating (U_Values)	Heat pump vf/heating	49400	38038	11362	10	1136
Ventilation	50% solar	53200	40964	12236	90	11012
					TOTAL	14757
		TOTAL		317952	TOTAL	115048
					TOTAL	kWh/year

TOTAL
PERCENTAGE
OF

RENEWABLES
on BR 23% is
36%

TOTAL
PERCENTAGE
OF

RENEWABLES
on Carbon Trust
Target is 29%

Hot Water Demand

Estimation of water use
CIBSE Guide F - Page 18.10 refers:

$$Q \text{ (kWh/annum)} = 0.0864 \times q \text{ AN} \times 10^{(-3)} \times 278$$

$$A_f = \text{area} = 195\text{m}^2$$

$$NW = \text{No working days} = 7\text{d} \times 48\text{w} = 336$$

Q = 20 from table

$$Q = 0.0864 \times 20 \times 195 \times 336 \times 10^{(-3)} \times 278 = 31,500 \text{ kWh/year}$$

APPENDIX 2

Table 11 - Engineering benchmarks

Item	Description	Benchmark	Reference
1	Lighting: Fluorescent 500 Lux Compact Fluorescent 500 Lux Metal Halide 500 Lux	11 W/m ² 14 W/m ² 18 W/m ²	CIBSE Guide 'F' Page 9.2
2	Ventilation Fan Capacities	2.1 l/s/m ³ of space	CIBSE Guide 'F' Page 7.3
3	Ventilation Fan Power	1-2 W/l/s	CIBSE Guide 'F' Page 7.2
4	Heat Pump up to 20 kW heating capacity	Minimum 2.2 COP	CIBSE Guide 'F' Page 10.6

APPENDIX 3 - REFERENCES

Energy Efficiency Best Practice programme (EEBPP) publications are available from 0900 585794 (generally without charge).

CIBSE publications are available from 020 8765 5211.

Sport England publications are available from 0990 210255.

1. Chartered Institution of Building Services Engineers.
Technical Memorandum 22 'Energy Assessment and Reporting Methodology'.
CIBSE, London 1999.
2. Energy Efficiency Best Practice programme
Good Practice Guide 137 'Energy efficiency in sports and recreation buildings: effective plant maintenance. A guide for sports centre managers and maintenance staff'.
Carbon Trust, London 1995.
3. Energy Efficiency Best Practice programme.
Good Practice Guide 211 'Drawing a winner. Energy efficient design of sports centres'.
Carbon Trust, London 1996.
4. Energy Efficiency Best Practice programme.
Good Practice Guide 228 'Water-related energy savings - a guide for owners and managers of sports and leisure centres'.
Carbon Trust, London 1998.
5. Sports England (English Sports Council).
Guidance Note SC383/2000 'Sports hall - lighting'. Sports Council, London 2000.
6. Sports England (English Sports Council).
Guidance Note SC370/2000 'Floodlighting'. Sports Council, London 2000.
7. Energy Efficiency Best Practice programme.
General Information Report 35 'Daylighting for sports halls. Two case studies'.
Carbon Trust, London 1997.
8. Energy Consumption Guide 78
Energy Use in Sports and Recreation Buildings - Carbon Trust
9. Non Domestic Heating Cooling and Ventilation Compliance Guide
Department for Communities and Local Government (DCLG)
10. Low or Zero Carbon Energy Sources: Strategic Guide
Department for Communities and Local Government (DCLG)

APPENDIX 4

Strategy Matrix

RIBA	Brief			Design Process		
	Client Requires	Sustainable Policy	Financial commitment	Integrated design	Construction methods	Handover & Feedback
4 Innovative	An exemplar building which pushes the boundaries of sustainability with innovative features and approaches. Building to be used as a corporate advertisement for sustainability policy and CSR.	Minimal / zero impact on the environment, in balance with social and economic factors. Excellent energy efficiency in components and materials. Energy performance related fees for consultants. Excellent BREEM rating.	A comprehensive whole life costing analysis is required for all environmental aspects, with long term payback periods beyond 10 years. 60 year study period typically applied for life cycle analysis. Regulations. Sell energy to grid.		Clear commitment to recycled or recycled materials (Green Guide) used in at least 20% of the superstructure. Use of local materials and minimising transportation. Minimisation of construction waste and use of efficient construction methods - targets.	Commitment to ambitious targets carried through to operation of the building. Design intentions clearly communicated to facilities managers and users. Monitoring and feedback for at least the first five years of life. RIBA Stage M Feedback implemented.
3 Best				All consultants are appointed no later than RIBA Work Stage A. Use of performance-based fees rather than conventional % of construction costs. Energy targets set in the brief with incentives.		Commissioning and O&M of 24 months for all aspects. Consultants responsible for building performance. Feedback manuals provided for occupants.
2 Good practice	A building to current Good Practice B 10% above Building Regs Part L. No innovation at all - good practice solutions to reduce running costs.	Sustainability issues addressed in an ad hoc way. Energy efficiency not specified but no quantified targets set in brief. Good BREEM rating but 'cherry-picking' apparent.	Some environmental aspects analysed using whole life costing. Payback periods of 5-10 years applied to most. Many decisions made on capital costs.	All consultants are appointed no later than RIBA Work Stage C. Conventional fee structure but incentives set against defined target ranges.	Commitment to sustainable materials consistent with BREEM or Ecochemes rating. Some local material used. Policy of waste reduction.	
1 Standard	A building to current Building Regs standards. Adopting only conventional solutions.	Some token sustainability. Energy efficiency not apparent in brief - e.g. typical consumption figures. Pass BREEM rating.	No use of whole life costing techniques. Payback periods of 5 years applied to all features. Most decisions made on capital costs alone.	Some consultants appointed as late as RIBA Work Stage D. Conventional fee structure only. Fragmented design process to Building Regs minimums.	Minimum sustainable materials to achieve BREEM or Ecochemes pass. One or two local materials. Achar. waste reduction.	Commissioning and O&M of 6 months for all aspects. No attempt to quantify performance or educate users.
0 Below Standard	A building which relentlessly adopts the worst of commercial practice and may not wholly comply with Building Regs. Commercial decisions with adverse impact.	Sustainability not on the agenda or in the brief. Energy consumption above typical levels for the building type. Building Regs minimum standards. No BREEM rating.	All decisions are made on capital costs alone. Bias against environmental features with payback period criteria of a year. Sub-optimal running costs.	Some consultants appointed as late as RIBA Work Stage E. No specialist consultants. Conventional fee structure only. Fragmented design process to Building Regs minimums.	Extensive use of unsustainable materials. No local materials. Materials specification decisions made on the basis of lowest cost only. No attempt to reduce site waste.	Commissioning and O&M of less than 6 months for all aspects. No attempt to quantify performance or educate users. Building is 'put off contract' and no attempt to rectify.

	Feasibility			Pre-construction Period		
	A Appraisal	B Strategic Briefing	C Outline Proposals	D Detailed Proposals	E Final Proposals	F Production Information
	<p>Identification of clients' requirements and constraints. Ensure that sustainability is integrated into initial studies and proposals.</p>	<p>Fully integrate sustainability into the strategic brief. Set appropriate energy targets and performance fees. Note possible effect of procurement route on targets.</p>	<p>Ensure sustainability and energy targets are transferred to full project brief. Whole life costing exercises as they stage will identify optimum cost savings.</p>	<p>Retain sustainability in the project brief and integrate fully into detailed proposals. Environmental sustainability should be negotiated with planning authorities and submission of full planning applications.</p>	<p>Ensure environmental and sustainability targets are fully integrated into final proposals.</p>	<p>Preparation of information in sufficient detail to enable tenders for sustainability measures. Ensure statutory approvals to allow for any specialist needs e.g. renewable energy.</p>
	<p>Review good and best practice examples for sustainable project precedents. Agree a review and audit regime for energy efficiency design features.</p>	<p>Develop interdisciplinary dialogue, communication and trust - they are essential for success. Develop and refine the client's brief for energy efficiency.</p>	<p>Agree the scope of evaluating relevant integrated design options. Indicate how options can mitigate the capital cost, reduce planning costs, meet needs and improve asset value.</p>	<p>Project brief should be frozen at the end of Stage D. Carry out any outstanding studies for environmental and energy options. Clear up outstanding points in the detailed brief.</p>	<p>Agree final environmental and sustainability targets that will be incorporated into the final proposals. Ensure that the proposals are fully compliant with the relevant regulations.</p>	<p>Only select tenders who can demonstrate that they are compliant with energy efficient design and construction.</p>
	<p>Integrate fabric and services options. For refurbishments, consider improving thermal and day lighting performance and the removal of pollution material.</p>	<p>Discuss the latest information on the 'cradle to cradle' approach to energy and agree what is acceptable. Assess marketing possibilities of sustainability features.</p>	<p>Review detailed advice on energy efficiency, fuel policy, and energy targets. Prepare checklist of procurement method implications on proposed sustainability measures.</p>	<p>Carry out risk management assessments of proposed energy efficiency and sustainability features. Detailed whole life costing studies to establish preferred options and optimisation of capital and running costs.</p>	<p>Ensure that the proposals are fully compliant with the relevant regulations and that the proposals are fully compliant with the relevant regulations.</p>	<p>Where contractors have the responsibility for appointing sub-contractors and specialists, ensure that their compliance with energy efficiency requirements is assessed.</p>