

Solar schools audit report

Example Primary School

School Contact: Mrs. Smith Business manager
office@example.bradford.sch.uk

Auditor: Environment & Climate Change Unit Auditor

Audit date: 23/10/2014

Pupils: 462

DEC Score: C (75)

Floor area: 3059 sq.m

Heating energy use: 77 kWh/sq.m/year (155 typical)

Electricity use: 44 kWh/sq.m/year (40 typical)

Main heating fuel: Gas

Building environment : Heating & Natural ventilation.

Findings and recommendations

GREEN	Low cost measure with a relatively high effectiveness.
AMBER	Higher cost with a high to medium effectiveness
RED	High cost measure with lower effectiveness

	Issue	Recommendation	Indicative cost & payback
	HEATING		
1	Boilers & Plant		
	3 no. Remeha 210 ECO gas fired boilers.		
	2 no. Direct gas fired calorifiers (145 litres each.)		
1.1	Trend controller. (request visit to advise on operation.)	Check controller and optimised start controls to avoid unnecessary firing of the boilers. (Site management)	No cost When combined with other temperature reduction measures approximate savings of £400 p.a.

1.2	Boiler room has been refurbished as recently as 2000. Some fittings uninsulated	Valve, flange and pump jackets to be fitted so as to reduce heat loss. (Site Management)	£750.00 Estimated 2 year payback.
2	System & Controls		
2.1	Ensure that room thermostats are correctly set to avoid overheating.	Where fitted, set Thermostatic Radiator Valves at 2 to 2.5 and monitor comfort. Increase incrementally as necessary. Where classrooms are overheating, ensure that heating is turned off before opening windows. Where TRVs are not fitted, investigate options for local control of heating. (Site Management)	No cost When combined with other temperature reduction measures approximate savings of £400 p.a.
2.2	Some radiators were obstructed with furniture or drying outdoor wear.	Allow for air circulation around radiators, and avoid blocking slatted radiator covers with gloves etc. A radiator shelf to the landing radiator may improve circulation of warm air. (Site Management)	No cost Unlikely to afford a saving, but will allow the heating system to operate more effectively.

3	VENTILATION & AIR CONDITIONING		
3.1	Several air conditioning units are fitted. One of these was set to cool to 16deg.C.	Where air conditioning units are fitted, e.g. to IT suites, ensure that they are set appropriately and do not cool below approx. 20 deg. C. Ensure that they are not used when heating is operating or windows open. They are not to be used to chill rooms, but to maintain a comfortable working temperature. Where they are fitted to maintain operating temperatures for IT equipment, ensure that natural ventilation is the first option for preventing overheating. Refer to equipment manufacturers recommendations and do not cool rooms unnecessarily. Air conditioning should not be in use when heating is on. Control heating to a comfortable level before using AC. Ensure that staff are aware of this advice. (Site Management)	No cost When combined with other temperature reduction measures approximate savings of £400 p.a.
4	LIGHTING		
4.1	Lighting is mostly via ceiling flush mounted CFLs and T8 ceiling mounted or suspended ceiling grid luminaires	Investigate costs and options for conversion to more up to date T5 or better still, LED lighting. (Electrical contractors)	Typical classroom: £4,500 Saving £689.00 p.a. Payback 6.5 years. (Paybacks dependent on usage and subject to a full survey and design.)

4.2	Several unoccupied areas were fully lit at time of visit .	Encourage staff and pupils to turn off lights in unoccupied areas. Make use of natural lighting where possible. (Site Management with Staff assistance)	No cost When combined with other lighting reduction measures, savings of approximately £500 p.a.
4.3	Kitchen lighting was reported to be on from 7 until 7 each day	Ensure that lighting is switched on only when needed. (Site Management with Staff assistance)	No cost When combined with other lighting reduction measures, savings of approximately £500 p.a.
4.4	Some WC, cloakroom and external lights are timer and/or sensor operated.	Where appropriate fit motion sensors to prevent unnecessary use of lighting. These may be suitable for classrooms, halls and corridors if suitably sensitive units are fitted. In classrooms and halls consider fitting motion operated sensors and light sensors to switch off those lamps nearest windows when natural light is sufficient. Rarely used areas such as store rooms, janitor cupboards, cloakrooms and WCs should all be fitted with motion sensors. (Electrical contractors)	£45.00 to £80.00 per sensor plus labour. (Paybacks dependent on usage, subject to a full survey)

4.5	Check operating times of external lighting.	Minimise lighting up times of standard lamps and external lighting. (Site Management)	No cost When combined with other lighting reduction measures, savings of approximately £500 p.a.
5	FABRIC & INSULATION		
5.1	Windows and external doors have been recently fitted and are mostly up to a good standard	Ensure that external door seals and sill/smoke seal brushes are in good order. Ensure that doors are properly adjusted within their frames to prevent draughts. (Site Management/maintenance)	Minimal cost as part of maintenance.
6	EQUIPMENT		
6.1	Fear of turning off the 'wrong equipment' or something in use, is an obstacle to switching off unused appliances	Identify and label plugs and switches so staff can confidently turn off unused equipment. Encourage staff (and students) to switch off lights and equipment when not in use. (Site Management with Staff assistance)	No cost
6.2	Staffroom Tea boiler is not fitted with a time switch.	Fit a seven day plug timer or timed spur outlet so that this can be automatically switched off when not in use. (especially at weekends & holidays) (Site Management)	£20 Payback dependent on current use.
6.3	Copiers, computers and whiteboard projectors.	Enable energy saving features on IT and office equipment. (IT management)	No cost When combined with other IT savings measures, Approximate savings of £388 p.a.

6.4	Copiers, computers and whiteboard projectors	Ensure that desktop computers and monitors etc are switched off when not in use. Consider centralised software to hibernate networked computers.	No cost When combined with other IT savings measures, Approximate savings of £388 p.a.
6.5	Copiers, computers and whiteboard projectors	Fit 7 day timers to copiers and laptop trolleys so they are not using energy unnecessarily. 6 hrs reduction in use per night for 10 laptops will save approximately £25 per year. (Laptops should only need charging for 1-2 hrs before use. They tend to be left on from close of school to first use next day, wasting electricity and reducing battery life.) (IT management)	£15- £25 per timer. Payback in one year.
6.6	Copiers, computers and whiteboard projectors	Rationalise use of copiers. Timed copying policies can reduce the amount of time that a copier needs to be on. (IT management/Admin)	No cost When combined with other IT savings measures, Approximate savings of £388 p.a.

7	WATER		
7.1	WC flush cisterns Some cisterns appeared oversized with no flush economy.	Fit proprietary 'Hippo' flush volume reducers, or alternatively place a filled and tightly closed 1 litre mineral water or pop bottle into the cistern, taking care not to interfere with the flush or filling mechanism. This will save a litre of water at each flush. Yorkshire water offer advice and assistance with water saving measures(Site Management).	No cost A 5 litre flush will cost approximately 1p. This will be saved every 5 flushes.
8	RENEWABLES		
8.1	The south facing aspect of the roof would suit a solar PV array. Costings and paybacks are estimated below.	A 20 kW array would be estimated to cost £30,000. The system would pay for itself in 8 years at current feed in tariff rates and at expected rates of generation. Based on a 5 year loan the shortfall payable per month is :	£167.51 per month. Refer to point 8.1 in summary below.

Summary of recommendations

The consumption figures quoted on the current Display Energy Certificate (2014/2015) show the following consumptions in comparison with an average similar building:

Heating energy use: 77 kWh/sq.m/year (155 typical)

50% of typical use.

Electricity use: 44 kWh/sq.m/year (40 typical)

110% of typical use.

If accurate these figures demonstrate commendable economy in use of heating systems, and close to typical consumption of electricity.

The colour coded table above offers an indication of the relative cost and effectiveness of energy saving measures.

Green suggests a low cost with a relatively high effectiveness. (Some measures e.g. behaviour change, setting of controls correctly, draughtproofing doors, etc are of almost zero cost and will reduce consumption to a greater or lesser degree. These recommendations should be carried out at the first opportunity.

Amber suggests a higher cost with a high to medium effectiveness. E.g. replacement of outdated lighting with LED lamps, fitting occupancy and light sensor controls to lighting. These recommendations will require evaluation and may be suitable for loan assistance.

Red suggests a high cost measure with lower effectiveness.

The Advisory Report that accompanied the schools first Display Energy Certificate should be referred to in conjunction with this audit report.

Higher cost measures with a high to medium effectiveness.

1.2 Valve, flange and pump jackets to be fitted so as to reduce heat loss. A typical small boiler room fitted with valve and flange jackets will cost approximately £750.00 estimated payback within 2 years. These figures are based on similar work in a small boiler room, estimated payback from <http://www.sustain.co.uk/>

(This cost and payback is an estimate only and will be subject to a full design and calculation of savings.)

4.1 Investigate costs and options for conversion to more up to date T5 or better still, LED lighting.

Based on a typical classroom of 56 x 600mm tubes x 36Watts, @ 11hrs per day for 195 days per year. Replacement cost of £4,500 and annual saving of £685.00 offers a 6.5 year payback.

(This cost and payback is an estimate only and will be subject to a full design and calculation of savings.)

4.4 Where appropriate, fit motion sensors to prevent unnecessary use of lighting. These may be suitable for classrooms, halls and corridors if suitably sensitive units are fitted. In classrooms and halls consider fitting motion operated sensors and light sensors to switch off those lamps nearest windows when natural light is sufficient. Rarely used areas such as store rooms, janitor cupboards, cloakrooms and WCs should all be fitted with motion sensors.

(This cost and payback is an estimate only and will be subject to a full design and calculation of savings.)

8.1 The south facing aspect of the roof would suit a solar PV array. Costings and paybacks are estimated below.

A 20 kW array would be estimated to cost £30,000.

Average yearly benefit in the first 5 years would be approximately £4081.92

Annual loan repayments over 5 years would be £6092.04

Annual shortfall to be met by the school would be approximately £2010.12

Monthly shortfall to be met by the school would be £167.51

The system would pay for itself in 8 years at current feed in tariff rates and at expected rates of generation.

(This cost and payback is an estimate only and will be subject to a full design and calculation of savings, and subject to variable weather conditions.)

A detailed analysis of estimated costs, savings and income is provided in Appendix 1.

Appendix 1 shows expected savings on electricity from the proposed solar PV installation, as well as income from feed in tariffs and export of generated electricity to the grid. Any shortfall between these savings and the loan repayments will be met either through economies achieved by implementing other energy saving measures or school funds.

It is difficult to forecast the savings that can be made through implementing a variety of low cost measures, such as those labelled Green in the above table. Approximate savings have been estimated using The Carbon Trust's 'Empower@ savings calculator'. <http://www.carbontrust.com/resources/tools/empower-savings-calculator>

A useful tool to help estimate potential economies is to carry out a metered night switch off.

Take representative readings over several days from say 4.00PM to 7.30AM to determine current night time usage, (or alternatively refer to half hourly meter readings if available).

Carry out a switch off exercise throughout the school, turning all appliances and equipment off where safe to do so and making a note of what has been turned off. Compare the consumption for 'switch off night' with previous readings. This will serve to identify equipment habitually left on, and quantify savings possible from better management of night time electricity use.

Appendix 1.

Technical Feasibility and costings/paybacks

YEAR	ELECTRICITY RATE	GENERATION	YEARLY SAVINGS	FIT RATE	FIT EARNINGS	EXPORT RATE	EXPORT EARNINGS	MAINTENANCE	YEARLY BENEFIT	PAYBACK PROGRESS
										-30000
1.00	0.12	16700.00	1503.00	0.12	1955.57	0.05	404.98	0.00	3863.55	-26136.46
2.00	0.13	16533.00	1562.37	0.12	1994.09	0.05	412.95	0.00	3969.42	-22167.04
3.00	0.13	16367.67	1624.08	0.12	2033.38	0.05	421.09	0.00	4078.55	-18088.49
4.00	0.14	16203.99	1688.23	0.13	2073.44	0.05	429.38	0.00	4191.05	-13897.44
5.00	0.15	16041.95	1754.92	0.13	2114.28	0.05	437.84	0.00	4307.04	-9590.39
6.00	0.15	15881.53	1824.24	0.14	2155.93	0.06	446.47	0.00	4426.64	-5163.75
7.00	0.16	15722.72	1896.30	0.14	2198.41	0.06	455.26	0.00	4549.96	-613.79
8.00	0.17	15565.49	1971.20	0.14	2241.71	0.06	464.23	0.00	4677.15	4063.36
9.00	0.18	15409.84	2049.06	0.15	2285.88	0.06	473.38	0.00	4808.31	8871.67
10.00	0.19	15255.74	2130.00	0.15	2330.91	0.06	482.70	0.00	4943.61	13815.28
11.00	0.20	15103.18	2214.13	0.16	2376.83	0.07	492.21	0.00	5083.17	18898.45
12.00	0.21	14952.15	2301.59	0.16	2423.65	0.07	501.91	1500.00	5227.15	24125.61
13.00	0.22	14802.63	2392.51	0.17	2471.40	0.07	511.80	0.00	5375.70	29501.30
14.00	0.23	14654.60	2487.01	0.17	2520.08	0.07	521.88	0.00	5528.97	35030.27
15.00	0.24	14508.06	2585.25	0.18	2569.73	0.07	532.16	0.00	5687.13	40717.41
16.00	0.25	14362.97	2687.36	0.18	2620.35	0.08	542.64	0.00	5850.36	46567.77
17.00	0.26	14219.34	2793.51	0.19	2671.97	0.08	553.33	0.00	6018.82	52586.59
18.00	0.28	14077.15	2903.86	0.19	2724.61	0.08	564.23	0.00	6192.70	58779.29
19.00	0.29	13936.38	3018.56	0.20	2778.29	0.08	575.35	0.00	6372.20	65151.49
20.00	0.30	13797.02	3137.79	0.21	2833.02	0.09	586.68	0.00	6557.50	71708.98
21.00	0.32	13659.05	3261.74	0.00	0.00	0.00	0.00	0.00	3261.74	74970.72
22.00	0.33	13522.46	3390.57	0.00	0.00	0.00	0.00	0.00	3390.57	78361.29
23.00	0.35	13387.23	3524.50	0.00	0.00	0.00	0.00	0.00	3524.50	81885.80

24.00	0.37	13253.36	3663.72	0.00	0.00	0.00	0.00	0.00	3663.72	85549.52
25.00	0.39	13120.82	3808.44	0.00	0.00	0.00	0.00	0.00	3808.44	89357.95

Payback
Achieved

Possible Invertor replacement

End of Government Incentives (FITS & Export)

Annual loan repayments over 5 years	6092.04
Average yearly benefit in first 5 years	4081.92
Annual Shortfall to be found by school	2010.12
Monthly shortfall to be found by school	167.51

The school is likely to receive payments of £2360.55 per year from incentive payments, any shortfall in monthly/yearly loan repayments will have to be allowed for, through saving any savings in previously purchased electricity and any other savings through good house keeping.