Carbon footprinting and energy efficiency audit

Golf course comparison summary

Date: 19 February 2010
Author: Richard Stuttard
Version: 001

Produced on behalf of
The R&A
The English Golf Union
and The Golf Union of Wales

ENGLISH
GOLF UNION

STRI
Ecology & Environment
St Ives Estate
Bingley
West Yorkshire
BD16 1AU

T. 01274 518903
F. 01274 561891
E. info@stri.co.uk
W. www.stri.co.uk

1.0 INTRODUCTION

The STRI Ecology & Environment Unit has been commissioned by The R&A, the English Golf Union and the Golf Union of Wales to undertake a carbon footprinting and energy efficiency audit of three golf clubs in England and Wales: Alresford Golf Club in Hampshire, Conwy (Caernarvonshire) Golf Club in North Wales and Woodhall Spa Golf Club in Lincolnshire.

These three clubs were chosen to represent elements of heathland, parkland, downland and links golf courses with buildings built between 1905 and 1998 to ensure that a wide range of golf club set-ups were covered. The clubs are also at different stages in their energy management.

Following the submission of three individual course-specific reports indicating each club's carbon footprint, the elements and processes which contribute to this figure, along with suggestions on how their impact on the environment can be reduced, the following report serves to compare the findings at each of the three golf clubs taking into account their size, type and building age and construction. The report will highlight similarities and differences among the three surveyed golf clubs, thereby indicating a series of generic initiatives which can be implemented by golf clubs throughout the UK towards reducing their carbon footprint, as well as highlighting more specific initiatives that may be relevant in certain circumstances.

2.0 SURVEYED GOLF CLUBS

Every golf club is different in terms of its size, age and numerous aspects of its design. These factors inevitably have an impact on resource use and therefore carbon footprint The following text outlines the basic features and workings of each golf club.

2.1 ALRESFORD GOLF CLUB

Alresford Golf Club is an 18 hole parkland club in Hampshire with around 675 members. It is an established club, founded in 1890, but has a relatively new clubhouse built in the 1980s. There have also been several extensions to the original building including a dining room built in the mid-1990s and the pro shop added in 2000. The majority of the roof space is insulated with glass fibre insulation material to 300 mm depth and the cavity walls of the building are insulated. The building is heated by 4 gas boilers and the heating is thermostatically controlled and also operates on a timer.

Recycling at the club is minimal with only glass waste segregated and collected for recycling and green waste composted by the greenstaff. All other waste streams are collected as general waste for landfill.

The golf course has a wide range of diesel powered greenkeeping equipment and has an automatic irrigation system which uses water from a borehole source augmented by mains water when necessary. The golf club has only one electric buggy, reserved for the use of members and visitors of limited mobility.

2.2 CONWY GOLF CLUB

Conwy Golf Club was established in 1890. The club supports an 18 hole links golf course situated along the Caernarvonshire coastline. The Club has a membership of 620 playing members plus a further 400 'social' (non-golfing) members with an estimated annual footfall of 9000.

The original clubhouse was demolished and replaced with a new construction in 1996. As a result, the building is reasonably efficient, being fitted with cavity wall insulation, a good depth of roof insulation and double glazed windows throughout. The building is also however fitted with energy demanding devices including air conditioning, an elevator and automatic entrance doors.

The Clubhouse is fed by mains water and central heating is fuelled by natural gas. Paper and glass waste is recycled by external contractor.

There are a series of maintenance buildings at Conwy, constructed between approximately 1975 and 1995. These are fairly basic constructions with little in the way of insulation however the office and canteen areas are fitted with double glazed windows. Bottled gas cylinders fuel blow heaters within the maintenance facility. The water supply for the maintenance facility is sourced from the mains whereas golf course irrigation water is drawn from a borehole.

Oil filters, aerosol cans, chemical containers and batteries are all recycled and some on-course waste is composted.

2.3 WOODHALL SPA GOLF CLUB

Woodhall Spa Golf Club was established in 1905. The National Golf Centre at Woodhall Spa consists of two 18 hole golf courses (the Hotchkin Course and the Bracken Course). The Club supports a 600 strong membership and the estimated annual footfall at the club is in excess of 75000. The original wood construction clubhouse dating back to 1905 is still present and in use to this day and given its age and type of construction, does not have the benefit of modern day insulation. In 1995 a Conference Centre was constructed at the Woodhall Spa site and in 1998 the original clubhouse was extended considerably, incorporating additional changing facilities and meeting rooms. These recent constructions at Woodhall Spa do have the benefit of effective roof, window and cavity wall insulation. Roof insulation within the newer buildings was found to be 200-300mm in depth.

Mains water is fed to the clubhouse and the central heating systems are fuelled by natural gas.

Glass, paper and food waste is all recycled by an external contractor with some waste also being composted.

The principal maintenance buildings were constructed in 1998. The water supply for the maintenance buildings is from the mains whilst irrigation water for the golf course is sourced from two on-course reservoirs. Some golf course waste is composted and re-used on the golf course. In addition to the wide range of diesel, petrol and electric golf course maintenance vehicles (see Appendix 1), the club also owns a petrol fuelled Ford Escort.

The club own two electric and one petrol fuelled golf buggy and also hire two further buggies for use on the course. Golf buggies are, in the main, used exclusively by staff.

3.0 METHODOLOGY

There are two elements to the carbon and energy audit: i) a high level carbon audit which allowed considerations of all energy use and waste produced by the golf club and ii) a more detailed assessment of equipment and energy use across each area of the clubhouse and golf course management.

3.1 CARBON FOOTPRINTING

The carbon footprint of the golf clubs estimates the total set of greenhouse gas emissions caused directly and indirectly by the golf club in one year. These emissions come from electricity use, central heating, fuel for course maintenance equipment and the treatment of waste and wastewater.

3.1.1 SCOPE OF THE CARBON FOOTPRINT

An important stage at the start of any audit is to determine the scope of the project, i.e. what data are ideally required and what can be achieved given time, cost and quality constraints. A golf club is a complex business with multiple energy sources and operations occurring across the golf course and within the various elements of the clubhouse.

The golf club audits follow the recognised methodology set out in *The Greenhouse Gas Protocol*, produced by the World Business Council for Sustainable Development and the World Resources Institute, which uses 'control' (either financial or operational control over operations) as a means of defining a boundary for the scope of an audit. This assumes that the aim of the audit is to reduce emissions where the golf club has direct control and not to undertake a complete life cycle assessment (LCA) of all the operations relating to the golf club. Under this remit, the audit will consider lighting, heating, general energy use and waste produced from the following areas of the golf club operations: bar/restaurant, offices, changing rooms, toilets/showers, the pro shop, the maintenance compound, and maintenance of the golf course. However, operations and travel outside of the golf clubs direct control but necessary for the golf club to function (e.g. the extraction of raw materials, the production of machinery, processing of foodstuffs, chemicals, sand, etc. and travel undertaken by delivery vehicles and staff and member travel) will be excluded from the audit. The audit will not consider the carbon sequestration potential of the golf course land.

3.1.2 DATA COLLECTION

Data for the carbon footprint was obtained from several sources:

1. Observations and quantitative measurements by STRI during visits to the golf clubs in April 2009.
2. Questionnaires responses from selected golf club staff.
3. Utility bills and fuel receipts held by the golf clubs
4. Published 'conversion factors' used to estimate the CO_2e emissions arising from energy use, water use and waste disposal

3.1.3 CARBON CONVERSION

The energy used and waste produced by each golf club was converted to metric tonnes of carbon dioxide (t CO_2e) using *The 2009 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting* (Defra and DECC, 2009). Metric tonnes of carbon dioxide were used as a cross-disciplinary unit, which allows direct comparisons between

different operations and allows different operations to be aggregated to provide an overall footprint for the selected operations.

3.2 ENERGY ASSESSMENTS

An energy assessment of each individual area of the club's operations, across the clubhouse and greenkeeping facilities was made during the site visit. This involved measuring the energy used by electrical appliances and lighting, checking the fabric of each building and observing operational practices.

Within each area, the energy consumption of each piece of electrical equipment was considered in terms of the likely electricity use and monetary cost across one year. Usage times for equipment in each area was calculated based on the assumptions described in Table 1. The annual cost of running each item of equipment was calculated by multiplying the annual kWh energy consumption by an average electricity cost for electricity in 2008 of £0.083 (based on the electricity rate from electricity bills in December 2008).

Table 1 Assumptions used to estimate usage times for equipment in each area of the club's operations

Description of annual usage	Assumed hours
Equipment in constant use, e.g. fridges and freezers	24 hours per day, 365.25 days a year = 8766 hours per year
Equipment within main frequently used clubhouse areas (e.g. bar, lounge, locker rooms, hallways, etc.) and in constant use during opening hours	15 hours per day, 365.25 days a year = 5479 hours per year
Equipment within kitchen areas and in constant use during staff hours	10 hours per day, 365.25 days a year = 3653 hours per year
Equipment within the secretary's office and in constant use during staff working hours	8 hours per day, 260 days a year = 2080 hours per year
Equipment within greenkeeping areas and the pro shop and in constant use during staff working hours	8 hours per day, 365.25 days per year = 2922 hours per year
Equipment not in constant use	Estimated on an individual basis, e.g. electric showers assumed 3 hours per day, 365.25 days a year = 1096 hours per year

4.0 CARBON FOOTPRINT DATA

The following table provides a breakdown of all elements contributing to each of the three golf clubs' carbon footprint. The information has been supplied to STRI by each of the three golf clubs and the resultant carbon footprint data has been produced following the methodology outlined in section 3.1.

Table 2 Breakdown of factors contributing to each club's carbon footprint

Footprint:	Quantity (2008)			Kg CO_2e			Percentage (%) Contributions		
	Alresford	Conwy	Woodhall Spa	Alresford	Conwy	Woodhall Spa	Alresford	Conwy	Woodhall Spa
Gas (kWh)	112329.7	284708	469377.2	20664.17	52266.7	86168.3	16.4	23.6	26.4
Electricity (kWh)	98882.4	247717.1	273415.2	53809.8	124953.0	148787.1	42.8	56.5	45.6
Petrol (litres)	800.0	1263.4	5503.2	1864.6	3372.5	12826.3	1.5	1.5	3.9
Diesel (litres)	11201.0	11701.8	19701.0	33926.7	35443.6	59672.4	27.0	16.0	18.3
Mains water supply (m^3)	1500.0	1675.4	2237.4	414.0	462.4	617.5	0.3	0.2	0.2
Waste water treatment (m^3)	1425.0	1591.6	2013.7	987.5	1103	1395.5	0.8	0.5	0.4
Borehole water (m^3)	2425.0	4680.2	N/A	0	0	N/A	0	0	N/A
General waste (tonnes)	45.8	45.0	97.0	13972.9	13712.3	29597.2	11.1	6.2	9.1
Card/Paper recycling (tonnes)	N/A	5.4	18.0	N/A	-3832.6	-12834	N/A	-1.7	-3.9
Glass recycling (tonnes)	13.3	13.3	N/A	0.0	0.0	N/A	0.0	0.0	N/A
Can recycling (tonnes)	N/A	0.7	N/A	N/A	-6297.2	N/A	N/A	-2.8	N/A
Total Carbon Footprint 2008	-	-	-	**125639.7**	**221183.7**	**326230.3**	-	-	-

4.1 2008 CARBON FOOTPRINT

The carbon footprint of each respective golf club reflects the relative size and footfall of each club:

Table 3 Golf course comparison table

Element	Alresford	Conwy	Woodhall Spa
Age of buildings (years)	10-30	14	12-105
Clubhouse floor space (m^3)	918	2778	c. 4000
Golf course area (ha)	44.8	54.2	145
Total carbon footprint	**125.6**	**221.2**	**326.2**

The 2008 footprint of 125.6 tonnes of CO_2e for Alresford Golf Club although considerably lower than the footprint of the other 18-hole facility in the study, Conwy, can largely be attributed to the size of the clubhouse at each venue (Alresford = 918 m^2, Conwy = 2778 m^2). The figures also relate to the amount of people visiting the club annually (Alresford = 675 members, Conwy = 1020 members). As a result, there is an increased requirement for heating and lighting within the clubhouse at Conwy and higher visitor numbers requiring food and drink. These factors largely explain the difference in electricity and gas consumption between the two clubs.

The difference has however been further widened as Alresford Golf Club has had a previous energy audit undertaken and therefore have already begun implementing energy efficiency measures. It is thought that as Conwy act upon the recommendations made to them in STRI's report, the gap between the two clubs in terms of electricity and gas consumption will narrow somewhat, although Conwy will inevitably always have a higher footprint than the smaller club, Alresford.

Woodhall Spa, as would be expected for the 36-hole National Golf Centre (including Conference Centre) with an annual footfall exceeding 75000, has a considerably higher carbon footprint than the other two surveyed clubs at 326.2 tonnes of CO_2e. This figure has been further elevated by the relative inefficiencies of the original 1905 section of the clubhouse and whilst recommendations have been made to improve this, the building, by design, will always have a degree of inefficiency.

5.0 SPECIFIC ANALYSIS

The following text summarises the differences between each surveyed club for each element contributing to the overall carbon footprint. A summary is also provided of the recommendations made towards reducing the carbon footprint contribution of each individual factor.

5.1 GAS

The difference in gas consumption between clubs is largely proportionate to the size of the clubhouse. For example, the clubhouse at Conwy Golf Club is approximately three times larger than that at Alresford and Conwy's gas consumption is 2.5 times greater. Because both clubhouse buildings are relatively new and are therefore built to modern insulation standards, the difference in gas consumption is largely due to the increase in space requiring heating and greater demands for food production at Conwy rather than building inefficiencies. There is, of course,

always room for improvement in terms of the 'human' factor and educating staff and members and encouraging changes of habit will have a significant impact.

The gas consumption of Woodhall Spa is considerably higher than Conwy and Alresford. Again, an increase in building size is a crucial factor, however inadequate insulation within the original section of the clubhouse (constructed in 1905) is increasing heating requirements and therefore gas consumption considerably. Recommendations have been made to improve this, however, given the historic nature of the building and its type of construction, it is unlikely that the building can be brought fully up to modern-day standards.

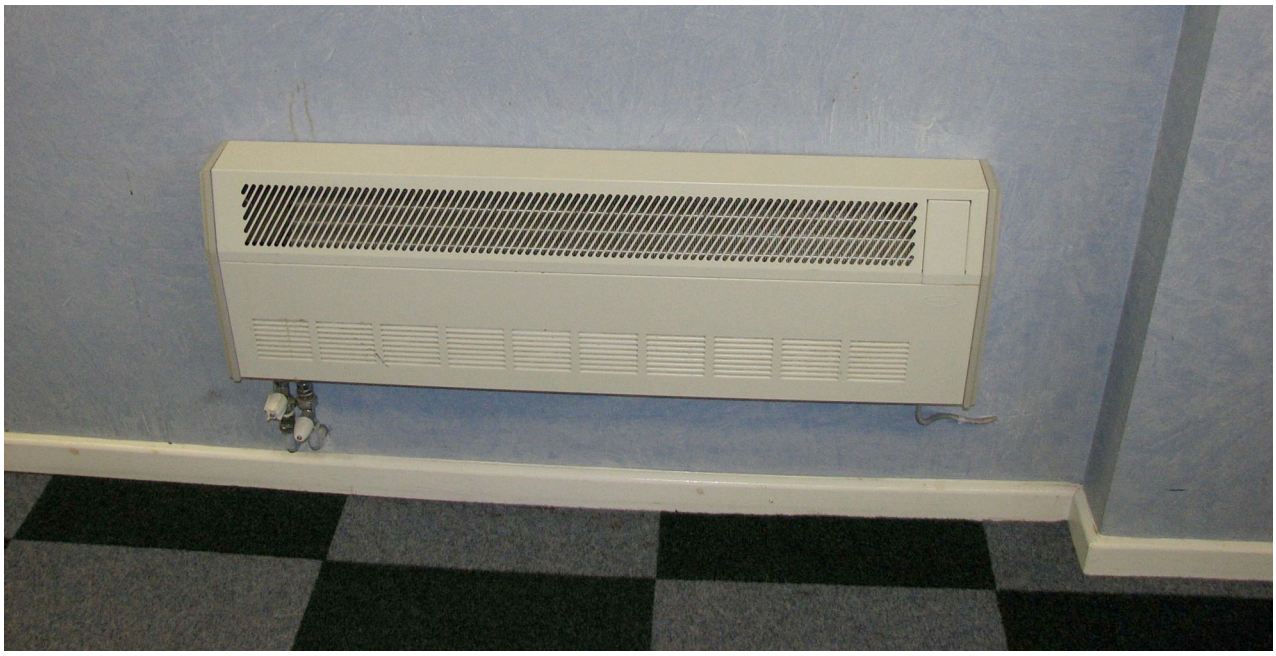
Tables, 4, 5 and 6 summarise recommendations made towards reducing gas consumption at Alresford, Conwy and Woodhall Spa respectively.

Table 4 Gas usage at Alresford

Issue	Solution
Loss of heat from hallway through doors and windows of entrance foyer	Installation of internal doors between foyer and hallway
Radiators blocked and operating inefficiently	Rearrange furniture away from radiators
Internal doors poorly insulated leading to a heat exchange between bar and beer cellar	Install new insulated doors or add insulation to existing doors
Poorly insulated roof space and large number of windows within dining area is resulting in considerable heat loss	Install roof insulation, close curtains at night to reduce heat loss and close internal doors between dining area and lounge when lounge not in use
Heating on and windows open	Use individual thermostatic controls on radiators to ensure each area is maintained at an acceptable temperature
Overheating of office in summer	Replace windows to improve airflow from outside
Maintenance facility – lack of control over heating	Use thermostatic controls on radiators to provide short term control. In the long term provide separate centralised heating control for the greenkeeping facility

Table 5 Gas usage at Conwy

Issue	Solution
Room partitions not used to full effect	Ensure room is divided to the minimum appropriate size, thereby reducing the area requiring heating
Office heated to excessive temperatures	Reduce thermostat setting by 3-4°C
Committee room and snooker room remain heated when not in use and heated to excessive levels	Ensure thermostatic radiators are switched off until room is to be used. Assign responsibility for this. Reduce thermostat setting when in use
Maintenance facility – office heated excessively by electric heater whilst windows are left open	Ensure that electric heater is switched off when not required



Inefficient heating systems are extremely costly

Table 6 Gas usage at Woodhall Spa

Issue	Solution
Hearting when rooms are unoccupied and during periods of hot weather	Regularly monitor and adjust heating settings to meet the minimum needs required. Give someone the responsibility of monitoring heating levels
Food storage area within kitchen is air conditioned yet positioned adjacent to excessively heated locker room. Poor insulation between the two rooms	Improve insulation between the two rooms and reduce heating levels to a more acceptable temperature
Poor insulation within 1905 clubhouse building	Investigate improving window, door and roof insulation
Room partitions in place but not fully utilised	Always have partitions closed if full room capacity is not required. Heating should then only be switched on in sections of the room in use
High ceilings equals extensive area requiring heating	Consider fitting false ceilings in these areas to reduce energy demand
Door and roof insulation inadequate within Secretary's office	Investigate ways of improving insulation
Drying room functioning all year round	Drying room should not be operational during periods of dry weather

5.2 ELECTRICITY

The electricity consumption of the three surveyed golf clubs produced similar trends to that of gas. Again, this is a direct result of building and the associated increase in lighting requirements and electrical equipment. The following recommendations have been issued to reduce demands on electricity:

Table 7 Electricity usage at Alresford

Issue	Solution
Inefficient light bulbs	Replace all incandescent bulbs with compact fluorescent units; replace all halogen spotlights with LEDs
Inflexible lighting in many areas	Install differential controls thereby allowing the minimum required lighting to be utilised
Lights left on when room vacant	Install motion/light sensors where appropriate. Employ switch-me-off signage. Educate staff and members
Old inefficient equipment	Assess the cost benefit of purchasing new efficient equipment over continuing to run existing inefficient appliances
Equipment left on or on standby when not in use	Educate staff to switch off equipment when not required
Bottle fridges in bar area left on 24 hours a day	Fit timer switches to bottle coolers to ensure they are only operational when required

Bottle fridges presented a prime opportunity for energy savings at all three surveyed clubs

Table 8 Electricity usage at Conwy

Issue	Solution
Equipment left on or on standby when not in use	Turn off equipment when not in use. Employ switch-me-off stickers. Educate staff and members
Some appliances are dated and consume large amounts of power	Replace ancient appliances with new energy efficient models
Current light fittings are inefficient	Replace all incandescent bulbs with compact fluorescent units. Replace all halogen spotlights with LEDs.
Bottle fridges in bar area current left on 24 hours a day	Fit timers to ensure fridges are only operation when required
Showers demand considerable amounts of energy	Educate users and encourage their showers to be kept to a minimum
Lighting left on during daylight hours despite good available natural light	Fit light level sensors and utilise flexible lighting

Automatic doors are an energy demanding luxury

Table 9 Electricity usage at Woodhall Spa

Issue	Solution
Equipment left on or on standby when not in use	Turn off equipment when not in use. Employ switch-me-off stickers. Educate staff and members
Some appliances are dated and consume large amounts of power	Replace ancient appliances with new energy efficient models
Current light fittings are inefficient	Replace all incandescent bulbs with compact fluorescent units. Replace all halogen spotlights with LEDs.
Bottle fridges in bar area current left on 24 hours a day	Fit timers to ensure fridges are only operation when required
Showers demand considerable amounts of energy	Educate users and encourage their showers to be kept to a minimum
Lighting left on during daylight hours despite good available natural light	Fit light level sensors and utilise flexible lighting
Skylights not fully effective	Clean skylights to maximise natural light potential

Energy efficient lighting is the way forward

5.3 PETROL/DIESEL

The amount of diesel consumed at both Alresford and Conwy in 2008 is very similar. Although the course at Conwy is some 10 ha larger than that at Alresford, the vast majority of Alresford's maintenance equipment is diesel powered whilst Conwy utilises a number of petrol powered vehicles and machines. As such, diesel consumption between the two clubs is very similar whilst petrol consumption at Conwy is somewhat higher.

Woodhall Spa's fuel consumption is considerably elevated compared to the other two surveyed clubs. However, proportionately this compares favourably when considering that Woodhall Spa is a 36-hole facility covering some 145 ha.

The following recommendations for reducing petrol and diesel consumption were made to each of the three surveyed clubs:

- Ensure vehicle tyres are correctly inflated to maximise fuel efficiency.
- Schedule work tasks so that work requiring the same vehicle or piece of equipment can be completed together and in similar areas of the course to reduce unnecessary travel between tasks and multiple trips to and from the storage heads.
- Consider fuel efficiency when purchasing new equipment or replacing old equipment.
- Do not leave transport vehicles idling when completing work on site.
- Evaluate mown areas of the golf course. Do all areas currently mown need to be? Could some areas be managed as tall rough. Reducing mowing frequency in these areas reduces fuel use and can also have wider environmental benefits.

Regular machinery maintenance and efficient usage can lead to significant reductions in fuel requirements

5.4 WATER

Conwy and Alresford were found to be using similar amounts of mains water in 2008. Whilst this is somewhat disproportionate given the size of the clubhouses and the high number of members at Conwy, the figures can be explained by the fact that Alresford uses mains water to supplement its borehole allowance for the irrigation of the golf course. This is a practice that should be discouraged at Alresford as applying treated mains water to the golf course brings with it a considerable financial and environmental burden. Course management at Alresford should be geared towards minimising the water requirements of the golf course, thereby ensuring the club's annual borehole extraction allowance is sufficient for the needs of the course.

Given the high visitor numbers at Woodhall Spa, mains water consumption, although considerably higher than Alresford and Conwy, is proportionately low.

The following recommendations for minimising water use were prescribed to each of the three assessed clubs:

- Install bricks or Hippo devices within toilet systems to reduce water used for toilet flushing.
- Consider rainwater harvesting to provide water for flushing toilets/irrigating clubhouse gardens.
- Install push taps in locker rooms.
- Fit electronic flush controllers in urinals.
- Consider hand watering of greens in high spots to reduce the need for automatic irrigation.
- Check sprinkler heads and pipes frequently to improve resource efficiency.
- Irrigate the golf course based on weather conditions, i.e. to replace water loss through evaporation rather than routinely irrigating or irrigating on the basis of time rather than water volume.
- Install correct sprinkler heads for the situation, e.g. 180° sprinkler heads at the edge of maintained areas that reduce overthrow of water to non-target areas.
- Consider grass species within playing surfaces, such as tees and greens, and perhaps switch to more drought-tolerant species.

5.5 WASTE

The total waste production at Alresford and Conwy was found to be extremely similar (59.1 tonnes at Alresford versus 63.7 tonnes at Conwy). This is a somewhat strange result given the larger visitor numbers to Conwy and highlights potential inefficiencies at Alresford. It will be important that Alresford review their purchasing policy and general waste management practices. Alresford has a significant opportunity to offset its carbon footprint further by setting up paper/cardboard and can recycling facilities.

The amount of waste produced at Woodhall Spa is largely proportionate to the size of the club. Paper and card recycling has been an excellent initiative and one that has served to offset close to 13 tonnes of CO_2e from the club's carbon footprint. Woodhall Spa's general waste figure could be reduced significantly if the club were to begin recycling all glass and can waste.

Given the amount of the glass bottles and cans used at golf facilities daily, recycling of this nature really should be standard practice throughout the industry. If the maximum waste recycling potential of a golf club is realised, the impact on their carbon footprint will be significant.

The following recommendations were made to each of the three assessed golf clubs:

- Purchase recycled products.
- Develop recycling policy.
- Develop purchasing policy.
- Choose products with the least packaging.
- Reduce paper use.
- Use long life products.
- Use wood material from the golf course to heat buildings.
- Develop composting facility to deal with green waste.

Glass recycling is a carbon neutral process

Cardboard and paper recycling initiatives have offset almost 13 tonnes CO2e from Woodland Spa's carbon footprint

6.0 CLOSING COMMENTS

This study has provided a valuable insight into the working practices of a golf facility and how these practices contribute to a golf club's carbon footprint. Many of the inefficiencies identified were common across all three clubs surveyed and, as such, there are a number of general recommendations that can be made to assist golf clubs in reducing their carbon footprint and therefore their costs.

Quantifying the potential reduction in a club's carbon footprint is difficult in year one of the process as it is unlikely to be the case that clubs adopt all recommended energy saving measures. To obtain a realistic view of what is achievable by the average golf club, the most appropriate way forward will be to reassess Alresford, Conwy and Woodhall Spa on an annual basis for a period of three years.

Signed:

RICHARD STUTTARD
Ecology & Environment

Appendix 1

Alresford Golf Club Equipment Audit

TABLE 1: Entrance and hallway			
Electricity			
Type of equipment or bulb	Number	Total annual kWh	Cost (£/year)
Halogen spot lights	6	1314.9	109.1367
LED spotlights	25	547.875	45.473625

TABLE 2: Bar/lounge			
Electricity			
Type of equipment or bulb	Number	Total kWh	Cost (£/year)
Till monitor	1	2211.7	183.6
Glass washer	1	3122.9	259.2
Coffee machine	1	2991.3	248.3
Fridge	2	2768.6	229.8
Fridge	2	807.3	67.0
Wall lights	4	876.6	72.8
Low energy ceiling lights	19	763.4	63.4
Incandescent bulbs	2	438.3	36.4
Trophy cabinet halogen spotlights	3	438.3	36.4
Table lamp incandescent bulb	1	219.2	18.2
Halogen low energy spotlights	13	189.9	15.8
Coffee pot heater	1	183.1	15.2
TV	1	149.6	12.4
skybox	1	87.7	7.3
Card reader	1	44.7	3.7
Till drawer	1	43.8	3.6
Order printer	1	29.8	2.5
Bottle cooler	2	?	?
PA system	1	?	?

TABLE 3: Lockers			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Gents lockers			
Shower	4	29186.397	2422.5
Halogen spots	32	1863.68	154.7
Hair dryer	1	1124.2395	93.3
Hand dryer	1	2848.95	236.5
Fluorescent strip light (not motion sensor)	2	582.4	48.3
Fluorescent strip light (motion sensor)	4	584.4	48.5
Ladies lockers			
Electric shower	3	21889.8	1816.9
Hand dryer	1	2849.0	236.5
Halogen spots	29	1694.8	140.7
Hairdryer	1	607.4	50.4
Hairdryer	1	579.4	48.1
Hairdryer	1	417.4	34.6
Monitor	1	255.1	21.2
Laptop	1	191.1	15.9
Printer	1	108.0	9.0
Curling tongs	1	58.7	4.9
Curling tongs	1	7.8	0.6

TABLE 4: Secretary's Office			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Computer	3	1248	103.6
2m strip lights	6	873.6	72.5
Photocopier	1	545.6835	45.3
Printer	1	362.40105	30.1
Printer	1	265.1715	22.0
Computer monitor	3	255.0906	21.2
Fax	1	191.9754	15.9
Phone	1	30.2427	2.5
Shredder	1	4.565625	0.4
Fan	1	3.28725	0.3
Calculator	1	2.704	0.2
Power reserve battery	2	?	?

TABLE 5: Pro's Shop			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Strip lights	20	4090.8	339.5
Battery charger	7	2172.2	180.3
Halogen spots	11	1356.1	112.6
Monitor	1	887.6	73.7
Computer	1	616.4	51.2
LED spots	12	147.9	12.3
Monitor	1	89.7	7.4
Phone charger	2	70.0	5.8
Printer	1	55.4	4.6
Printer	1	23.7	2.0
Laminator	1	16.1	1.3
Radio	1	7.2	0.6
Security monitor	1	?	?
Kettle	1	?	?
Fridge	1	?	?

TABLE 6: Maintenance facility			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Strip bulb	7	733.8	60.9
Kettle	1	724.3	60.1
Battery charger	1	436.8	36.3
Incandescent bulb	2	349.4	29.0
Microwave	1	303.8	25.2
Computer	1	192.2	16.0
Fridge	1	187.9	15.6
Washing machine	1	138.6	11.5
Fan heater	1	100.2	8.3
Laptop	1	80.4	6.7
Walky talky charger	3	77.1	6.4
Fax	1	34.2	2.8
Angle grinder	1	1338.3	111.1
Radio	1	14.2	1.2
Printer	1	10.5	0.9
Radio	1	7.0	0.6
Shredder	1	1.3	0.1
Shower	1	608.0	50.5
Air compressor	1	0.3	0.0
Power washer	1	0.1	0.0
Water recycling unit	1	?	?

Appendix 2

Conwy Golf Club Equipment Audit

TABLE 1: Bar and Beer Cellar			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Bar			
Large spot light	11	6026.6	500.21
Flourescent 2d square bulb	11	2169.6	180.08
1200 mm strip lights	4	876.6	72.76
TV, media reciever and sky digibox	1	596.1	49.48
Beer Cellar			
Soda recirculation equipment	1	5697.9	472.93
Carbonator	1	4207.7	349.24
1.5 m strip light	6	142.4	11.82
Drinks pumps	14	?	?
Freezer	1	?	?
Room refrigeration unit	1	?	?

TABLE 2: Dining Room			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Flourescent 2d square bulb	56	11045.2	916.75
Coffee machine	1	3837.3	318.50
Wall lights	8	2629.8	218.27
Halogen spot lights	6	1314.9	109.14
Picture light (incandescent)	2	657.5	54.57
Computer	1	635.5	52.75
Side light	1	328.7	27.28
Computer monitor	1	210.4	17.46
Disco lights	2	?	?

TABLE 3: Secretary's Office			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Strip lights	12	898.6	74.58
Printer	3	872.2	72.39
Kettle	1	767.0	63.66
Photocopier	1	537.6	44.62
Electric heater	1	362.5	30.09
Computer	2	249.6	20.72
Monitor	2	99.8	8.29
Fax machine	1	23.7	1.97
Laminator	1	28.3	2.35
Air conditioning	1	?	?
Shredder	1	?	?
Computer server	1	?	?

TABLE 4: Locker Rooms and Toilets			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Ladies lockers – members			
Shower	2	14593.2	1211.24
Hand dryer	2	3835.1	318.32
Hairdryers	2	3287.3	272.84
Flourescent 2d square bulb	6	1183.4	98.22
Strip lights	2	821.8	68.21
Strip lights	3	493.1	40.93
Drying room			
Strip light	1	27.4	2.27
Ventilation system	1		
Ladies lockers – visitors			
Electric shower	2	14593.1985	1211.235476
Hand dryer	2	5478.75	454.73625
Halogen spot lights	17	4319.7	358.5351
Hair dryer	1	712.2375	59.1157125
Curler	1	222.8025	18.4926075
Personal hygiene dispenser	1	?	?
Mens locker room			
Shower	3	21889.8	1816.85
Hand dryer	2	5478.8	454.74
0.5 m strip light	40	4383.0	363.79
1800 mm strip light	2	821.8	68.21
1.5 m strip light	2	712.2	59.12
Extractor fan	?	?	?
Visitors locker room			
Hand dryer	1	9587.8	795.79
Shower	3	21889.8	1816.85
1800 mm strip light	8	3287.3	272.84
Halogen spots	5	219.2	18.19
Extractor fan	?	?	?
Caddy room			
1800 mm light strip	5	2054.5	170.53
Junior changing room			
1800 mm light strip	6	2465.4	204.63

TABLE 5: Pro's Shop			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
1800 mm strip lights	18	3944.7	327.41
Halogen spot lights	28	3272.6	271.63
Fridge	2	2505.7	207.97
TV	2	1099.8	91.29
Hot water boiler	1	993.8	82.49
Computer	2	350.6	29.10
450 mm strip light	2	263.0	21.83
Computer monitor	2	140.3	11.64
DVD player	1	?	?
Digital message board	1	?	?

TABLE 6: Maintenance Area			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
1800 mm strip lights	12	3506.4	291.03
Compressor	1	2081.9	172.80
Kettle	1	1604.2	133.15
Incandescent bulb	3	876.6	72.76
Shower	1	608.0	50.47
Electric heater	1	334.6	27.77
Computer	1	175.3	14.55
Microwave	1	173.5	14.40
Toaster	1	112.8	9.36
Computer monitor	1	70.1	5.82
Irrigation equipment	1	?	?
Printer	1	?	?
Fridge	1	?	?
Outside lights	2	?	?

Appendix 3

Woodhall Spa Golf Club Equipment Audit

TABLE 1: Old Clubhouse Kitchens			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Toaster	2	38570.40	3201.34
Water boiler	1	24544.80	2037.22
Sandwich toaster	1	21038.40	1746.19
Dishwasher	1	6519.71	541.14
Microwave	3	6138.94	509.53
Freezer	1	4303.23	357.17
1.5 m strip lights	15	3813.21	316.50
Toasting grill	1	3287.25	272.84
Freezer	2	1490.22	123.69
Bug catcher	2	1327.17	110.16
Fixed air con unit	1	1022.70	84.88
Large freezer	1	471.14	39.10
Incandescent bulb	1	262.98	21.83
Vacuum cleaner	1	255.68	21.22
Walk talkie chargers	4	136.75	11.35
Fluorescent ‘ring’ bulbs	1	122.72	10.19
Incandescent bulb	1	109.58	9.09
Fridge	1	56.10	4.66
Deep fat fryer	1	54.79	4.55
Potato rumbler	1	45.66	3.79
Order printer	1	29.80	2.47
Card reader	1	43.83	3.64
Till monitor	1	22116.62	1835.68
Till drawer	1	43.83	3.64
Mixer	1	?	?
Large fridge	1	?	?
Large fridge	3	?	?
Large fridge	1	?	?
Mobile air con unit	1	?	?
Fixed electric heater	1	?	?
Extractor fan	1	?	?
Dryer	1	?	?
Washing machine	1	?	?
Large freezer	1	?	?
Chest freezer	1	?	?

Gas			
Type of equipment or bulb	**Number**		
Spider gas burners	15		
Grill	1		

TABLE 2: Old Clubhouse Bar and Beer Cellar			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Old clubhouse bar			
Tills	2	4423.32	367.14
Halogen spotlights	14	3259.86	270.57
Glasswasher	1	3122.89	259.20
Drink pumps	2	547.00	45.40
Dustbuster	1	0.40	0.03
Security monitors	1	?	?
Sky box	1	?	?
Small fridge	1	?	?
Large fridge	1	?	?
Drink pumps	1	?	?
Drink pumps	1	?	?
Card reader	1	?	?
Receipt printer	2	?	?
Small fridge	1	?	?
Beer cellar			
Main beer cooler	1	3666.82	304.35
Flourescent 2d square bulb	2	40.91	3.40
Room chiller	1	?	?
Ice fridge	1	?	?
Gas beer pumps	7	?	?

TABLE 3: Dining Area 1 – closest to the kitchen

Electricity

Type of equipment or bulb	Number	Total kWh	Cost (£/year)
Hot cupboard	1	12316.23	1022.25
Halogen spots	14	3259.86	270.57
Small ping pong light bulbs (chandeliers)	10	2191.50	181.89
Fan lights	6	1314.90	109.14
Display chiller	1	1306.20	108.41
Cup warmer	1	940.15	78.03
Strip light	3	723.20	60.03
Hot water heater	1	624.58	51.84
Small ping pong light bulbs (chandeliers)	15	575.27	47.75
Side lights	9	542.40	45.02
Picture light	1	164.36	13.64
Till	1	?	?
Card reader	1	?	?

TABLE 4: Dining Area 2 – linked to the bar

Electricity

Type of equipment or bulb	Number	Total kWh	Cost (£/year)
Halogen spots	49	11409.50	946.99
Side lights ping pong	24	5259.60	436.55
Desk lamps	5	547.88	45.47
Strip light	1	197.24	16.37
Picture light	1	164.36	13.64
Fluorescent 2d square bulb	1	153.41	12.73
TV	1	72.94	6.05
Desk lamps	1	60.27	5.00
Electric fan	1	?	?

TABLE 5: Secretary's and Admin Offices			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Secretary's office			
Halogen spots	6	530.4	44.02
PC	1	416.0	34.53
Scanner	1	46.8	3.88
Printer	1	6.9	0.57
Server	1	?	?
Adjoining office			
Strip bulb	12	898.6	74.58
Printer	1	645.6	53.59
Computer	1	364.0	30.21
Scanner/fax/phone	1	319.1	26.48
Small fridge	1	123.6	10.26
Laminator	1	40.3	3.35
Walkie talkie charger	1	30.1	2.50
Monitor	1	8.3	0.69
Catering office			
Printer	1	482.4	40.04
strip bulb	1	145.6	12.08
Computer	1	85.3	7.08
Monitor	1	49.1	4.07
Laminator	1	40.3	3.35
Phone + charger	1	35.9	2.98
Shredder	1	6.5	0.54

TABLE 6: Small Office			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Printer	1	482.4	40.04
strip bulb	1	145.6	12.08
Computer	1	85.3	7.08
Monitor	1	49.1	4.07
Laminator	1	40.3	3.35
Phone + charger	1	35.9	2.98
Shredder	1	6.5	0.54

TABLE 7: Locker Rooms and Toilets			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Ladies toilets conference centre - downstairs			
Strip lights	8	52.6	4.37
Fluorescent 2d square bulb	4	20.5	1.70
Ladies toilets conference centre - upstairs			
Strip lights	3	19.7	1.64
Fluorescent 2d square bulb	2	10.2	0.85
Ladies changing rooms			
Electric shower	2	14593.2	1211.24
Strip lights	7	2684.6	222.82
Hand dryer	1	1200.7	99.66
Halogen spots	4	931.4	77.31
Strip light in drying room	1	383.5	31.83
Picture lights	2	328.7	27.28
Spots (incandescent)	1	328.7	27.28
Strip lights	1	317.8	26.37
Fan heater	1	7.3	0.61
Curlers	2	7.3	0.61
Gents toilets adjacent to meeting rooms new building			
Hand dryer	1	1753.2	145.52
0.5m strip light	2	197.2	16.37
Fluorescent 2d square bulb	1	153.4	12.73
Extractor fan	1	?	?
Gents locker room			
0.5 m fluorescent strip	42	4141.9	343.78
Hand dryer	1	1753.2	145.52
Fluorescent 2d square bulb	9	1380.6	114.59
1.5 m strip light	2	635.5	52.75
1 m strip light	2	394.5	32.74
Extractor fan	6	?	?
Hydrostatic showers			
Gents locker room old clubhouse			
Hand dryer	1	2629.8	218.27
Low energy bulbs	14	843.7	70.03
1m strip lights	4	788.9	65.48
2 m strip light	1	547.9	45.47
Fluorescent 2d square bulb	3	460.2	38.20
keypad	1	?	?
Shower	3	?	?

TABLE 8: Conference Room and Kitchens			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Freezer	1	6307.1	523.49
Water boiler	1	5290.6	439.12
Drinks chiller	1	5060.6	420.03
Till monitor	1	4607.6	382.43
Hot cupboard	1	3811.4	316.34
Dishwasher	1	2173.2	180.38
Strip lights	30	1972.4	163.71
Sup pots	2	1761.2	146.18
Glo-ray	1	1525.6	126.63
Microwave	2	1351.4	112.17
Hotplate	1	772.5	64.12
Microwave	1	438.3	36.38
Kitchen lights (incandescent)	3	328.7	27.28
Wharfedale speakers	4	65.7	5.46
Card reader	1	9.3	0.77
Till drawer	1	9.1	0.76
Order printer	1	6.2	0.52
Coffee machine	2	5.5	0.45
Seinheiser microphone and sound system	1	4.0	0.33
Coffee machine	1	2.7	0.23
Electric storage heater	?	?	?
Aircon/fans	?	?	?
Strip lights	54	?	?
Halogen spots	20	?	?
Drinks chiller (double)	1	?	?
Freezer	2	?	?
Bug catcher	?	?	?
Aircon unit	?	?	?
Dishwasher	1	?	?
Freezer	1	?	?
Deep fat fryer (twin)	1	?	?
Grill	1	?	?
Oven	1	?	?
Display cupboards	Various	?	?

TABLE 9: Pro's Shop			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Coffee machine	1	3837.3	318.50
Short strip lights	4	1753.2	145.52
Halogen spots	13	1519.4	126.11
Strip lights	14	1472.7	122.23
Strip lights	6	631.2	52.39
Short strip lights	6	631.2	52.39
Photocopier	1	545.7	45.29
Small grey fridge	1	526.0	43.65
Printer	1	482.4	40.04
Printer	1	482.4	40.04
Walkie talkie charger	2	350.6	29.10
Computer	1	119.8	9.94
Computer	1	119.8	9.94
Monitor	1	116.9	9.70
Flourescent 2d square bulb	1	81.8	6.79
Monitor	1	69.0	5.72
Monitor	1	69.0	5.72
Footjoy revolving shoe	1	14.9	1.24
Electric fan	1	13.1	1.09
Water cooler	1	12.3	1.02
Drinks cooler	1	2.5	0.21
Caddy battery charger	6	1.0	0.09
Drinks cooler	1	?	?
Till + monitor	1	?	?
Security monitor	1	?	?
Monitor	1	?	?

TABLE 10: Maintenance Compound			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
Maintenance area - workshop and storage areas			
2m strip light	24	7012.8	582.06
Maintenance area - offices/showers etc			
Water boiler	1	25395.1	2107.79
Fridge	1	5689.1	472.20
Fax	1	5470.0	454.01
1m strip lights	25	2629.8	218.27
Electric shower	1	2432.2	201.87
Dishwasher	1	840.1	69.73
Water cooler	1	657.5	54.57
Toaster	1	644.3	53.48
Microwave	2	584.4	48.51
Toaster	1	554.1	45.99
Flourescent 2d square bulb	2	163.6	13.58
PC	1	119.8	9.94
Printer	1	43.0	3.57
Extractor fan	1	?	?
Telephone	3	?	?
ESD waste to water	1	?	?
External security lights	1	?	?
Bretts cottage			
Water boiler	1	25395.1	2107.79
2m strip light	7	2045.4	169.77
1 m strip light	2	210.4	17.46

TABLE 11: Conference Rooms and Corridors			
Electricity			
Type of equipment or bulb	**Number**	**Total kWh**	**Cost (£/year)**
New building upstairs corridor			
Electronic door release	1		
0.5 m fluorescent strip	24	788.9	65.48
Meeting room 1 new building			
Halogen spot	14	1086.6	90.19
Meeting room 2 new building			
Halogen spot	13	1009.0	83.75
Corridor to conference centre			
Halogen spots	16	1241.9	103.07
0.5 m strip lights	18	526.0	43.65
0.25 m strips	2	58.4	4.85
Dumb waiter	1	Out of service	Out of service
Boiler room			
2m strip light	1	182.6	15.16
Foyer of conference centre			
Halogen lights	12	931.4	77.31

Appendix 4

List of Golf Course Machinery at
Woodhall Spa Golf Club

Diesel Machines

4 x Toro 3250 greens mowers (2x2004 2x2007)
3 x Toro 3200 greens mowers (1997)
2 x Toro 3500 rotary mowers (2003,2005)
2 x Toro 5610 fairway mowers (2007)
1 x Toro 6500 fairway mower (2003)
1 x Toro 4500 rotary mower (2003)
1 x Toro multipro sprayer (2006)
1 x Toro 3000D rotary mower (1997)
3 x Toro 3300D workman (1998,2005,2007)
2 x Cushman utility vehicles (1991,1995)
1 x Isuzu Rodeo Denver 2.5L pick up (2006)
1 x Etesia (2007)
1 x John Deere 855 tractor (1994)
1 x Iseki 545 tractor (1993)
1 x New Holland Boomer 3045 tractor (2009)
1 x Kubota ST30 tractor (1999)
1 x Kubota L3600 tractor (1998)
2 x Kubota L4200 tractor (1996,1997)

Petrol Machines

6 x Toro GM 1000's greens mowers (1998)
3 x Toro GM flex 21's greens mowers (2003)
3 x Toro Gm flex 21's greens mowers (2009)
1 x Toro 3020 sand pro (1998)
1 x Toro 648 aeration machine (2007)
1 x Atilla brush cutter(2006)
6 x Stihl 036 chain saws (1998-2006)
9 x Stihl FS55 strimmers (2004-2009)
4 x Stihl hand held blowers (2006-2009)
2 x Stihl hedge cutters (2004)
1 x Vermeer 206 stump grinder (2004)
1 x Ryan renothin (1997)
1 x Sisis autorake (2000)
1 x Honda 536 rotary mower (2005)
3 x Billy Goat push blowers (1998,2000,2005)

Electric Machines

4 x Toro E2050 workman utility vehicles (2004)
Year of purchase in brackets.