# CARBON FOOTPRINTING AND ENERGY EFFICIENCY AUDIT

# Alresford Golf Club


Produced on Behalf of The R&A, EGU and GUW

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By
Kelly Harmar & Richard Stuttard
Ecology & Environment

STRI
St Ives Estate, Bingley, West Yorkshire, BD16 1AU
T: 01274 518903 ● F: 01274 561891 ● E: info@stri.co.uk ● W: www.stri.co.uk

STRI Ecological & Environmental Services

## 1.0 INTRODUCTION

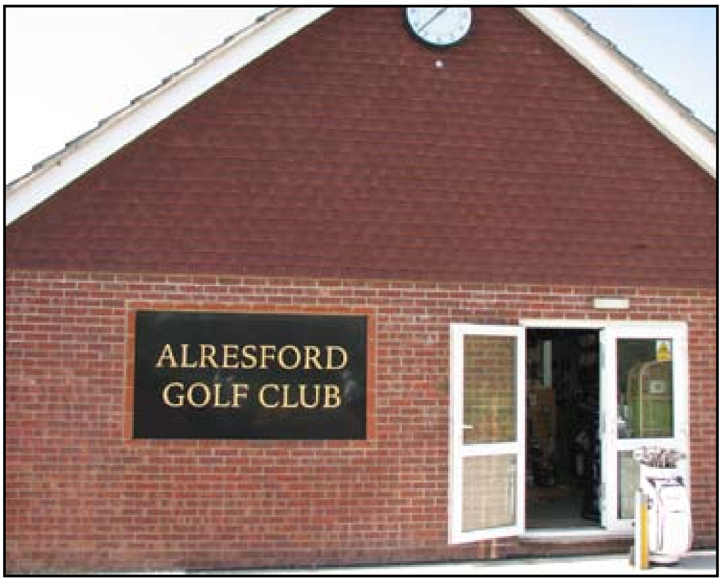
The STRI Ecology and Environment Unit have been commissioned by The R&A, The English Golf Union and The Golf Union of Wales to undertake a carbon footprinting and energy efficiency audit of three golf clubs in England and Wales: Alresford Golf Club in Hampshire; Conwy (Caernarvanshire) Golf Club in North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

The energy efficiency and waste management advice given during the project should help the clubs to save energy, reduce waste and greatly reduce their overheads. In doing so, the carbon emissions from the clubs should also decrease, reducing their contribution to climate change. The reports are available for other golf clubs to look at on The R&A, EGU and GUW websites, alongside a 'Carbon Calculator' which will allow clubs to enter simple utility and energy data and gain an estimate of their own carbon footprint.

## 2.0 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 proshop 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 mainswater when necessary. The golf club has only one electric buggy, reserved for the use of members and visitors of limited mobility.

# 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 THE CLUB'S CARBON FOOTPRINT

Based on the methodology outlined in Section 3.1, the total carbon footprint for Alresford golf club (clubhouse and golf course) in 2008 was estimated as 125.6 metric tonnes of $CO_2e$[1] (see Table 2). This 105.95 tonnes of $CO_2e$ footprint roughly equates to the $CO_2e$ emissions generated by 23 company cars over one year to the methane emissions generated by 41 cows over one year or the average $CO_2$ emissions generated in 7 minutes and 55 seconds by a conventional coal-fired power station.

**Table 2** Carbon footprint of Alresford Golf Club for 2008 (based on the methodology described in Section 3.1).

| Footprint element | Quantity (2008) | Conversion factor | kg $CO_2e$ | Percentage (%) contribution |
|---|---|---|---|---|
| Gas (kWh) | 112329.7 | 0.18396 | 20664.17 | 16.4 |
| Electricity (kWh) | 98882.4 | 0.54418 | 53809.8 | 42.8 |
| Petrol (litres) | 800.0 | 2.3307 | 1864.6 | 1.5 |
| Diesel (litres) | 11201.0 | 3.0289 | 33926.7 | 27.0 |
| [2]Mains water supply ($m^3$) | 1500.0 | 0.276 | 414.0 | 0.3 |
| Wastewater treatment ($m^3$) | 1425.0 | 0.693 | 987.5 | 0.8 |
| [3]Borehole water ($m^3$) | 2425.0 | 0 | 0 | 0 |
| General waste (tonnes) | 45.8 | 305 | 13972.9 | 11.1 |
| Glass recycling (tonnes) | 13.32736 | 0 | 0 | 0 |
| **Total** | - | - | **125639.7** | - |

# Total carbon footprint in 2008 = 125.6 tonnes $CO_2e$

Table 2 reveals that the highest contribution to annual emissions are from electricity use (which accounted for around 42% of the annual emissions) diesel use on the golf course (27% of annual emissions) and gas consumption (16 % of annual emissions). These three elements should therefore be targeted as priorities for future initiatives and changes. The following room by room observations in Section 5.0 provide measures for reducing emissions and expenditure, particularly in terms of electricity use.

[1] Expressing greenhouse gas emissions as $CO_2e$ or 'carbon dioxide equivalent' allows greenhouse gases other than carbon dioxide to be considered, e.g. methane and nitrous oxide. Each of the various greenhouse gases have a different Global Warming Potential (GWP) per kg (a measure of their effect on global warming) and for comparison purposes the quantity of these gases released during a process are generally expressed as their carbon equivalent. For example, 1 kg of methane gas has the same global warming impact as 21 kg of carbon dioxide.

[2] Estimated water usage due to errors in water bills for Alresford Golf Club in 2008.

[3] Borehole water does not require any pre-treatment and therefore has been given a carbon rating of zero. Energy is required to pump the water from below ground but this is included in the electricity element of the club's carbon footprint.

## 5.0 THE CLUBHOUSE - ROOM BY ROOM OBSERVATIONS AND RECOMMENDATIONS

The Clubhouse at Alresford Golf Club was assessed on a room by room basis in terms of lighting, heating, electrical equipment and the general characteristics of each room, e.g. ceiling height, insulation, number and type of windows. Observations for each room are detailed below.

### 5.1 ENTRANCE FOYER AND HALLWAY

The club have been proactive in testing different lighting methods and have replaced the former halogen bulbs in the foyer with low energy LED spot lights, effectively reducing the electricity use in this area around tenfold. However, the entrance foyer has glass walls and high windows which provide excellent natural light, yet all the lights in this area were observed to be on during the visit, despite dry sunny conditions outside. The lights in the foyer and hallway can be controlled differentially and therefore only the hallway lights may be required to be on when outside light conditions are good.

All windows in the foyer are double-glazed but the roof space is high with no insulation and much heat is lost from the foyer. The installation of a second set of internal doors between the entrance foyer and the main entrance hall would help to conserve heat in the main entrance hall in winter and also help keep the main hall cool in summer.

As Table 1 (Appendix 1) indicates, the 6 halogen bulbs in the display case in the entrance hall now cost more than twice as much to run across the year as the LED bulbs, despite the much larger number of LED bulbs.

| Issue | Potential solutions |
|---|---|
| Inefficient lighting types and lighting use | Change halogen spotlights to LED lights and turn off lights in entrance foyer on bright days. |
| Loss of heat from hallway through doors and windows of entrance foyer | Installation of a set of internal doors between foyer and hallway |

## 5.2 BAR AND LOUNGE

Table 2 (Appendix 1) lists the electrical equipment within the bar and lounge area, most of which are located in the bar. This reveals that two high energy pieces of equipment, the till monitor and two bottle coolers are left on constantly at a high cost to the club. The bottle coolers are used solely to cool bottles, and as there are no health and safety implications, the energy usage can be reduced by fitting a timer switch which will allow the fridge to be turned off when the bar is closed overnight (perhaps from 12am to 7am). The cooler door will not be opened in this time and should not warm up very much and in any case cool bottles are not required during this time. This would save the club around £86.70 per year. Similarly, the till monitor should be switched off when the bar is closed saving as much as £536.

In addition, the lights in the bar and lounge are differentially controlled but more specific controls that would allow different sets of lights in the lounge area to be isolated would be beneficial to stop lights being turned on when not required.

Several radiators in the lounge area were partially blocked by the lounge chairs, which will absorb the heat and prevent circulation of heat around the room. Care should be taken to arrange furniture away from radiators to increase the efficiency of the heating system. The curtains in the lounge should be closed after dark to reduce heat loss.

| Issue | Potential solutions |
|---|---|
| Bottle cooler equipment on when not required | Install timer switches on plug points |
| Lack of control over lighting in lounge area | Install differential controls for lights |
| Radiators blocked and operating inefficiently | Rearrange furniture away from radiators |

## 5.3 BEER CELLAR

The beer cellar is located at ground level to the rear of the bar area. Several specialist items of chilling and pumping equipment are located within the beer cellar. An assessment of the energy consumption of these items was not possible as we were not bale to switch the items on and off. However, it was observed that the doors to the room are basic wood and these could be replaced or better insulated to keep the beer cellar room cool and also to prevent heat loss from the bar area. In addition, it was observed that the light in the beer cellar was on when the room was not in use and that staff should be encouraged to switch off the light when not needed.

| Issue | Potential solutions |
|---|---|
| Lights on when room not in use | Pursue policy of switching lights off when leaving a room |
| Doors poorly insulated leading to heat exchange between the bar and beer cellar | Install new insulated doors or add insulation to existing doors |

## 5.4 KITCHENS

The kitchen contains a range of high energy equipment necessary for the safe storage and preparation of food.

The fridges and freezers are the main high-energy pieces of equipment which must be constantly switched on. There is no scope to reduce the usage of these freezers, though savings could be made by replacing inefficient equipment. Older equipment is generally less efficient than new equipment and the cost balance can be such that replacing old equipment can be cheaper than the extra electricity costs of running the old equipment. For example, the 3 Gram freezers within the kitchens are over ten years old and use 24.8 w of electricity, even when inactive, while the new Tefcold freezer uses energy only when actively cooling.

For items of kitchen equipment that can be switched off when not in use, the club have already introduced several measures to reduce energy use. For example, the gas burners are only switched on in the morning once the first order has been received and the hot water boiler is only switched on after 11:00 am and switched off when the kitchen closes.

Heating is not required in the kitchen due to the waste heat from kitchen appliances.

| Issue | Potential solutions |
|---|---|
| Old inefficient equipment | Consider annual cost of running inefficient older equipment and payback time of replacing with new more efficient equipment |

## 5.5 DINING ROOM

The ceiling in the dining room is high with no insulation and there are eight large windows in the room. This means that the room will lose heat easily in winter and may overheat in summer. The ceiling height could possibly be reduced to allow the introduction of insulation above, though the skylight in the room may make this more difficult. The curtains in this room should be closed at night, particularly in winter, to reduce heat loss. The internal doors between the dining room and lounge area will also help to reduce heat loss from the lounge through the poorly insulated dining room and should be closed when possible.

The only electrical items in the dining room are the ceiling lights. These are currently incandescent bulbs and should be replaced with low energy lights to reduce electricity use throughout the year.

| Issue | Potential solutions |
|---|---|
| Inefficient lighting | Replace incandescent bulbs with compact fluorescent bulbs |
| Roof poorly insulated and high number of windows leading to high heat loss | Consider installing roof insulation<br>Close curtains at night to reduce heat loss and close internal doors between dining area and lounge when lounge not in use |

## 5.6 MEETING ROOM

The meeting room has a lower ceiling than the dining room which and is therefore assumed to be insulated. There are several items of electrical equipment such as a CD player, tuner, cassette deck, amplifier and VHF receiver. These items are very infrequently used and generally have a low wattage. The lights in the room are a mix of energy efficient compact fluorescent bulbs and incandescent bulbs. The incandescent bulbs should be replaced when possible.

As in the lounge, the radiators in the meeting room were blocked by chairs and care should be taken to ensure that furniture is positioned away from radiators to permit heat to circulate around the room. The partition doors between the meeting room and the lounge are poorly fitted allowing heat to transfer between the two rooms and making it more difficult to heat the lounge which is the more frequently used space.

| Issue | Potential solutions |
|---|---|
| Radiators blocked and operating inefficiently | Rearrange furniture away from radiators |
| Inefficient lighting | Replace incandescent bulbs with compact fluorescent bulbs |

## 5.7 LOCKER ROOMS AND TOILETS

The majority of the lights in the gents and ladies locker rooms are fitted with motion sensors which reduce the length of time lights are on when the room is not in use, though given the likely high numbers of people passing through the locker rooms before and after their round then the lights are likely to be on much of the time which reduces the savings normally associated with the use of motion sensors.

There are only three windows within each locker room and natural lighting in the rooms is very poor. Consequently the level of artificial lighting required is high. The windows are double-glazed which reduces heat loss.

The heating in the ladies locker room was on during the visit, while two windows were open in the room. This indicates the room was heated to too high a temperature and windows were opened to reduce the temperature resulting in an unnecessary loss of heat and use of energy. The room temperature should be controlled using the individual thermostatic controls on the radiators in the room. This should be set to a reasonable level by golf club staff and checked periodically to make sure that these have not been altered by club members.

Table 3 (Appendix 1) lists the electrical equipment within the ladies and gents locker room and demonstrates that the showers in each locker room (assumed to be electric showers) are by far the main energy users, followed by the halogen lighting. The use of showers can probably not be greatly reduced, though members could be made more aware of the high energy cost of the showers by placing notices in the locker rooms. The lighting costs could be reduced by replacing the 40 w halogen bulbs in each room with low energy LED bulbs, reducing the annual cost tenfold from an estimated £295 to £29.

| Issue | Potential solutions |
|---|---|
| Heating on and windows open | Use individual thermostatic controls on radiators to control the room temperature. Check controls periodically to correct any alterations. |
| High lighting costs | Replace halogen bulbs with low energy LED bulbs |
| Water use | Install bricks or 'hippo' devices within toilet cisterns to reduce water use for toilet flushing<br>Consider rainwater harvesting to provide water for flushing toilets |

Motion sensors have not been installed in the disabled toilet. There are perhaps health and safety reasons behind this but also the energy savings from the two bulbs in the toilet would not justify the installation of motion sensors. However, two lights are used to light a very small space, each controlled by the same switch, when perhaps only one light is really required. Removing one light could provide small annual energy savings. The disabled toilet has no heating.

## 5.8 SECRETARY'S OFFICE

The secretary's office serves as an office for three staff and the room is prone to overheating in summer due to the number of electrical items in the room. The club are considering installing air conditioning in this office but should bear in mind that air conditioning systems can be relatively inexpensive to install but will have high running costs.

A previous energy report commissioned by the club suggested that the ceiling above was poorly insulated and that this was a major contributor to the heat gain in summer. Installation of adequate insulation will help to reduce temperatures in the room in summer and retain heat in winter. In addition, the windows in the office are very small and will not permit adequate ventilation in the height of summer. Replacement of the main window with window with large openings may be a viable and cheaper alternative to installing an air conditioning unit, though the staff did mention that this may not be feasible due to dust problems associated with the nearby gravel carpark.

An assessment of the electrical items show that items that are used regularly for long periods of time, such as the lights and computers, have a high energy cost across the year (see Table 4, Appendix 1). Simply switching the computers, computer monitors and lights off over an hours lunch break each working day would save an estimated 404 kWh per year, or around £34.00 in electricity costs annually.

| Issue | Potential solutions |
|---|---|
| Overheating of office in summer | Replace window to improve airflow from outside<br>Install adequate installation |
| High number of electrical items | Reduce energy consumption where possible, e.g. switching equipment off over lunch |

## 5.9 PRO SHOP

The Pro shop consists of a main shop display area and an office and stock room. The Pro shop requires a lot of light to showcase the golfing products on sale and Table 5 (Appendix 1) illustrates that the lights in the Pro shop account for the highest consumption of energy in the Pro shop throughout the year. The club are currently trialling different lighting systems in the pro shop to evaluate their performance and the variation in energy consumption for the three main lighting methods (fluorescent strip lights; halogen spot lights and LED spot lights) can be compared in Table 7, which shows the much lower cost of running the LED lighting system. However, LED bulbs and halogen bulbs should not be mixed in the same lighting array and a new transformer may be required to ensure compatibility with the LED lights and this adds to the cost of the LED bulbs.

The seven battery chargers which are used to charge trolley batteries also consume a significant amount of electricity each year. The calculation in Table 7 assume that each battery charger is in constant use and switching off the battery chargers when not in use could bring amount significant savings throughout the year.

| Issue | Potential solutions |
|---|---|
| Inefficient lighting | Replace inefficient lighting types with best performing lighting systems at end of trial period |

## 5.10 RESIDENTIAL FLAT

The flat is in private residential use and was not visited during the audit.

## 5.11 CLUBHOUSE WASTE

The club currently only recycle glass waste, all other waste is sent to landfill. The club should look to increase the number of waste streams that are segregated and recycled to help reduce their carbon footprint.


# 6.0 GOLF COURSE MAINTENANCE

As the highest energy user at a golf club, attention is generally focused on the clubhouse but energy, cost and carbon savings can be made through changes to golf course maintenance practices and facilities.

## 6.1 MACHINERY USE

The diesel receipts for the club show that 11201 litres of diesel were delivered to site in 2008. Petrol is also used for small items of equipment and bought in small jerry cans (estimated at 800 litres for 2008). This fuel is used exclusively to run course maintenance vehicles. The use of these vehicles is essential to maintain the golf club and it is unlikely that use can be reduced significantly. However, some simple measures could be implemented to reduce fuel consumption:

- 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 sheds
- 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.

## 6.2 IRRIGATION AND WATER USE

The golf course at Alresford is served by an automatic irrigation system, with water predominantly sourced from a borehole on site but occasionally augmented with water from the mains.

The borehole water is less expensive for the club and should be used in preference to mainswater. In particular, a look at the water bills for the irrigation supply meter suggests that mainswater used on the course still attracts a sewerage charge (charged on 95% of the volume used) even though water is not discharged to the sewer and, therefore, when using mainswater the golf club are paying for a facility that they do not use. In addition, as the water is not treated to drinking water standard the carbon footprint of the borehole water is effectively zero, as reflected in Table 2.

The amount of borehole water that can be used each year is limited by the club's abstraction license. According to the club's records a small volume of mainswater was used by the club for irrigation in 2008, despite the volume of borehole water for the year being significantly less than that used in 2007.

The irrigation system also requires energy to pump water from groundwater and across the golf course. The irrigation system is housed in 'Curly's barn' which is separately metered. Apart from lighting within the building, which is infrequently used, the energy use at this meter relates almost entirely to the irrigation system. The electricity bills for Curly's barn indicate that 1764 kWh of electricity was required to run the irrigation system in 2008, and that 2486 litres of water (sourced from the borehole and mainswater) were used in the same period. This suggests that each litre of water used on the golf course in 2008 required 1.4 kWh of electricity, though this is likely to include standby electricity use when no water is pumped onto the course.

Saving water on the golf course will save the club money in terms of electricity use and could mean that mainswater top ups are not required. Several measures for reducing water use could be adopted:

- Consider hand watering of greens and 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 lost 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. 180º sprinkler heads at the edge of maintained areas that reduce overthrow of water to non-target areas
- Consider grass species within playing surface such as tees and greens and perhaps switch to more drought tolerant species.

In addition to the fuel use, Machinery also requires energy use for the daily cleaning of machinery. Maintenance machinery at Alresford is washed down using a Course Care Clearwater water recycling unit. This unit effectively cleanses washdown water, removing chemical residues and nutrients and, as the water is recycled, also reduces the amount of water required by the club each year. However, the recycling unit does require a constant supply of electricity to sustain the microbes used in the system and this constant energy use may be significant when considered on an annual basis. However, quantifying this energy consumption on site was not possible as this would have required temporarily switching the unit off.

## 6.3 ADMINISTRATION, STORAGE AND WELFARE FACILITIES

In addition to energy use associated with machinery use and irrigation, energy is used within the offices and storage space of the greenkeeping buildings. There are three maintenance buildings at Alresford Golf Club:

- The main greenkeeping facility – storage, administration and washdown facilities
- 'Curly's barn' – houses irrigation pumping equipment and provides limited storage
- 'Greenkeeping barn' – main storage facility

### 6.3.1 Main greenkeeping facility

The maintenance area is on the ground floor of the clubhouse building and is poorly lit by natural light, with only three single glazed windows concentrated in one area. Installation of further windows may improve the natural light within the facility and reduce the need for artificial lighting in summer, particularly in storage areas. The lights in the facility are left on throughout the working day and switched off only outside working hours.

The heating for the main greenkeeping area is controlled from the flat above and the greenstaff have no control as to the timing of heating. Given that the main usage times for the flat and the maintenance compound are in conflict, i.e. the main heating needs for the maintenance facility are in working hours, while the main heating demands in the flat are during the evening then some way of isolating these two areas and providing separate heating control would be desirable. The radiators in the greenkeeping facility do have individual thermostatic controls and these could be used to provide some degree of control until more centralised control of the heating system can be achieved.

The doors to the maintenance area are often open, resulting in a loss of heat in admin and canteen areas. There is no benefit in adding double glazing to the windows in the maintenance area as most heat will be lost through the main doors. If space permits, it may make sense for the majority of machinery and equipment to be stored at the greenkeeping barn, reducing the need for the main doors to be open at the main greenkeeping facility.

There are also a large number of electrical appliances within the maintenance area and these are listed in Table 8, alongside the recorded energy consumption for each item and the estimated annual usage.

High energy items of equipment, even when used infrequently, will inevitably have a high associated energy consumption and cost, e.g. the electric shower, kettle and battery charger and use should be minimised where possible, e.g. by only boiling the minimum amount of water each time, rather than routinely filling the kettle each time it is boiled.

Electrical equipment that uses a small amount of energy but is frequently or constantly in use can also be high energy users. For example, in the maintenance area the lights are the second highest user of electricity, despite the low power consumption of each light bulb, costing approximately £260 per year for all lighting (assuming lights are left on constantly during working hours and based on electricity prices from December 2008). Switching off the lights when not in use or on bright summer days when the main door are open may will reduce energy use and monetary costs throughout the year. Table 6 (Appendix 1) lists equipment in this area.

| Issue | Potential Solutions |
|---|---|
| Lack of control over heating | Use thermostatic controls on radiators to provide short term control<br>In the longer term an attempt should be made to provide separate centralised heating controls for the greenkeeping facility |
| Lights on when not in use | Improve natural lighting by adding extra windows<br>Manually switch lights off when not in use<br>Install motion sensors |

### 6.3.2 Curly's barn

Curly's barn is an historic brick and stone built barn located away from the clubhouse within the golf course. This building is used to store machinery which is infrequently used on the golf course and also houses the irrigation system for the course. Six 100w fluorescent strip lights are provided within the building but these are used very infrequently and switched off when not in use. The irrigation system uses a significant amount of energy each year and this is discussed in Section 6.2

### 6.3.3 Greenkeeping barn – machinery storage

The main storage facility for greenkeeping equipment is provided by a simple barn constructed of breezeblocks with a metal roof. No heating is provided as the primary use is for machinery storage.

The metal roof has several large skylights and the large doors also allow for good natural light. However, the skylights require cleaning and are not as effective as they could be. Artificial lighting is provided by twelve 100w strip lights, which are left on during the working day, including when the facility is not in use. Switching off the lights when not in use and providing improved natural light would help to reduce energy use and monetary costs.

| Issue | Potential solutions |
|---|---|
| Lights on when not in use | Improve natural lighting by cleaning skylights<br>Manually switch lights off when not in use or install motion sensors |

## 6.4 WASTE

The waste for the greenkeeping facility is stored and collected with the clubhouse waste and has been covered in Section 5.11.

# 7.0 CONCLUSION

The carbon and energy audit provides a detailed assessment of the various facets of the golf club and golf course operations at Alresford Golf Club. The room by room analysis provides a quantitative assessment of the energy used in each area and highlights where potential energy, carbon and cost savings can be made. The 2008 carbon footprint for the club allows the club to assess future changes and future progress, relative to the 2008 baseline, in reducing the impact of the clubs operations on the 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 | ? | ? |