



**PRACTICAL WAYS TO IMPROVE  
ENERGY EFFICIENCY IN  
GOLF FACILITIES**

# **PRACTICAL WAYS TO IMPROVE ENERGY EFFICIENCY IN GOLF FACILITIES**

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# I INTRODUCTION

This guide by the Scottish Golf Environment Group, aims to provide a practical introduction to energy conservation specifically for golf facilities. Experience shows that very few golf facilities have paid much attention to this topic, yet it is one in which, for little effort, significant cost savings and environmental benefits can be achieved.

The development of this guide has been a partnership initiative spearheaded by the Scottish Golf Environment Group, supported financially by the Sustainable Development Unit of the Scottish Executive and with technical support from the Scottish Energy Efficiency Office (now Energy Efficiency Unit) and the Committed to Green Foundation (now Golf Environment Europe).

To help golf facility managers and greenkeepers get the most out of being energy efficient, this guide sets out to achieve the following:

- To encourage golf facilities to improve their energy efficiency
- To explain energy efficiency in the context of golf facilities
- To provide practical, no-cost and low-cost suggestions on how to go about improving energy efficiency
- To point golf facilities in the direction of further sources of help, including expert advice and funding opportunities

By following this guide, it is hoped that many golf facilities will appreciate the added value of being energy efficient. It is not difficult and it does not require major investment. Much can be achieved for minimal, or even no cost at all. For those wanting to take this further, help can be available in the form of free advisory services and even interest-free capital loans.

The development of this guide has been a partnership initiative spearheaded by the Scottish Golf Environment Group, supported financially by the Sustainable Development Unit of the Scottish Executive and with technical support from the Scottish Energy Efficiency Office and the Committed to Green Foundation.

Much of the material in this guide has been drawn from existing publications<sup>1</sup> aimed more generally at small businesses, and adapted to the particular situation of golf courses. This sectoral approach to energy efficiency is a pilot for similar projects on related golf environment topics, such as waste management and water conservation.

<sup>1</sup> The Scottish Energy Efficiency Office (now the Energy Efficiency Unit) has kindly granted permission to use copyright material from the Energy Efficiency Best Practice Programme: notably *Energy Saving Guide for Small Businesses* and *FOCUS – the manager's guide to reducing energy bills*.

## 2 WHY ENERGY CONSERVATION MATTERS TO GOLF

Every time we switch on machinery, lighting or turn up the thermostat we use energy. Whatever kind of fuel we use (whether we burn it directly or indirectly), when electricity is generated, we are releasing greenhouse gases, including carbon dioxide (CO<sub>2</sub>), into the atmosphere, contributing to climate change.

It is now widely accepted that climate change is the most serious environmental threat to our planet. Left unchecked, it will have profound effect on weather patterns globally. Recent research suggests that in Scotland there will be:

- more severe weather events
- rainfall may increase by up to 50% in the west
- storms, floods and gales are likely to be more common

These effects will impact on golf. Traditional links courses are already experiencing problems of coastal erosion, while the general change in weather patterns may affect golf courses in terms of different prevalence of turfgrass pests and diseases, seasonality of play, changes required to drainage and irrigation systems, pricing of energy and fuel supplies, as well as less predictable revenue streams from tourism and events.

While climate change policy is being tackled at government and international levels, everyone should recognise that it will affect their lives; how they live, work and play, and that there is something they can do, by taking some personal responsibility for energy conservation. Individual efforts may seem trivial in the big picture but collectively they add up - for example, over a quarter of the CO<sub>2</sub> produced in the UK comes from domestic energy use alone.

Although in the grand scheme of things, golf clubs are relatively modest users of energy – average annual expenditure on energy for a typical Scottish golf club is some £15,000 – this is nevertheless a significant part of a club's controllable running costs. Potential savings of 10-20% of a club's energy bill would certainly be worthwhile, and in many cases quite easily achievable, simply through good housekeeping management in and around the clubhouse.

Benefits from being more energy aware may be apparent in other ways too: by more careful management and upkeep of machinery it is possible to extend the working life of equipment through less wear and tear, less frequent breakdowns, less noise and less wastage of fuels and lubricants. While these benefits may not be so visible to golfers, they are, for example, likely to appreciate higher quality, less disease prone playing surfaces resulting from having better maintained mowing machines that run more evenly and have sharper cutting blades.

**The UK's sports sector spends £700 million every year on energy use in buildings, resulting in annual emissions of 10 million tonnes of carbon dioxide (Energy use in sports and recreation buildings, December 2001). Britain's 2500 golf courses probably account for about 7-8% of this total.**

## DESIGNING FOR ENERGY EFFICIENCY IN NEW GOLF COURSES

New golf courses have the chance to maximise energy efficiency from the beginning.

### Clubhouse and other buildings

There is much information available on energy efficient building design and/or for the restoration of existing buildings that can be applied to new golf course developments. Given that the clubhouse is normally the most energy consuming part of a golf course, it is important that any new build, or major refurbishment, gives high priority to energy efficiency criteria: notably choice of materials, heating, lighting, insulation, ventilation and refrigeration systems. It is important to convey to the architects that energy efficiency is a key factor. Consider also commissioning Design Advice services, which includes an initial free one day consultancy on environmental and energy-efficient design of buildings (see Chapter 5).

Golf clubhouses are typically stand-alone buildings, often in exposed sites. Give consideration to the aspect and prevailing winds in locating the position of the clubhouse. By reducing the exposure of the building, one can save significant long-term energy consumption costs.

One of the commonest mistakes in golf course development is over-specification of the clubhouse. Buildings that are larger than necessary are both costly to build and to maintain. Their energy requirements are disproportionately high for the amount of actual use of the building.

### Golf course

In designing new golf courses, there are a number of points to bear in mind that can help conserve energy, both immediately in the construction phase, and also in the longer-term operational management.

- Plan the golf course as close as possible to fit with the existing landform. Not only will this be more visually compatible with the surrounding landscape but the reduced need for cut and fill will significantly lower the energy cost of construction.
- Source materials from local suppliers wherever possible to avoid unnecessarily long distance transportation. Locally available materials, such as sands for bunkers, are likely to be more in-keeping with the landscape.
- The golf course design should avoid intricate details around bunkers, tees and greens, sharp angles and steep banks to tees, so that maintenance does not require additional special equipment, or lead to extra wear and tear on machinery.
- Non-playing areas should be clearly indicated for low-maintenance regimes, to avoid unnecessary mowing with its related machine time and fuel costs.
- The location and design of the maintenance facility is very important. It is inappropriate and old-fashioned to consider this as mere 'greenkeeping sheds' to be kept out of sight at the far end of the property. The maintenance facility is in reality a 'resource management centre' which should be placed where it can be most efficient in accessing and managing the golf course. Given good building design, use of sympathetic materials and landscaping, a modern purpose-built maintenance compound can be successfully placed centrally within the golf course area and/or close to the clubhouse.
- Whether the maintenance facility is brand new, or adapted from existing agricultural buildings, thought should be given to maximising natural lighting, draught-proofing and providing sufficient covered space for storing all machinery and equipment.
- The specification for the irrigation system should ask tenderers to indicate its energy consumption.

# 3 GETTING STARTED

Every golf club, large or small, is effectively like any business or household. It uses fuel, power and water and generates waste, all of which has to be paid for. So the first, obvious question is to find out how much you are spending at present. That is a starting point for going on to identify possible energy saving opportunities. But it is not simply a matter of doing a few one-off improvements. The best results come from organising a proper action plan, one which can prioritise the most effective measures and allows for effective control and monitoring. To make this work properly you will need someone to be responsible for making it happen.

The following basic steps offer a good approach to tackling energy efficiency and provide the necessary framework to enable you to take full advantage of the practical measures proposed in Chapter 4.

## 1. Decide who will be responsible

To ensure things get done, there needs to be an 'energy champion' within the club. This need not be an onerous task and it is by no means a full-time job, but it is important to have someone to act as the club's 'eyes and ears' for energy wastage.

In a typical golf club the 'energy champion', either an employee or a member, should focus on the clubhouse and related buildings. Golf course and maintenance facility aspects are the responsibility of the Head Greenkeeper, who may decide to nominate a 'golf course energy champion' from among the greenstaff. In such situations, there should be close liaison between the two energy champions, forming an 'Energy Action Team', to ensure a uniform approach to energy conservation throughout the golf club.

The duties of the energy champions should include:

- noting examples of energy wastage
- reading meters and checking fuel bills
- encouraging others to use energy more efficiently
- regularly reporting findings back to senior club management

## 2. Establish the facts

How much energy are you using? To find out you need to collate invoices for electricity, gas, heating oils and/or coal, as well as all fuel bills for vehicles and golf course maintenance

equipment, and water and sewerage bills. Do not just check the cost, look also at the metered usage. For past periods you will have to rely on reported meter readings on invoices, but from now on also do your own meter readings.

Ideally, records for the last three years should be compiled, so you have a view on whether usage and costs are stable or changing. Key things to look out for are:

- any signs of exceptional consumption
- whether you are paying for the amounts of fuel/power you actually use
- how costs are changing over the years
- seasonal patterns to energy consumption

## 3. Compare your performance

Once you have calculated your absolute costs, it is useful to do some comparisons, both internally and with other, similar golf clubs - such data may be scarce at first but as more clubs engage in energy efficiency projects, there will be more information available (always check with the Scottish Golf Environment Group for up to date news). Or you can benchmark against data for a range of building types published by the Scottish Energy Efficiency Office.

Internal comparisons may be year on year, seasonal or between activity centres: e.g. which is the main energy consumer within the club - the clubhouse, or golf course maintenance? Such information can help set priorities and targets for improvement.

## 4. Plan and organise

The first step in planning is the development of an energy policy statement. This is important because it means the club's decision makers are consciously committed to the initiative, and the policy is a valuable tool for raising awareness among staff, members and visitors. It will also provide continuity of purpose as personnel and committee members come and go.

The policy statement should provide a basic reasoning for why the club is carrying out an energy efficiency programme, and it should highlight the main objectives together with performance targets to meet these objectives.

Having defined the policy, the next step should be to draw up an action plan. This should cover the various component areas of the golf club (clubhouse, pro shop, golf course...) and the specific energy areas (electrical, boilers, heating, lighting...). The action plan will need to identify tasks to be undertaken, their frequency, how they should be recorded and reported, and by whom.

Defining policy, setting objectives, involving members and staff, and assigning responsibilities are the core components.

## 5. Pay less for your energy

Before even looking for energy conservation measures, it is worth checking whether you are paying the best price for the energy you do use. The simple exercise of reviewing your energy bills can produce some surprising results, as some golf clubs have already discovered to their benefit. Understanding the range of tariffs and deciding what is best for you may take some effort. Some clubs have found it useful to call in an energy consultant to help them through this process.

It may also be possible to maximise use of cheaper night-time electricity units and to minimise use of winter peak-rate units. This is especially important for golf clubs which tend to be much less active during winter.

## 6. Use less energy

Using less does not mean doing less – the goal here is to eliminate waste. A good start would be to conduct an 'energy walk-round'. This should involve key members of staff and club officials, both to help identify problems and opportunities, and to ensure they feel part of the process.

Conducting a walk-round is simple; just walk round your premises and note down what equipment is being used, how it is being used, and where. There is a wide range of areas of opportunity to look out for including lighting (indoors and outside), boiler rooms, offices, function rooms, kitchens, bar, cellar, locker rooms, pro shop, store rooms. Include also the maintenance compound and irrigation pump house if you have one.

It is sensible to conduct a number of such walk-rounds at different times: e.g. during normal opening hours, when the cleaners are on duty and at off-peak times when the golf course is either little used, or unused. By doing a series of

such inspections, you will gain a much better insight into how energy is being used and where the principal areas of waste are occurring.

To help begin to prioritise energy conservation actions, it would be best to place the findings of the walk-rounds into simple categories:

- where energy is being wasted through;
  - ⇒ lack of awareness/missed opportunities
  - ⇒ procedures being ignored
- where repair or maintenance work is needed to reduce energy costs
- where there is a need for capital investment to improve energy efficiency;
  - ⇒ structural work to upgrade insulation, double glazing...
  - ⇒ replacement boilers and heating system
  - ⇒ investment in renewable energy sources

A comprehensive list of practical measures to implement is given in chapter 4. These will give a useful guide to help you adopt the best approach for your circumstances. It is up to each club to decide how it wants to proceed and how many measures it wants to implement. Each situation will be different. There is no definitive menu for achieving energy efficiency but generally speaking, the more you do, the greater the amount of savings and other benefits you will realise.

It is wise to build up your energy efficiency programme, rather than trying to do too much all at once. Look for 'early-wins', simple, no-cost or low cost achievable actions that can be implemented straight away. These will offer a good platform for future initiatives and give the club membership and management confidence in the programme.

## 7. Control and monitor

Energy consumption is a continuous process. Likewise, energy conservation has to be treated as an on-going policy. It is not a one-off exercise. The goal should be continual improvement.

The best way to achieve such continuity of purpose is to have an effective recording and monitoring system. Large golf and leisure complexes – e.g. Gleneagles – may take energy efficiency so seriously that they have full time energy managers and a computerised Building Management System, enabling precise control over all heating, water, ventilation, air-conditioning and lighting.

Such sophistication is beyond the means of ordinary golf clubs but the principles are just as valid. It is essential to keep a regular check on energy consumption and bills so that you can see whether your energy efficiency measures are having any effect. If there are any sudden blips or surges in the normal pattern of energy consumption, you will be able to identify the cause and remedy it as necessary.

Another benefit from having a vigilant eye on energy consumption, is that you will be able to identify and/or keep abreast with further cost saving opportunities – e.g. tariff changes and other incentive schemes.

It does necessarily involve some extra paperwork but it is worth it. If a couple of dozen members decided not to bother paying their annual subscription, you would hopefully notice they were overdue and do something about it. So why waste the equivalent amount of money on not tightening up your energy costs?

# Example Energy Walk-Round Sample Checklist

Date of Energy Walk-Round

.....

|  |  |
|--|--|
| <b>Heating</b>   |  |
| • Are there complaints about comfort conditions?                             |  |
| • Were heaters/boilers serviced in last 12 months?                           |  |
| • Is there evidence of use of portable heaters?                              |  |
| • Are heaters and air-conditioning units in the same space?                  |  |
| • How is hot water provided?   |  |
| • Do all areas have the same heating requirements?                           |  |
| • Is the room thermostat working and on correct temperature?                 |  |
| • Are the timers working and on correct settings?                            |  |
| • Are other heating controls working and on correct settings?                |  |
| • Are there obstructions in front of radiators or heaters?                   |  |
| • How are extractor fans in toilets, etc, controlled?                        |  |
| • Are windows and doors open when heating is on?                             |  |
| • Are there any cold draughts coming from windows or doors?                  |  |
| <b>Lighting</b>  |  |
| • Are lights switched off (if daylight sufficient/room not in use)?          |  |
| • Are any old large diameter fluorescent tube lights still in use?           |  |
| • Are lamps, fittings and rooflights clean?                                  |  |
| • Are tungsten light bulbs still in use?                                     |  |
| • Are light switches arranged conveniently?                                  |  |
| • Is exterior lighting switched off when not needed?                         |  |
| <b>In the Offices</b>  |  |
| • Have computers got built-in energy saving features?                        |  |
| • Are computers left on overnight?   |  |
| • Are monitors switched off when not in use?                                 |  |
| • Are photocopiers located in air-conditioned areas?                         |  |
| • Are printers and fax machines left on overnight / at weekends?             |  |
| • Are vending machines / water coolers left on all the time?                 |  |
| <b>In the Maintenance facility</b>   |  |
| • Are pumps / fans switched off when the equipment they serve is not in use? |  |
| • Are compressed air driven tools being used unnecessarily?                  |  |
| • Are tractors, mowers and utility vehicles being serviced regularly?        |  |

# 4 PRACTICAL GUIDELINES

The guidelines given in this chapter are primarily drawn from FOCUS – the manager’s guide to reducing energy bills published through the Government’s Action Energy programme. This edited version of FOCUS contains general practical recommendations that are likely to be applicable to golf clubs and the section headings have been set to best reflect golf club/course situations.

The guidelines follow a questionnaire format. These questions are designed to prompt you to think about the various ways in which your club uses electricity, gas, fuel and water. The questions are backed up by reasons for reconsidering your approach to energy use, and then by practical suggestions for specific actions to reduce energy consumption and help you to save money.

There is nothing especially difficult about being more energy efficient and it does not need to involve great expense. All golf clubs can achieve valuable benefits from such simple measures.

There is also space in a column headed ‘Plan’ for you to make your own notes and to keep track of the actions undertaken.

There are nine separate sections in this chapter. The first two, Management and Buying, set out general ideas on organising your energy efficiency programme. These sections are highlighted in **YELLOW**.

Thereafter, under each of the remaining practical subject headings there are three colour-coded parts:

- RED NO COST** actions you can carry out immediately
- GREEN LOW COST** actions requiring small initial investment
- BLUE MORE IDEAS** activities that will require some research and planning

The purpose here is to help your club implement energy-efficient and cost-saving measures as quickly and as effectively as possible.

Do not be put off by the range of activities suggested here. These are guidelines and can be taken in part or in full according to your needs and wishes. It is not expected for you to do everything. Obviously, the more energy-saving measures you implement, the bigger rewards you will experience, but this can be built up gradually.

It is sensible to start with the **NO COST** suggestions and to build up the programme from there. When it comes to **LOW COST** activities, guide prices for the equipment have been indicated where possible. Please note these are only approximate figures and the precise cost will depend on factors such as the size of the premises, number of units to be installed etc. There may also be installation costs to consider.

Although many of the measures listed here are simple and require no expertise, some energy-related actions do have health and safety implications. Always take care when implementing any of the actions in this guide.

Remember, you are not alone. There are many sources of help, including a freephone helpline, advisory services, other publications and grant and loan schemes. Details of the relevant sources of help are given in Chapter 5. Do not be afraid to ask.

*N.B. Always seek professional help and advice whenever in any doubt.*

# MANAGEMENT

## how to organise energy efficiency in a golf club

**The key to energy efficiency is management – it doesn't matter how much you spend on technology, if you don't manage your energy resources efficiently, you will waste money. It is likely to be easier to improve the balance sheet of a golf club through reducing energy costs than trying to increase revenue through membership or green fees. Whatever the size of the golf club, potential savings from energy efficiency could be significant.**

To benefit from energy saving activities depends on people. It is therefore vital to make sure the membership and staff are fully behind the programme. Outside contractors or franchisees can also be brought into your collective effort.

This section deals with the way energy resources are managed and shows various actions you can take to improve efficiency. Emphasis here is on techniques rather than technology. Good management is a question of organisation not of financial investment. A few minutes of clear thinking can save masses of wasted effort and cost. To do this most effectively involve other people as much as possible, even if this initially requires some time and effort in persuading them of the need to be more energy efficient.

Don't worry if it takes some time. Real energy efficiency is a long-term, continual commitment and the eventual results will be all the more solid for having been built up steadily.

| Opportunity  | Reason   | Action   | Plan |
|--|--|--|------|
| Is there someone responsible for energy efficiency within the club?                            | Having someone responsible gives energy efficiency higher profile and creates a focal point  | Nominate an Energy Efficiency Officer for the club who will be responsible for monitoring the cost of all energy and water.<br>Ensure that this person has the full support of the club management.<br>Ensure this person works in close liaison with the head greenkeeper and other key personnel: e.g. golf professional, caretaker...                     |      |
| Does your club have an energy efficiency policy?   | A simple statement of policy objectives will demonstrate the club's awareness and commitment to energy efficiency.<br>The most cost-effective energy efficiency programmes are led by management example.  | Formulate a simple policy statement on energy efficiency and make sure this is signed-off by the Club Management Board.<br>Ensure a copy of this policy is made available to all staff and is communicated to members via notice boards and newsletters. Use staff meetings to discuss the policy and consider practical ideas to improve energy efficiency. |      |
| Do you fully understand and make use of all information on your club's energy and water bills? | These bills provide information essential for monitoring your club's energy efficiency. Keeping accurate records of consumption and costs is a prerequisite for developing an effective energy efficiency programme. Such records are vital for assessing alternative tariffs and suppliers. | Set up a system for recording all the relevant information from energy and water bills. Record as much information as possible, noting whether bills are actual or estimated, number of units used and tariff.   |      |

| Opportunity  | Reason  | Action  |
|--|---|---|
| Do you compare energy and water bills with the previous equivalent month or quarter? | This is an easy way to monitor expenditure on energy and water. Careful comparisons of consumption will help identify changes in usage and possibly areas where there is wastage.   | Compare consumption (units) and cost for direct equivalent billing periods in previous years.<br>Investigate any unexplained changes.   |
| Do you read your energy and water meters and check fuel bills on a monthly basis?    | Regular monthly meter readings will show a pattern of usage. This will be especially helpful when billing periods are irregular or amounts frequently estimated.<br>Fuel usage (diesel, petrol) is likely to be seasonal but striking variations from the norm could reveal golf course maintenance problems. | Set up a routine for making and recording monthly readings and fuel bills.<br>It is a good idea to plot the readings on a graph, to gain a visual impression of trends.   |
| Do you look for reasons for all increases in energy consumption?                     | You can only deal with energy waste if you can accurately account for and identify all changes in usage.<br>Increases may be due to faulty equipment which could impact on golf course quality.   | Where consumption has risen, check all possible causes.<br>Verify that control devices, such as time switches, valves and thermostats, are correctly set and functioning.<br>Check whether any changes in work routine or golf course usage may have affected results – e.g. newly laid/seeded turf requiring more intensive management during the grow-in period, or an increase in number of rounds played. |
| Do you compare your energy usage with that of similar golf clubs in your local area? | Such comparisons are an excellent way of gauging your current level of efficiency and the potential for improvement.  | Check with the Scottish Golf Environment Group for relevant data on golf course energy consumption.<br>Club house energy consumption expressed as usage per square metre of floor space can be compared against national performance bands for similar sectors; e.g. offices, hotels, schools, shops.   |
| Do you set targets for reducing energy consumption?                                  | Setting realistic targets for energy reduction will help focus attention on inefficient practices and will raise the profile of energy efficiency within the club.  | Obtain data for comparable activities/periods among golf clubs, or similar building types.<br>Identify your best two or three month period.   |

## Plan

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| Opportunity  | Reason  | Action   | Plan |
|--|---|--|------|
| <i>Continued from previous page</i>  |   | Set regular and achievable targets based on these internal and external guide figures.   |      |
| Do you check energy efficiency against 'productivity'?   | Relating energy usage to golf course usage can provide a good internal benchmark of energy efficiency.  | Set up a procedure to calculate energy performance: e.g.<br>Relate monthly energy costs with green fees sold and/or rounds played, or functions hosted in the clubhouse.<br>Relate fuel costs among greenkeeping equipment to amount of grass clippings removed.<br>N.B. These can be based on samples rather than absolute total amounts per month. |      |
| Do you continuously promote the benefits of energy conservation to everyone in the club?   | Energy efficiency programmes must involve all staff and club members if they are to be effective.   | Use team briefings and club newsletters to reinforce simple good housekeeping message: such as switching off lights, closing doors and windows when heating is on, switching off unnecessary equipment...<br>Include summary of energy efficiency results in club's annual report.   |      |
| Do you provide energy efficiency training for key staff?   | Appropriate training is vital to make staff aware of energy efficiency techniques.  | Identify training needs at club and individual level.<br>Ensure all key staff receives initial energy efficiency training and regular updates.   |      |
| Do you make full use of energy efficiency support services and material?   | There is plenty of information and sources of help available: from good practice case studies, literature, cd-roms and videos, to advisory visits, free audits and grant aid. | Contact the Environment and Energy Helpline 0800 585 794 or the Scottish Energy Efficiency Office 0141 242 5835, <a href="http://www.energy-efficiency.org">www.energy-efficiency.org</a>  |      |
| If your energy bill is greater than £10,000 a year (true for most golf facilities), have you commissioned a formal energy audit? | An in-depth review of energy usage will identify where most effective cost-savings can be made.<br>The review will help implement an integrated energy policy.                | Use the application form in Appendix I to request a free Energy Audit.<br>Repeat this exercise, either internally, or with a specialist energy consultant every five years.  |      |

| Opportunity   | Reason  | Action   |
|---|---|--|
| Do you publicise your energy saving successes both internally and externally?               | Internal publicity maintains the profile of the programme within the club.<br>External publicity on energy efficiency activities is good PR and can help the club's relations with the local community. | Provide feedback to staff and members via notice boards, newsletter and on your own club web site.<br>External promotions can range from press releases for local media and trade journals, to achieving recognition through green label programmes and awards: e.g. Committed to Green. |
| Do you run a suggestions box for improving energy efficiency?                               | Encouraging staff and members/visitors to participate in this way can often produce worthwhile ideas, and at least makes them aware of the programme.   | Set up a suggestion scheme – this should cover the greenkeeping staff, pro shop and clubhouse, so all users of the golf course are included.<br>Discuss ideas received with the individual proposer.   |
| Are new staff and members informed about your energy/environmental policies?                | It is important that new staff and members are informed about the club's commitment to good energy practice. This will help them to fit into the programme.   | Ensure energy efficiency is included in staff induction programmes.<br>Ensure all new club members and employees receive a copy of the club's energy/environmental policy.   |
| Are there any incentives offered to staff/members to encourage good energy practices?       | People are more likely to carry out energy efficiency measures if they themselves can benefit.  | Consider setting up a scheme to maintain staff and membership interest in energy efficiency. As personal reward schemes can be difficult to administer, incentives could be more based towards improving club/staff facilities, or donations to nominated charities.                     |
| Does your club reinvest a proportion of savings made in further energy efficiency measures? | Reinvesting initial savings will further improve energy efficiency. It will also confirm the club's commitment to energy efficiency.  | Calculate the savings achieved through the programme per year.<br>Agree a percentage of this to be allocated towards further energy efficiency measures.   |

## Plan

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# BUYING

## developing a purchasing policy

**Even before considering technical improvements to your energy management, immediate savings may be achieved through making sure you are on the right tariff. Check to see if there are any alternative, cheaper energy suppliers.**

**Money can also be saved by reducing water and sewerage bills.**

This section deals with the way you buy energy and water and shows various actions you can take to save money. There are more and more opportunities on the market for buying alternative gas and electricity supplies. These economies will be an important part of the overall savings you can expect to make.

The actions outlined here should, ideally, form part of a wider commitment to improving your environmental performance, and at the same time improving the financial position of the club. You can do as many or as few of these actions as you feel fit, but the more you do the greater the benefits that will accrue.

| Opportunity  | Reason   | Action   | Plan |
|--|--|--|------|
| Does the club include energy efficiency in all specifications for buying supplies and equipment?                 | The lifetime cost of running equipment or a line of supplies may be very different from the original purchase cost.<br>Careful procurement can achieve major savings.<br>It is good to let suppliers and manufacturers know you consider energy efficiency to be an important purchasing factor. | Ensure all purchasing specifications include energy efficiency.<br>Key criteria should include: fuel/energy efficiency rating, durability, performance quality, servicing requirements.<br>All staff responsible for purchasing should receive energy efficiency awareness training. |      |
| Is there someone in the club responsible for checking all bills received from energy and water supply companies? | It is essential that someone in the club has detailed knowledge of how energy and water charges are calculated.<br>Significant cost savings can be achieved through choosing the best energy tariffs – but first you need to understand how these tariffs work.                                  | Ensure there is a specific person responsible for checking all energy and water bills.<br>Obtain tariff booklets from energy and water suppliers for detailed information.<br>If there is any doubt about the way charges are calculated, contact your supplier.                     |      |
| Do you check that all incoming bills are accurate?   | Do not assume that the supplier is always right.<br>It is important to check that estimated bills are reasonable for the period in question.   | Check all incoming bills against in-house meter readings.  |      |

| Opportunity  | Reason   | Action  |
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| Is there an annual check to assess whether you are on the best tariff?       | Tariff prices and charging structures frequently alter. It is necessary to monitor the situation regularly.<br>Or, your pattern of energy consumption may have changed, making a different tariff more attractive.   | Carry out an annual tariff review.<br>Ask your supplier for advice on tariffs.<br>You will only be able to identify the best tariff for your club if you have good data on the patterns of energy consumption at your club.<br>Regular in-house meter readings are therefore essential.   |
| Do you monitor the amount of energy used overnight?                          | Information on overnight consumption will help you determine whether changing to a cheaper night tariff would be worthwhile. Although golf clubs are essentially day time operators, you may not be aware that you could be using a lot of electricity during off-peak periods when the premises are unoccupied. | Arrange for your meters to be read daily for one or two weeks of normal working.<br>Readings should be taken both at the end of the day and first thing in the morning (if you are already on a two rate tariff, then the meter will have high and low readings).<br>Complex tariffs will require more sophisticated meters.<br>Calculate average hourly usage by dividing the number of units used by the number of hours between readings.<br>Check whether overnight consumption matches essential requirements.<br>If overnight consumption is necessary, look for alternative cheaper night tariffs. |
| Do you make the best use of cheaper rate electricity?                        | If more than 15% of your total electricity usage occurs in off-peak periods, it is worth considering switching to a day/night tariff.  | Carry out a survey of individual equipment usage.<br>Items such as water heaters could be switched to operate in the off-peak period.   |
| Have you looked at alternative competitive suppliers of electricity and gas? | You can choose who to buy energy from – it does not have to be your 'local' supplier. Considerable savings may be achieved by shopping around.   | Seek alternative quotes from a number of suppliers.<br>The regulator OFGEM maintains a list of authorised suppliers. <a href="http://www.ofgem.gov.uk">www.ofgem.gov.uk</a>   |
| If you pay trade effluent charges, are these checked carefully?              | Trade effluent charges usually include provision for disposal of a proportion of incoming water as domestic sewage. The remainder is charged as trade effluent, which is normally cheaper than domestic sewage.  | Establish how the sewage charge is calculated.<br>Check that the proportion of domestic sewage corresponds to the number of employees.<br>N.B. As a general rule, you can estimate a requirement of 13m <sup>3</sup> per employee per year, or 50 litres per person per working day.  |

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| Opportunity   | Reason  | Action   |
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| If you use heating oil, do you belong to an oil purchasing consortium or group? | Buying oil in larger quantities enables better discounts to be negotiated. You may also get further benefits from the consortium in the form of information on price trends.  | Consider joining forces with other clubs in your area to form a purchasing group, or join an existing consortium.  |
| Do you try to avoid small deliveries of oil?                                    | Oil companies offer better prices for larger deliveries.  | Try to avoid small deliveries. Talk to your supplier to find out what quantity discounts exist and plan around these. It may be worth reviewing the amount of on-site oil storage.   |
| Are you aware of seasonal variations in oil prices?                             | The price of heating oil usually drops during summer months.  | If possible, fill up oil tanks in the summer. N.B. This may have stock value and cash flow implications.   |
| Is your water meter the correct size?   | Standing charges for water are calculated according to the size of the meter. If it is too large, you may be paying too much.   | Check the size of your meter. If it is larger than 25mm, compare the meter size with your maximum flow rate requirement. Contact your water supplier for assistance.   |
| Are minimum charges on water bills checked carefully?                           | Unnecessary minimum charges may be incurred due to underestimates by the supplier.  | Check minimum charges on estimated bills are not due to an underestimation by the supplier. If you think you have been incorrectly charged, take meter readings and inform the supplier.   |
| Do you claim rebates for mains water not discharged to the sewer?               | Charges for the disposal of water are normally calculated according to the incoming metered supply. If more than 10% of the water is evaporated or otherwise dispersed, you may be able to claim a rebate on disposal costs. If mains water is used for golf course irrigation (not normally a good option) this aspect may be important. | Calculate the quantity not returned to the sewer. Check that sewerage charges are being made only on water that is returned to the sewer. Seek a rebate from your supplier if you think this amounts to more than 10% of your total fresh water usage. |

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| Do you pay for the disposal of any surface water not flowing into the water company's drainage system? | You should only pay for water entering the water company's drains. | Check the method of disposal of surface water and verify that you are only paying for the water entering the water company's drains. |

## Plan

## Fortrose and Rosemarkie Golf Club

Like most golf clubs, Fortrose and Rosemarkie has not completed a full energy review. Nevertheless, a number of important energy saving measures were introduced in the development of the new greenkeeping facility, while other good housekeeping practices have been instigated within the clubhouse. Examples of measures included in the club's Committed to Green Environmental Statement (May 2002) are shown below.

- Heating system installed in the new greenkeeping facility, controlled by thermostats and timers, resulting in more efficient use of energy and a more comfortable environment for staff.
- Low energy bulbs have been installed throughout the clubhouse.
- Double sided copying has been introduced.
- Toner cartridges are recycled.
- Self-seal envelopes are no longer used.
- Eco-labels are checked when purchasing new items.
- Window sills and surrounds painted white to reflect maximum light.
- Reflective foil placed behind radiators to reflect heat.
- Shelves installed above radiators to stop heat going straight up the wall.



# BUILDINGS

## clubhouse, pro shop, maintenance facilities

**Buildings that are properly draught-proofed and insulated are much more comfortable and economical to run. Effective insulation can reduce heat losses by up to 90%.**

This section deals with the way you look after your buildings throughout the golf course (i.e. from clubhouse to maintenance facilities), and shows various actions you can take to reduce heat losses and draughts. Given the range of buildings on a typical golf course, the overall savings to be made here are likely to be significant. While clubhouses may be considered typical, conventional buildings for which much general guidance is applicable, the often open nature of maintenance facilities (especially converted agricultural sheds) makes them particularly difficult to manage to an economical and comfortable level.

The actions outlined here should, ideally, form part of a wider commitment to improving your environmental performance, and at the same time improving the financial position of the club. You can do as many or as few of these actions as you feel fit, but the more you do the greater the benefits that will accrue.

N.B. For health and safety reasons, ensure that all buildings remain adequately ventilated.

To help you plan your savings, this section is divided into three colour-coded parts, so you can see at a glance how much time and money might be involved.

**RED**      **NO COST**      **actions you can carry out immediately**  
**GREEN**    **LOW COST**      **actions requiring small initial investment**  
**BLUE**      **MORE IDEAS**     **activities that will require some research and planning**

| Opportunity  | Reason  | Action   | Plan |
|--|---|--|------|
| Are windows and doors kept closed during the time when heating is operating? | Windows are often opened because rooms are too warm.<br>Doors are often wedged open for convenience.<br>Up to one third of heating costs can be saved by reducing the amount of cold air that enters your building. | Use promotional materials (e.g. posters, leaflets, notes in club newsletter) to encourage staff, members and visitors not to leave doors and windows open when heating is on.<br>Use staff meetings and member meetings to raise awareness of the high cost of heating.  |      |
| Are all unused doors and windows permanently sealed?                         | Unused doors and windows are a source of draught which causes discomfort and wastes money.  | Identify and seal doors and windows that are no longer used.<br>N.B. Ensure that apparently unused doors and windows are not required for safety reasons.  |      |
| Do you have a maintenance programme for doors, windows and roofs?            | Draughts from doors and windows cause discomfort.<br>The resulting chill factor often prompts staff to raise room temperatures to compensate.   | Before the start of each heating season, make a careful check of all doors and windows and carry out necessary repairs.<br>Your checklist should include:<br><input type="checkbox"/> window panes<br><input type="checkbox"/> window furniture: frames, pull-cords...<br><input type="checkbox"/> door furniture: frame, hinges, closers, letterbox flaps |      |

| Opportunity   | Reason   | Action   | Plan |
|---|--|--|------|
| <i>Continued from previous page</i>   |  | <input type="checkbox"/> plastic strip curtains<br><input type="checkbox"/> rapid action doors<br><input type="checkbox"/> roller shutter doors<br><input type="checkbox"/> concertina doors<br><input type="checkbox"/> eaves, rooflights...  |      |
| Are ventilators that are used for summer cooling shut off before the heating season begins?         | It is wasteful to allow cold air into the buildings or to extract heated air unnecessarily.  | Make someone responsible for shutting off all summer cooling ventilators.<br>N.B. Check carefully that ventilators are not needed for essential purposes such as removing fumes, dust or odours. Do not enclose chemsafes in other rooms where agri-chemicals are stored.  |      |
| Have you checked your buildings for draughts from redundant fireplaces, flues, stacks and chimneys? | A lot of heated air can escape from buildings through these pathways.  | Carry out a check for redundant fireplaces etc.<br>Blank-off or remove all redundant fireplaces, flues, stacks, exhaust vents and chimneys.<br>N.B. For inbuilt brick chimneys, fit a vent at the base of the old fireplace to allow some air into the chimney to prevent damp. If you have doubts, seek professional advice.  |      |
| Are your buildings checked regularly for signs of damp?   | Damp causes damage to the building structure and severely reduces the insulating properties of building materials.                 | Check for faulty damp-proof courses, leaking gutters and downpipes, broken and missing roof tiles...<br>Repair all necessary items.<br>Set up a system of regular checks for blocked gutters and hopper heads.   |      |
| Are all accessible loft spaces adequately insulated?  | Uninsulated lofts are a major source of heat loss.<br>Insulation with say 100-150mm glass fibre can reduce heat loss by up to 90%. | Identify uninsulated loft areas and apply insulation where appropriate. Different insulating materials have different properties but normally a thickness of 100-150mm of most materials is recommended.<br>When applying ensure there is sufficient ventilation at the eaves.<br>Remember to insulate any water tanks and pipes in the loft space to reduce risk of freezing.<br><b>Approximate cost £2.50 per square metre</b> |      |

| Opportunity  | Reason   | Action   |
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| Are windows, rooflights and doors draught-proofed?   | Draught-proofing is a cheap and effective way of reducing heating costs and improving working conditions.  | Carry out survey of buildings to note where draught-proofing is needed.<br>In maintenance facility, try to section off working areas so they are not exposed to open air when main shed doors are open for passage of machines.<br>Fit draught-proofing to all external doors and all internal doors that separate warm and cold areas.<br>Draught-proof all windows.<br><b>Approximate cost £2 per metre</b><br>N.B. Ensure adequate ventilation in all places where combustion appliances or volatile chemicals are kept/used. |
| Are all external doors fitted with door closers?   | People often fail to close doors, leading to significant heat losses. This is especially significant for golf clubs where there are many people visiting during the day. | Fit spring-loaded door closers.<br><b>Approximate cost: £50 per door.</b>  |
| Do heaters switch off automatically when doors in maintenance sheds, loading bays and workshops are opened?            | Large open doors result in substantial heat losses.<br>If heat is cut off when doors are open, there is an incentive for green staff to keep doors closed more often.    | Interlock the operating of heaters and large opening doors, so that heaters are switched off automatically when doors are opened.<br><b>Approximate cost: £100 per door.</b>   |
| If you have buildings with high bays, have you checked the difference in temperature between floor and ceiling levels? | Warm air rises and collects in the roof space where it is not needed. This may also mean greater heat loss through the roof.   | If the temperature difference is excessive (more than 5°C) fitting a de-stratifying fan controlled by a thermostat will help bring warm air back down to where it is required.<br><b>Approximate cost: £80 per fan</b>   |
| Are all cavity walls insulated?  | Heat loss through cavity walls can be reduced significantly (up to two thirds) by installing cavity wall insulation in older buildings.                                  | Install cavity wall insulation where appropriate.<br>Seek professional advice from a qualified building surveyor.  |

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| Opportunity  | Reason  | Action   | Plan |
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| Are all roofs properly insulated?                                    | Some roofs have a very high rate of heat loss. These include single skin roofs of corrugated asbestos or iron. Losses can be as much as 15 times that of modern well-insulated roofs.                   | Look at the possibility of insulating roofs that suffer high heat loss. Suitable methods include lining, over-spraying and under-spraying. Seek professional advice.   |      |
| Have you considered the idea of installing suspended ceilings?       | Suspended ceilings reduce the volume of air to be heated. They provide additional insulation against heat loss. Installing suspended ceilings could also reduce lighting costs.                         | Look at possibility of installing suspended ceilings. Seek professional advice.  |      |
| Are all windows fitted with double or secondary glazing?             | Heat loss through windows can be halved by fitting double or secondary glazing. The comfort of people sitting/working near windows is improved. Noise levels from outside are considerably reduced.     | Look for opportunities to fit double or secondary glazing. N.B. This option should be considered when upgrading a heating system or replacing windows as the extra cost of additional glazing cannot normally be justified by energy savings alone.  |      |
| Have you installed secondary glazing under rooflights?               | Heat loss will be reduced by up to a half. Comfort levels will be improved by eliminating down draughts.  | Investigate opportunities to install polycarbonate secondary glazing under rooflights.   |      |
| Have you considered placing wind breaks around maintenance facility? | If the main machinery shed faces the prevailing wind, the wide entrance doors will be a significant source of heat loss. Cutting down the wind exposure factor will greatly improve working conditions. | Examine orientation of maintenance facility with respect to prevailing wind. Create windbreak if appropriate and space allows, either by building or raising height of external wall to compound, creating an earth bund and/or planting a shelter belt. The latter could, in the longer term, form a useful landscape and nature conservation function as well. |      |

# GREENKEEPING EQUIPMENT

tips for efficient use, maintenance and renewal

**A large part of a golf club's energy expenditure is on fuel – petrol and diesel – for use in greenkeeping equipment. Significant economies can be envisaged in this area without in any way diminishing the quality of the golf course.**

**Attention to the upkeep and efficiency of greenkeeping equipment is an essential part of general best practice golf course management that results in higher quality playing conditions, and ensures better value from your fleet of machinery. Fuel costs are likely to keep on increasing. Correct fuel management will ensure long-term benefits.**

This section deals with the way you utilise and maintain the greenkeeping equipment used on your golf course. Various actions are proposed to help make more efficient use of all machinery. This should result in significant long-term savings. The actions outlined here should, ideally, form part of a wider commitment to improving your environmental performance, and at the same time improving the financial position of the club. You can do as many or as few of these actions as you feel fit, but the more you do the greater the benefits that will accrue.

To help you plan your savings, this section is divided into three colour-coded parts, so you can see at a glance how much time and money might be involved.

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- BLUE**     **MORE IDEAS**    **activities that will require some research and planning**

| Opportunity  | Reason   | Action   | Plan |
|--|--|--|------|
| Do you carefully monitor the performance of each unit of machinery?                    | Careful monitoring of performance of all greenkeeping equipment will help to identify problem individual units – these may be due to faults or poor maintenance. In mixed fleets of equipment, you can compare performance of different makes. This may influence future purchasing decisions. | Set up a monitoring system to record fuel usage of each tractor, mower and utility vehicle. Prepare a 'league table' based on machine operating hours and fuel consumed. Investigate the worst performers. |      |
| Do you monitor the performance of individual drivers?                                  | Poor driving/operating techniques can lead to wastage.   | Set up a monitoring system to relate fuel consumption per driver/operator for identical machines. Talk to the worst performers and offer advice, or refresher training.                                    |      |
| Is fuel/energy efficiency a factor in purchasing decisions for greenkeeping equipment? | The difference in performance between makes can be marked, but of course fuel economy will depend on the job the machines are expected to do.  | When considering new purchases, always investigate fuel/energy efficiency data. Ask potential suppliers to explain their energy efficiency/fuel type options.  |      |

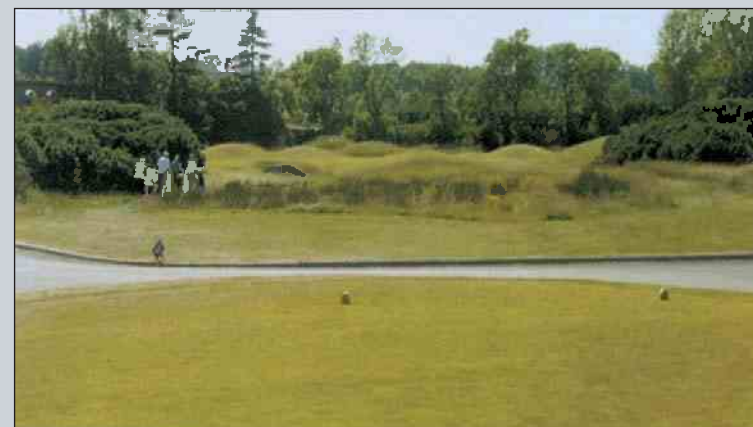
| Opportunity   | Reason  | Action   | Plan |
|---|---|--|------|
| Have you reviewed the type and grade of lubricants used on machinery?                 | Use of the wrong lubricant can add 5% to energy costs. Some high performance lubricants can reduce energy cost by more than this amount.  | Identify your lubricant needs and discuss with equipment and lubricant suppliers.  |      |
| Do you ensure mower blades are correctly set and regularly sharpened?                 | Not only do good blades give a better quality of cut, but they offer less drag and thereby improve fuel efficiency and machine life.  | Set up a programme for regular checking and maintenance of mower blades.   |      |
| Are you aware of the high cost of compressed air?                                     | Producing compressed air is very expensive – it costs ten times more than electricity.  | Ensure all greenkeeping staff are aware of the high cost of compressed air.<br>Determine a policy of minimum use – do not use for cleaning down machinery when more cost-effective alternatives are possible; e.g. dustpan and brush.  |      |
| Do you regularly check for leaks and carry out repairs to compressed air equipment?   | Leaks are responsible for the largest proportion of waste but are simple to control. Losses through a 1.6mm hole (size of a match head) require 1kW of power to compress the air lost.  | It is easier to check for leaks during periods when there is no demand for air.<br>During quiet periods listen for loud and obvious leaks and repair them immediately. Smaller leaks can be detected using a soap-water solution.<br>Check all joints, plug-in connectors, gauges and other fittings.<br>Inspect all flexible hoses.<br>Schedule a quarterly leak test/repair programme. |      |
| If you do use blow guns, are they operated at the correct pressure?                   | The Health and Safety Executive recommends that blowguns should not be operated above 30psi (2bar).<br>Reducing blowgun operating pressure to 30psi from a higher general system pressure can significantly reduce operating costs. | Check the operating pressure of blowguns. Adjust their pressure regulating valves to a maximum of 30psi (2bar).<br>Label blowguns to show the maximum permissible operating pressure.  |      |
| Is staff encouraged to turn off machinery and electrical equipment when it is idling? | Most equipment and machinery consumes a considerable amount of energy even when in an idling mode.  | Make staff aware of the cost of leaving machinery running when not in use.<br>Set up a procedure to ensure that machinery is switched off during stoppages (lunch breaks etc).   |      |

| Opportunity   | Reason  | Action   | Plan |
|---|---|--|------|
| Are automatic controls fitted which will turn off idling machinery? | Automatic controls are more reliable than manual ones.<br>Automatic controls can be set to switch off machinery after a set period of idling, therefore saving money both in terms of energy and wear and tear.   | Check which machines are suitable for automatic switches and fit where appropriate.<br><b>Approximate cost: £100 per machine</b>   |      |
| Have you considered switching to electric powered vehicles?         | Petrol/diesel powered machines are noisier and more polluting, but may be preferred according to the type of use required.<br>Recharging can be done overnight using cheaper electricity tariffs.   | Review the range of vehicles used on the golf course.<br>Identify which ones could be replaced with an electric powered alternative.<br>Plan a phased conversion of all suitable equipment/vehicles. |      |
| Have you considered switching to LPG fuelled vehicles?              | LPG is duty free and therefore considerably cheaper than both petrol and diesel.<br>LPG vehicles produce significantly cleaner exhaust emissions than petrol or diesel alternatives.<br>Oil changes are less frequent as less carbon is produced in the combustion cycle. | Review the range of vehicles used on the golf course.<br>Identify which ones could be replaced with an LPG powered alternative.<br>Plan a phased conversion of all suitable equipment/vehicles.      |      |

## The Duke's Golf Course, St Andrews

Extracts from the Energy Efficiency section of the Committed to Green Environmental Statement (May 2002)

- Existing fleet of petrol golf carts to be traded for electrically powered models, giving an anticipated reduction in unleaded petrol from 9,700 litres to 5,600 litres per year.
- Main lights in maintenance facility are turned off by a timer
- Office / lunchroom heaters are thermostat controlled
- Guidelines for turning-off other lights when not in use are included in staff induction notes
- Roof-lights are cleaned regularly to reduce dependency on powered lights



# ELECTRICAL EQUIPMENT

**Electricity is an expensive item that makes up a large part of a golf club's energy bill, yet electricity is easy to control and some simple measures will lead to dramatic savings.**

This section deals with the many ways you use electricity and shows various actions you can take to reduce waste. Electricity is very easy to waste, yet there are several simple, no-cost actions you could do immediately to save money.

The actions outlined here should, ideally, form part of a wider commitment to improving your environmental performance, and at the same time improving the financial position of the club. You can do as many or as few of these actions as you feel fit, but the more you do the greater the benefits that will accrue.

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| Opportunity   | Reason   | Action   | Plan |
|---|--|--|------|
| Are all computers, printers, copiers and associated equipment switched off when not in use? | Leaving computers and other similar office equipment running for long periods is wasteful.<br>The heat generated by such equipment may lead to staff putting on electrical fans and add to air-conditioning costs. | Identify equipment that can be switched off when not in use.<br>Use green and red labels to indicate which equipment can be turned off and which must be left running.<br>Make the appropriate people aware that the green coded equipment should always be off when not in use. |      |
| Are photocopiers switched to standby mode when not in use?                                  | Many photocopiers have a standby mode that will reduce the power used without switching off the machine.   | Encourage people to switch photocopiers to standby mode after use.<br>Where possible enable automatic use of standby mode.   |      |
| Do staff sometimes use portable electric heaters?   | Portable electric heaters are very expensive to run. Generally they do not have thermostats, time switches and are left running continuously.  | Check to see if portable electric heaters are regularly used.<br>If so, review heating arrangements for the area in question.  |      |

| Opportunity   | Reason   | Action   |
|---|--|--|
| Is a regular check made on the condition of seals on fridges and freezers?              | Worn or damaged seals increase refrigeration costs, allowing warm air in and cold air to leak out.                                   | Set up a programme for regular inspection of seals.<br>Replace all seals that show signs of wear or damage.                                  |
| Have you replaced old metal kettles with modern jug kettles?                            | Older kettles cannot heat a small quantity of water. If you boil twice the amount of water you need, it will cost you twice as much. | Replace older kettles with modern jug types if small quantities of water are being heated.<br><b>Approximate cost: £25 – £30 per kettle.</b> |
| Have you checked that tea urns are not left boiling continuously?                       | Continuous operation of tea urns is generally unnecessary and wasteful.  | Check how tea urns are used.<br>Install instantaneous water boilers wherever possible.<br><b>Approximate cost £350 per boiler.</b>           |
| When buying computers and office equipment, do you check for energy-efficiency ratings? |  |  |

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## LINLITHGOW GOLF CLUB\*

*Extracts from Environmental Statement, October 2000*

"Cost savings in utility usage have been achieved by identifying energy efficient practices whilst drawing up the Environmental Programme. Not everyone can boast a 75% reduction in water costs from one simple change, though we are the first to point out that our major usage of this scarce commodity was by way of old fashioned, continuous flushing of the gents' urinal. Having now carried out a full utility usage and cost audit, we have reduced electricity costs by the installation of insulation in the beer cellar and still room, again at low cost. The various tariffs and price/cost for all [utilities and fuels] are regularly checked and changes made where favourable to us. We hope that identifying and adopting energy saving changes will allow us to use the new "green tariffs" available for electricity. We will be utilising the technical knowledge of our members in recognising and adopting [further] energy saving improvements."

\* Linlithgow Golf Club is one of the pioneers of the Scottish Golf Environment Group's programme. The club achieved full Committed to Green recognition in November 2000.



# BOILERS

**Boilers are not 100% efficient – around 20% of the heat generated may be lost up the chimney.**

**Heat loss can increase to 30% or more if the boiler is poorly maintained or operated.**

This section deals with the way you heat water and shows various actions you can take to reduce costs.

N.B. for safety reasons, boilers must be maintained in the best possible condition.

The actions outlined here should, ideally, form part of a wider commitment to improving your environmental performance, and at the same time improving the financial position of the club. You can do as many or as few of these actions as you feel fit, but the more you do the greater the benefits that will accrue.

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| Opportunity   | Reason  | Action   | Plan |
|---|---|--|------|
| Is your boiler plant regularly checked?   | Inefficient boiler plant will waste money. Problems such as leaks, gas smells or blockages to the supply of air to a boiler should be detected and dealt with promptly. There is also a risk of build up of fumes creating a health and safety issue. | Conduct regular (say monthly) checks of the boiler plant. Look for: <ul style="list-style-type: none"> <li><input type="checkbox"/> any warning lights</li> <li><input type="checkbox"/> signs of leakage from pipework, valves, flanges, and boilers</li> <li><input type="checkbox"/> any gas smells</li> <li><input type="checkbox"/> damage and burn marks to boilers and flues</li> <li><input type="checkbox"/> blockages to air vents</li> </ul> If any problems arise, or if in doubt, seek professional advice immediately. |      |
| Do you turn off heating boilers and their pilot lights in summer?                           | Leaving boilers on during summer is wasteful. Pilot lights on gas boilers use significant quantities of gas.  | Arrange for someone to turn off boilers and pilot lights in the summer and relight them when required.   |      |
| Have you checked whether your boiler continues to fire when there is no demand for heating? | Boilers can continue to fire even when the room thermostat or heating time switch shuts off the pump. This wastes money during periods when there is no demand for heating.   | Arrange for the wiring to be altered so that the thermostat and heating time switch shut off both the circulating pump and the boiler(s).<br><br>Boilers and burners should be serviced  |      |

| Opportunity  | Reason   | Action  |
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| Are your boilers properly serviced at least once a year?       | A build up of deposits caused by combustion will reduce boiler efficiency.<br>Wear in controls and linkages can result in poor combustion.<br>Poor combustion can also be a health and safety risk.    | annually by a qualified contractor. The servicing should include a combustion efficiency check and adjustment of the burner air/fuel ratio for optimum efficiency in accordance with the maker's instructions.<br>Instruct the contractor to maximise the boiler efficiency and provide a boiler test sheet showing the results of the tests, the boiler efficiency and the maker's quoted maximum efficiency.<br><b>Approximate cost: £50 - £100 per service</b> |
| Do you monitor the performance of your boiler?                 | Combustion deposits cause an increase in flue gas temperatures and result in more heat being lost through the flue.<br>Water scale build up can also cause flue gas temperature to build up.           | Consider installing a flue gas thermometer. The boiler is ready for cleaning again when the maximum temperature of the flue gases rises by of 40°C since the last service.<br><b>Approximate cost: £20 per thermometer</b>  |
| Are all your boilers insulated?                                | Boilers which are not insulated lose heat into surrounding areas. This is a significant waste of money.  | Check that boilers are adequately insulated (minimum 50mm thick insulation).<br>If they are not adequately insulated, fit 50mm thick mineral fibre mat with foil laminate to the inside of the boiler casing. (Many manufacturers can supply custom made boiler insulating units).<br><b>Approximate cost: £30 - £100 per boiler</b><br>N.B. Make sure the insulation does not interfere with the burner or air supply to the boiler.                             |
| Are all heat distribution pipes, valves and flanges insulated? | Heat loss from pipes can be reduced by over 70% by insulation.<br>Significant heat is lost from valves (equivalent to the heat lost from 1m of pipework) and flanges (equivalent to 0.5m of pipework). | Check all pipes, valves and flanges around the boiler area.<br>Insulate all distribution pipework which is not contributing to the intended heated areas.<br><b>Approximate cost: £3 per metre of pipe (25mm diameter)</b><br>Insulate all valves and flanges (50mm or larger) with quick release valve jackets.<br><b>Approximate cost: £25 per jacket (50mm diameter)</b>   |

**Plan**

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Check your existing installation.

| Opportunity   | Reason   | Action  |
|---|--|---|
| Are heating and hot water supplied from different boilers?          | Where possible, hot water and heating should be supplied from different boilers. Dividing the system allows the heating boiler to be switched off during summer. | Consider the possibility of installing a dedicated hot water boiler or a hot water generator.   |
| Is your boiler plant the right size to meet your current needs?     | Over sized boilers waste money.  | Check whether your boiler is the right size to meet current needs.<br>Consider replacing boilers that are larger than necessary.<br>Consider installing a smaller, supplementary boiler to service periods of lower demand. |
| Have you looked at the operating efficiency of your present boiler? | Older boilers are usually less efficient than modern systems, sometimes by as much as 30% difference.  | Check your present boiler system.<br>If it is an older system, consider the benefits of upgrading to a modern system.   |
| Have you considered installing a condensing boiler?                 | Condensing boilers are very efficient as they recover a significant amount of heat from the flue gases.  | When existing plant is due for replacement, consider the merits of installing a condensing boiler.<br>N.B. To gain the full benefits of a condensing boiler may require changes to the existing heating system.             |

Plan

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## KILMACOLM GOLF CLUB

Kilmacolm is one of the relatively few Scottish golf clubs to keep detailed records of its energy usage. In parallel with this monitoring, a number of specific measures were reported in the club's Committed to Green Environmental Statement in October 2000.

- Replaced light bulbs with Low Energy bulbs.
- Installed dimmer switches in the clubhouse.
- Improved insulation in the clubhouse lofts.
- Upgraded radiators – adding individual thermostats to each radiator.
- Regular servicing of facilities such as boiler.
- Seeking advice from energy consultant. A report has been commissioned.
- Fitted eco-flow gas saver to the boiler.
- Regular servicing of all machinery to ensure best performance and fuel efficiency.



# HEATING

**Heating can account for around 50% of the energy used in clubhouses. You can save money by using simple time and temperature controls.**

This section deals with the way you heat your premises and shows various actions you can take to reduce heating costs. By developing a good understanding of efficient heating practices, you can make significant savings for the club.

Very few golf clubs spend much time looking at the way they heat their premises. Yet heating is a major item of the overall energy bill and small adjustments can add up to major savings. They should also contribute to an improved indoor environment for staff and members. It is good to involve staff and members in your plans – by participating they will understand better what you are trying to achieve, and help you to achieve the optimum working environment.

The actions outlined here should, ideally, form part of a wider commitment to improving your environmental performance, and at the same time improving the financial position of the club. You can do as many or as few of these actions as you feel fit, but the more you do the greater the benefits that will accrue.

To help you plan your savings, this section is divided into three colour-coded parts, so you can see at a glance how much time and money might be involved.

|              |                   |  |
|--------------|-------------------|--|
| <b>RED</b>   | <b>NO COST</b>    | <b>actions you can carry out immediately</b>                   |
| <b>GREEN</b> | <b>LOW COST</b>   | <b>actions requiring small initial investment</b>              |
| <b>BLUE</b>  | <b>MORE IDEAS</b> | <b>activities that will require some research and planning</b> |

| Opportunity   | Reason   | Action   | Plan |
|---|--|--|------|
| Have you checked whether your buildings are heated above 19°C?  | Most people don't realise that the maximum level recommended for heating is 19°C. Costs rise about 8% for each 1°C. The temperature in an area can be above 19°C but the heating should not be providing more heat once it has reached this level. Likewise, air-conditioning should not start to operate as soon as 19°C is exceeded. Unless there is a specific requirement, air conditioned areas need not be cooler than 24°C. | Carry out regular checks on thermostat settings.<br>Discuss heating levels at staff and member meetings.<br>Check settings of heating to ensure that heat is not supplied to raise the temperature above 19°C.                                   |      |
| Have you considered reducing the level of heating in some areas?  | Store rooms, corridors and areas where there is a high level of physical activity require less heat.   | Reduce thermostat settings in areas that do not require full conform heating.<br>Typical settings:<br><input type="checkbox"/> offices – 19°C<br><input type="checkbox"/> workshops – 16°C<br><input type="checkbox"/> store rooms – 10°C - 12°C |      |
| Are your thermostats and thermostatic radiator valves set to the correct temperature and then left alone? | Thermostat controls are often abused by being used as on/off switches. This can result in discomfort and wastes money.   | Set thermostats and radiator valves to give desired temperatures and make them tamperproof by using internal locking devices or external covers.   |      |

| Opportunity   | Reason  | Action  |
|---|---|---|
| Are your thermostats and temperature sensors located in the right place?  | Siting a thermostat in a cold or draughty place will result in overheating; conversely placing it near a heat source may lead to under heating. | Check thermostat locations and ensure they are appropriate for the area to be heated – they should be in a free flow of air but away from windows, heat sources and draughts. N.B. The siting of a thermostat is very often a compromise to achieve a reasonable balance of temperature throughout an area or building. |
| Are radiators and other heating surfaces always unobstructed?   | Radiators are often obstructed with furniture. This reduces their performance and extends warm up times.  | Check the layout of all heated rooms and ensure that radiators are not obstructed.  |
| Are your heating and ventilation time switches programmed to reflect occupancy patterns?                        | It is wasteful to continue heating buildings when they are not in use.  | Check settings on all time switches regularly to ensure that they are displaying the correct time and date and that the timings correspond to the occupancy pattern. Check that the heating and ventilation does actually switch off when the building is unoccupied.   |
| Do you regularly check that heating and ventilation plant controls, valves and dampers are operating correctly? | Seized valves and dampers, or those that will not close properly, will cause discomfort and waste money.  | Check that all radiator valves work. Check that motorised valves and dampers have full travel from open to close. Make sure that hot water is not passing through closed valves.  |
| Do you regularly check your heating system for leaks?   | Leaking systems require water losses to be made up. Adding water can result in corrosion, scalding and a loss of efficiency.                    | Check the feed and expansion tank regularly. If you can hear water filling the tank through the ball valve, it is likely the system is leaking. If you suspect a leak, call a contractor immediately to investigate.  |
| Are heated and unheated areas effectively separated?  | By separating heated and unheated areas draughts will be reduced, improving comfort and reducing running costs.                                 | Fit suitable partitions, swing doors or plastic strip curtains between cold and warm areas.   |

## Plan

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| Opportunity   | Reason   | Action   |
|---|--|--|
| Have you installed modern electronic thermostats?   | The older type of thermostats can allow room temperature to vary by up to 30C from the set temperature.<br>Unstable room temperatures are uncomfortable.   | Replace older bi-metallic type thermostats with modern electronic versions. These allow closer control, typically 0.5°C from the set temperature.<br><b>Approximate cost: £30 - £50 each</b>   |
| Have you considered fitting thermostatic radiator valves?   | If individual rooms suffer from over heating it is better to control the problem by regulating the heat source than by opening windows and wasting money.  | Carry out a survey of rooms which appear to suffer from overheating.<br>Fit thermostatic radiator valves which incorporate a locking mechanism; ensure they are correctly set and then locked.<br><b>Approximate cost: £15 each</b>  |
| If there are rooms that are quite often unoccupied (e.g. function rooms), can the heating system adjust to reflect the lower demand in these areas? | Reducing temperature in unoccupied rooms will save money.<br>Two-stage thermostats provide much more flexible control.   | Fit a two-stage thermostat linked to an occupancy sensor.<br><b>Approximate cost: £100 each</b>  |
| If you have electric heating, does it switch off automatically when not required?   | Although direct electric heating is cheap and easy to install, it is expensive to run, particularly when not controlled.<br>Electric heating should switch off (or drop to a reduced level) automatically when areas are unoccupied. | Fit 7 day electronic time switches to all electric heaters.<br><b>Approximate cost: £50 per switch</b><br>Or in intermittently occupied areas, install an electronic two-level thermostat with integral run-back timer to switch off electric heaters after a pre-set time.<br><b>Approximate cost: £90 per thermostat</b> |
| Is your heating system flexible enough to cope with occasional out-of-hours operation?  | Golf clubs often have evening functions in which only part of the building may be used. In these circumstances it is likely to be more economical to provide local heating rather than use the boiler to heat up the whole building. | Provide supplementary portable heaters where required. Ensure that their use is limited to approved periods only.  |
| Are extraction fans for areas such as toilets and kitchens time controlled?   | Excessive running of extraction fans is wasteful.<br>As warm air is extracted from the building, the heating system has to work more.  | Fit a 7-day time switch to all extraction fan units which are not needed to run overnight.<br><b>Approximate cost: £50 per switch</b>  |

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| Opportunity   | Reason   | Action  |
|---|--|---|
| <p>If you are using a lot of electric heating are you utilising off-peak electricity?<br/>Have you thought about using localised heaters for areas where general space heating is not required?</p> | <p>Day rate electricity is twice as expensive as night rate electricity.<br/>Spot heating of a localised area is often a much cheaper option than trying to heat a large area.</p> | <p>Install night storage heaters or change to gas or oil fired heating system.<br/>Install localised radiant heaters, controlled with a push-button run-on timer.</p> |

## Plan

## PUMPHERSTON GOLF CLUB

Pumpherstun is a long-established golf club which has undergone significant changes over the years. Most recently, the course was extended from 9 to 18 holes on derelict industrial land formerly occupied by the Pumpherstun Oil Company refinery works. From 1864 to 1993 various industrial processes were carried out on the site. This left a considerable legacy of pollution, which had to be cleared up as part of the golf course redevelopment. Although the club's primary achievements have been ecological benefits in transforming a contaminated site, detailed attention was also paid to energy efficiency in the design and construction of the new clubhouse and greenkeeping facility. Examples of good practice shown below have been drawn from the club's 2002 Committed to Green Environmental Statement.

- The new central heating system for the clubhouse uses LPG.
- All lights and computers are switched off when not in use and central heating and water heating systems utilise timer systems.
- Maintenance contracts for all new machinery ensure that all equipment is operating at optimum performance.
- Secure storage facilities are now available in the new clubhouse, which will reduce the use of cars for local golfers.
- New footpaths from the village have been constructed to encourage locals to walk to the course.



# LIGHTING

In a typical golf club, lighting accounts for around 50% of the money spent on electricity. Simply turning off the lights when they are not needed is one of the most effective ways of saving money. Making sure that you have the right bulb for the right job will also increase your efficiency.

This section deals with the way you light your premises and shows various actions you can take to reduce the cost of lighting. By developing a good understanding of efficient lighting practices, you can make significant savings for the club.

Very few golf clubs spend much time looking at the way they light their premises. Yet lighting is a major item of the overall energy bill and small adjustments can add up to major savings. They should also contribute to an improved indoor environment for staff and members. It is good to involve staff and members in your plans – by participating they will understand better what you are trying to achieve, and help you to achieve the optimum working environment.

The actions outlined here should, ideally, form part of a wider commitment to improving your environmental performance, and at the same time improving the financial position of the club. You can do as many or as few of these actions as you feel fit, but the more you do the greater the benefits that will accrue.

To help you plan your savings, this section is divided into three colour-coded parts, so you can see at a glance how much time and money might be involved.

- RED**      **NO COST**      **actions you can carry out immediately**
- GREEN**   **LOW COST**    **actions requiring small initial investment**
- BLUE**    **MORE IDEAS**    **activities that will require some research and planning**

| Opportunity   | Reason  | Action   | Plan |
|---|---|--|------|
| Do you encourage people to turn off lights when they leave an area?         | It is cheaper to turn off lights than to leave them running. Improving awareness of energy efficiency can achieve significant savings.                          | Use promotional materials (e.g. posters, leaflets, notes in club newsletter) to encourage staff, members and visitors not to leave lights on.<br>Use staff meetings and member meetings to raise awareness of the high cost of lighting. Remember, individual perception of appropriate levels of light varies. It is important to involve all staff in the discussions. |      |
| Are you sure that lights are switched off when the premises are unoccupied? | A lot of money is wasted when unnecessary lights are left on out of hours. Security lighting can be supplied by a smaller number of appropriate light fittings. | Carry out an 'out-of-hours' survey. Talk to cleaning and security staff. Set up an arrangement for switching off lights – in a golf club with a variety of buildings and functions, the best approach may be a policy of "last one out, switches off".   |      |
| Are you making best use of daylight coming through windows and roof lights? | Interior lighting will be used less when adequate daylight is available. Care needs to be taken with Visual Display Units to avoid glare problems.              | Check how often and how well your windows are cleaned; get the cleaner in more often if necessary. Move any objects (filing cabinets, plants etc.) that are obstructing windows.   |      |

| Opportunity  | Reason   | Action   |
|--|--|--|
| <i>Continued from previous page</i>  |  | Review the location of work stations. If possible move them closer to windows. Check that any roof lights are being used efficiently.  |
| Have you reviewed the level of lighting in all work areas?   | Non-critical areas, such as corridors, are frequently over-lit. Areas that are usually highly lit (e.g. pro shop) can have their lighting reduced for out of hours activities, such as cleaning. Generally, overall lighting can be reduced to a moderate level, enhanced by concentrated lighting for specific tasks. | Look at the lighting levels in all work and public/member areas – involve people in this activity. Decrease lighting in non-sensitive areas by selectively removing tubes from multi-tube installations, replacing light bulbs with lower powered bulbs, or disconnecting surplus lights. Use localise lighting for specific jobs. |
| Are your light fittings cleaned annually?  | Dirty diffusers or shades greatly reduce light output.   | Ensure that light fittings are cleaned at least once a year.   |
| Do you use slimline fluorescent light tubes?   | New slimline fluorescent tubes (26mm diameter) use 8% less electricity and cost the same as the older type.  | When replacing tubes, only use slimline tubes. N.B. Slimline tubes will not operate in a few older fittings. Try a sample one first.   |
| Have you checked whether the diffusers and shades on your light fittings are discoloured?  | Discoloured diffusers and shades substantially reduce light output.  | Discard discoloured items and replace.<br><b>Approximate cost: £5 (for a diffuser)</b>   |
| Have you got enough light switches?  | Where a single light switch operates a bank of lights, this means that whole rooms or working areas are lit on an all or nothing basis.  | Install pullcord switches to enable improved control of individual light fittings or groups of fittings.<br><b>Approximate cost: £15 per switch</b>  |
| Is your exterior lighting always switched off when it is not needed (including car park lighting, flood lighting of clubhouse facade)? | Exterior lighting should be limited to hours of darkness. It may not be necessary to have all exterior lighting operating throughout the night.  | Review exterior lighting needs. Fit photocells to restrict exterior lighting to hours of darkness. If exterior lighting is not required all night long, fit timer switches to allow separate settings. Fit movement detectors to security lighting.<br><b>Approximate cost: £60 per photocell</b>                                  |

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| Opportunity  | Reason  | Action  |
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| Are you replacing tungsten filament bulbs with compact fluorescent bulbs?  | Compact fluorescent bulbs use 75% less electricity, last eight times longer and reduce maintenance costs because of less frequent bulb replacement.   | Replace tungsten bulbs with compact fluorescent bulbs.<br><b>Approximate cost: £10 per bulb (cost-effective in almost all cases)</b>  |
| Are lights automatically switched off in areas that are not used frequently?   | Reducing the amount of time lights are operating in little used areas (toilets, changing rooms, locker rooms, corridors, store rooms) can save energy.  | Fit passive infrared presence detectors to allow automatic control in areas that are not in permanent use (can also be used for controlling urinal flushing and extractor fans, further improving cost-effectiveness).<br><b>Approximate cost: £150 per controller</b>  |
| If you are installing new lighting have you considered specifying high frequency fluorescent lighting?                                       | Energy costs can be reduced by around 25%. Mains hum and flicker (which can cause eye strain) can be eliminated. Starting is more reliable and the life of tubes is longer.   | Use high frequency fluorescent lights for all new applications and when replacing old fittings (don't forget office, workshop, machinery and communal areas).<br><b>Approximate cost: £25 more than equivalent conventional fittings</b>  |
| If you still have twin-tube fluorescent fittings, do you use mirror reflectors?  | Removing one tube and fitting a mirror reflector will probably reduce effective light output slightly, but this should still be acceptable. Reflectors are available as retrofit for many popular fluorescent light fittings. | Check whether existing light levels from fluorescent fittings are satisfactory. Find out whether mirror reflectors are available for your fittings. Fit a mirror reflector on a trial basis if possible. If subsequent light levels are satisfactory, instigate a full replacement programme.<br><b>Approximate cost: £40 per fitting</b><br>N.B. This is only worth doing if the fittings to be modified have life expectancy of more than five years. Professional advice should be sought. |
| In maintenance buildings with high ceilings (such as those in converted agricultural sheds), are you using high-pressure discharge lighting? | High-pressure discharge lighting is more efficient than most fluorescent systems and saves money. Higher wattage lamps mean fewer fittings and lower installation costs.  | Use high-pressure (SON) or low-pressure (SOX) sodium lighting in buildings with high ceilings. Seek professional advice from a lighting supplier.   |

**Plan**

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| Opportunity  | Reason   | Action  |
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| <i>Continued from previous page</i>  |  | <p>N.B. SON/SOX lighting is not suitable for use in offices and in situations where colour definition is critical. They also take some time to warm up to full output and this may limit the use of presence detectors and photocell controls.</p>  |
| <p>Have you replaced tungsten-halogen floodlights with discharge lighting?</p> | <p>tungsten-halogen floodlights are very expensive to run.<br/>Replacement with discharge lighting will give lower running costs, especially where the lights are to be used for long periods.</p> | <p>Check the length of time your Tungsten-Halogen floodlights are in operation.<br/>Check whether SON/SOX lighting would be a suitable alternative – seek professional advice.<br/>N.B. tungsten-halogen floodlights are best suited to intermittent use, such as security lighting controlled by presence detectors.</p> |


**Plan**







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## HOW TO SPOT DIFFERENT TYPES OF LIGHTING

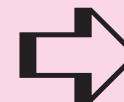
|   | Type                                  | Pros  | Cons  | Application   |
|---|---------------------------------------|---|---|---|
|    | Tungsten filament                     | <ul style="list-style-type: none"> <li>• Good light quality</li> <li>• Cheap</li> <li>• Easy to dim</li> </ul>  | <ul style="list-style-type: none"> <li>• Inefficient</li> </ul>   | <ul style="list-style-type: none"> <li>• Hotels</li> <li>• Public houses</li> <li>• Historic buildings</li> </ul>   |
|    | Tungsten halogen                      | <ul style="list-style-type: none"> <li>• Like tungsten filament but increased light output and longer life</li> </ul>   |   | <ul style="list-style-type: none"> <li>• Security lighting where immediate lighting is required at switch-on</li> <li>• Floodlighting where annual operating hours are very low</li> </ul>          |
|    | Low voltage tungsten halogen/dichroic | <ul style="list-style-type: none"> <li>• Like tungsten halogen but smaller</li> <li>• Give off less heat</li> </ul>   |   | <ul style="list-style-type: none"> <li>• Display and effect lighting in hotels, retails, museums, etc</li> </ul>  |
|    | Compact fluorescent*                  | <ul style="list-style-type: none"> <li>• Consume only one quarter or one fifth of electricity consumed by normal tungsten filament light bulbs</li> </ul>                       | <ul style="list-style-type: none"> <li>• Not always suitable for dimming</li> <li>• Can be large in size</li> </ul>   | <ul style="list-style-type: none"> <li>• Lower wattage types for amenity, effect and display lighting</li> <li>• Higher wattages used for general lighting of offices, retail stores etc</li> </ul> |
|  | Linear fluorescent                    | <ul style="list-style-type: none"> <li>• Can be 20% more efficient with high frequency (HF) fittings.</li> <li>• HF fittings also eliminate flicker and stroboscopic</li> </ul> | <ul style="list-style-type: none"> <li>• T12 tubes (37mm dia.) very inefficient – can often be replaced with more efficient T8 tubes (26mm dia.)</li> <li>• HF fittings can be identified as they do not need a 'starter' in the fitting</li> </ul> | <ul style="list-style-type: none"> <li>• Offices</li> <li>• Industrial</li> <li>• Retail</li> </ul>   |

|   | Type                  | Pros  | Cons   | Application   |
|---|-----------------------|---|--|---|
|    | High pressure sodium* | <ul style="list-style-type: none"> <li>• Low running cost</li> <li>• Very long life</li> </ul>    | <ul style="list-style-type: none"> <li>• Long warm-up and restart times</li> </ul>   | <ul style="list-style-type: none"> <li>• Industrial</li> <li>• Area, flood and street lighting</li> <li>• Office uplighting</li> </ul>                        |
|    | High pressure sodium* | <ul style="list-style-type: none"> <li>• Can operate at very low external temperatures</li> </ul> |  |   |
|    | Low pressure sodium*  | <ul style="list-style-type: none"> <li>• Most efficient of all lamps</li> </ul>                   | <ul style="list-style-type: none"> <li>• Orange colour</li> <li>• Long warm-up time</li> <li>• Often have delayed restart</li> </ul> | <ul style="list-style-type: none"> <li>• Street/security lighting where lack of colour recognition is acceptable</li> </ul>                                   |
|    | Metal halide*         | <ul style="list-style-type: none"> <li>• Available in many types and wattages</li> </ul>          | <ul style="list-style-type: none"> <li>• Some must be enclosed</li> <li>• Some have restricted operating positions</li> </ul>        | <ul style="list-style-type: none"> <li>• Industrial</li> <li>• Retail, including display effect lighting</li> <li>• Outdoor area and floodlighting</li> </ul> |
|  | High pressure mercury |   |  | <ul style="list-style-type: none"> <li>• Industrial</li> <li>• Outdoor lighting</li> </ul>  |
|  | Induction*            | <ul style="list-style-type: none"> <li>• Long life</li> </ul>                                     | <ul style="list-style-type: none"> <li>• Very expensive</li> </ul>   | <ul style="list-style-type: none"> <li>• Low maintenance applications</li> </ul>  |

### Key Fact:

#### Misunderstanding ...

'Switching fluorescent lights on and off uses a lot of electricity – it is cheaper to leave them on all the time.'



#### The truth is ...

... a fluorescent tube uses over 500 times more energy if left on for 15 minutes than the energy needed to restart

**Most people think the cost of water stays the same no matter how much you use.**

**Do you know that you pay for water twice? Once when it enters the site and once when it leaves as effluent. And, if it's hot water, you have paid to heat it too.**

This section deals with the way you use water and shows various actions you can take to reduce the cost of water. By developing a good understanding of efficient water use, you can make significant savings for the club. Golf courses are often criticised for using too much water. This is typically an issue associated with drier climates, but even in Scotland, the larger and more heavily used golf courses are resorting more and more to supplementary irrigation. This section, however, focuses on the use of potable water supplies in the golf course buildings, a previously neglected area and one in which considerable savings can be envisaged. Guidance on Best Management Practice in turfgrass irrigation is being developed in other publications.

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| Opportunity   | Reason   | Action   | Plan |
|---|--|--|------|
| Are people using and working at your golf facility aware of the need to prevent water being wasted? | Taps that are not properly turned off waste costly water.<br>Hot taps left dripping also waste money in heating water.   | Initiate 'good housekeeping' campaign to encourage people to turn off taps completely.<br>Use promotional material (stickers, notices) to raise awareness.<br>Use team briefings and club meetings to reinforce the message.   |      |
| Are people aware that your water supply is metered?   | Many people are unaware that non-domestic water supplies are usually metered.<br>Raising awareness of the cost of water will help to promote more efficient usage.   | Use promotional material (stickers, notices) to raise awareness.<br>Use team briefings and club meetings to reinforce the message.   |      |
| Have you carried out a water use audit?   | Water costs are an increasing element of utility costs, yet usage is often taken for granted.<br>In many situations, tracking water use may simultaneously track energy usage.<br>A water use audit can also form part of a wider environmental programme. | Carry out a simple water use audit: check all areas of the club using domestic water:<br><input type="checkbox"/> locker rooms<br><input type="checkbox"/> kitchens<br><input type="checkbox"/> toilets<br><input type="checkbox"/> maintenance facility<br><input type="checkbox"/> landscaping/garden areas<br><br>Try to assess the relative amounts used in each area. |      |

| Opportunity   | Reason  | Action   | Plan |
|---|---|--|------|
| Are all dripping taps repaired immediately?   | Dripping taps are obviously inefficient and wasteful. They are also very visible and if not repaired promptly, the credibility of your energy efficiency campaign will be undermined.   | Carry out regular checks on all outlets. Act on all reported dripping taps immediately. It is vital to show urgency to demonstrate your commitment to the programme.<br>Fit new washers to dripping taps immediately – keep a stock of washers in house; they only cost a few pence each.                        |      |
| Do you check regularly for leaks in your water systems, including sections underground? | Leaks in visible pipes are obvious but leaks in hidden sections can go undetected for years.  | Carry out regular checks on visible water pipes.<br>Set up a system for reporting leaks immediately.<br>Check for possible leaks in hidden pipes by monitoring your water meter regularly.<br>Consumption during periods of non use suggests leakage somewhere in the system and should be investigated at once. |      |
| Have you checked the temperature of your hot water?                                     | It is very common to find hot water that is too hot for comfort. Every 10°C reduction in hot water temperature saves 15% energy.  | Set immersion thermostats to 60°C.   |      |
| Do you switch off hot water systems when the course is closed?                          | There is no need to heat water that is not going to be used.  | Make someone responsible for switching off water heating whenever the course (and clubhouse) is to be closed.  |      |
| Have you checked whether hot water is used unnecessarily?                               | Hot water is always more expensive than cold water, yet is sometimes used when cold water would be just as effective (e.g. washing floors, rinsing).  | Check the different ways in which hot water is used throughout the club.<br>Use cold water for cleaning.   |      |
| Are your hot water controls set correctly?  | A lot of heat can be lost from boiler and distribution pipes. Running a boiler all day is usually uneconomical. Many electric immersion heaters are set to switch off at the end of daily occupancy. This wastes a lot of heat as the cylinder cools down over night. | Reset time switches to provide a few separate 2-hour heating periods during the day, based around normal demand.<br>Set immersion heater switches to turn off about 1 hour before the end of daily occupancy. This makes better use of stored hot water.   |      |

| Opportunity  | Reason  | Action  |
|--|---|---|
| Do you encourage catering and bar staff to use water economically?   | Good housekeeping routines in kitchens can significantly reduce water consumption, and save energy.                           | Initiate and encourage good housekeeping routines for efficient water use in kitchens and bars.   |
| If you use electric immersion heaters to generate hot water in the summer, have you checked whether the circuit from the heating boiler is isolated? | Water heated by an immersion heater, can pass heat to the boiler, which is a waste.   | Check the pipework linking the boiler to the hot water cylinder during the summer. If the pipes are warm, isolate the primary circuit (boiler plant to hot water storage cylinder). Carefully label and record all valves that have been closed.<br>N.B. it is possible to fit a non-return valve, but this entails some cost – seek professional advice.<br>An alternative is to install local water heaters where required – this would normally be the case for maintenance facilities and any outlying buildings with low water use; e.g. pro shop. |
| Are all your hot water storage cylinders insulated?  | Insulating unlagged storage cylinders will reduce heat losses by 75%.   | Insulate all hot water storage cylinders.<br><b>Approximate cost: £20 (for a 150 litre cylinder)</b>  |
| Are all hot water pipes insulated?   | Insulated pipes will reduce heat loss by 70%.   | Insulate all hot water pipes.<br><b>Approximate cost: £3 per metre of pipe (25mm diameter)</b>  |
| Are all electric immersion heaters fitted with time switches?  | A time switch can be used to ensure that hot water is generated only when needed.   | Install an immersion heater time switch.<br><b>Approximate cost: £50</b>  |
| Are flush controllers installed on urinal systems?   | Uncontrolled urinals usually flush every 20 minutes. Controllers can limit flushing to periods when the building is occupied. | Install electronic urinal flush controllers incorporating passive infrared (or similar) presence detectors to trigger flush cycle.<br><b>Approximate cost: £150 per controller</b><br>N.B. Presence detectors can also be linked to lighting and extraction fans.   |

## Plan

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# 5 GETTING THE MOST OUT OF BEING ENERGY EFFICIENT

## Further information and sources of help

There is a vast amount of literature available on energy efficiency, both in printed form and on the internet, as well as videos and CD-ROMs. Although much of this is pitched at an introductory level, the sheer volume alone is daunting and confusing, and there is a fair amount of duplication. None of this, of course, relates specifically to golf courses.

That is one key reason why this document has been produced, to distil much of what is currently available into a more easily digestible format specifically aimed at the golf sector. It would therefore be self-defeating to include here a comprehensive reference list, without some guidance as to how to research further, step by step.

In Scotland, the primary route to finding out more about energy efficiency is via the Energy Saving Trust business advice programme which is funded by the Scottish Executive.

**Tel: 0845 458 5040**  
**[www.energy-efficiency.org](http://www.energy-efficiency.org)**

Another option is to call the Environment and Energy Helpline number: **0800 585 794**. This is part of the service (co-funded by the Scottish Executive) to provide free advice to companies in the UK on any business related environmental or energy issue. The Energy Saving Trust business advice programme and the helpline can assist with many different issues that include how to:

- reduce energy costs
- increase profits by reducing waste
- improve environmental performance
- cut water and effluent bills

It also provides information on environment-related legislation and how it affects your business.

N.B. The Energy Saving Trust business advice programme has a regional network of six business advisers. Up to date contact details for all personnel can be found on the [www.energy-efficiency.org](http://www.energy-efficiency.org) web site.

## Free Energy Audits

Through the Energy Saving Trust business advice programme it is possible for small organisations in Scotland to receive free, on-site consultancy from an energy expert to help you with a specific environmental problem or to look at opportunities to save money through reducing your energy bills. The level of support available is determined by your total annual energy bill. If this is below £50,000 you may be eligible for a free energy audit from the Energy Saving Trust programme. That range is likely to cover the majority of Scottish golf courses. A few larger facilities are likely to have annual energy bills in excess of £50,000. These are likely to be eligible for a Carbon Trust audit.

As golf courses are special cases, combining a range of building types and a large managed land area, a special Energy Audit Application Form has been designed (see Appendix 1). This is coordinated by the Scottish Golf Environment Group and all applicants will be passed on to the Energy Saving Trust business advice programme.

## Design Advice

New golf course developments may qualify to take advantage of Design Advice audits, a consultancy service offering professional, independent and objective advice on the energy efficient and environmental conscious design of buildings. The level of support provided depends on the size of the project.

Smaller sites that do not qualify for on-site support from the Design Advice scheme may still obtain support from the Energy Saving Trust business advice programme.

Details can be found at [http://www.thecarbontrust.co.uk/energy/assessyourorganisation/design\\_advice.htm](http://www.thecarbontrust.co.uk/energy/assessyourorganisation/design_advice.htm) or by asking your local business adviser about design advice.

### Energy Saving Trust

The Energy Saving Trust is one of the UK's leading organisations set up to address the damaging effects of climate change. They aim to cut carbon dioxide emissions – the main greenhouse gas causing climate change – by promoting the sustainable and efficient use of energy. The Energy Saving Trust is an independent, non-profit making organisation and acts as a bridge from government to consumers, trade, businesses, local authorities and the energy market. They provide impartial information and advice and have a network of advice centres in the UK specifically designed to help consumers take action to save energy.

Energy Saving Trust  
112/2 Commercial Street  
Edinburgh  
EH6 6NF  
Tel: 0131 555 7900  
Fax: 0131 555 7919  
[www.energysavingtrust.org.uk](http://www.energysavingtrust.org.uk)

### Funding opportunities

There are a number of grants and other funding schemes relating to energy efficiency that may potentially be available to Scottish golf clubs. The following brief descriptions give an outline of the principal schemes but you would be best seeking advice first through the relevant helpline number or from your local business adviser before applying.

### Loan Action Scotland

Loan Action Scotland is funded by the Scottish Executive (as well as receiving additional funding through the European Regional Development Fund), and is operated by the Wise Group. The scheme provides **interest free loans of £5,000 to £100,000**, so that companies can take action to reduce their energy bills. The loans can have a repayment period of up to **four** years, and are available to companies based in Scotland, with up to 250

employees and a turnover of less than £25m. What you borrow is what you repay (there are no interest or arrangement charges).

The loans are for measures that reduce energy consumption, which may include improved lighting and lighting controls, high efficiency heating, pipework, boiler and tank insulation, water controls, building insulation etc.

To qualify for a loan, you first need to have an energy report prepared by an approved energy consultant, obtain a quote for the intended work and to complete the Loan Action Scotland application form together with supporting information. The latter will include financial information about your organisation that demonstrates you normally trade at a profit.

Loan Action Scotland  
Strathclyde and Central EEAC  
FREEPOST SCO6861  
Glasgow G1 5BR  
Tel: 0800 092 9002  
[www.energy-efficiency.org](http://www.energy-efficiency.org)

### Low Carbon Building Programme

Phase one of the DTI's low carbon buildings programme will provide grants for microgeneration technologies to householders, community organisations, schools, the public and not for profit sector and private businesses. Managed by the Energy Saving Trust, phase one will award grants for technologies including solar electricity, wind turbines, heat pumps, solar hot water, hydro power, and biomass. From Autumn 2006 private, public and not for profit organisations across the UK will be able to bid from a total of £18m for medium and large scale microgeneration projects. For more information about the grant and how to apply please visit [www.lowcarbonbuildings.org.uk](http://www.lowcarbonbuildings.org.uk) or call your local Energy Saving Trust business adviser on 0845 458 5040.

### Enhanced Capital Allowance scheme

The Enhanced Capital Allowance (ECA) was introduced by the Government in 2001. Businesses that invest in energy efficient technologies that qualify for the ECA can claim 100% tax relief for their investment. The list of qualifying products appears on the

Energy Technology List at [www.eca.gov.uk](http://www.eca.gov.uk). This list is constantly updated and is worth checking regularly, even just as a useful reference guide to products and manufacturer contacts.

The ECA covers the cost of the product and directly related costs such as installation. Claiming the allowance is done through the normal income/corporation tax return calculations.

### Training

The Carbon Trust provides a wide range of training courses which are run nationally. Your local business adviser can pinpoint local demand for particular types of course and organise seminars/workshops accordingly. In this way the Energy Saving Trust business advice programme and the Scottish Golf Environment Group will be able to arrange a series of joint golf course energy workshops to provide a hands-on introduction to energy efficiency for golf club/course managers and as a supplement to these guidelines.

### Awards and incentives

Hopefully this publication has persuaded you of the many good reasons for golf clubs to become more energy aware and to adopt more energy efficient practices. The benefits from this alone should be welcome.

Energy management is, of course, only part of the wider sense of environmental responsibility. Golf courses interact with the natural environment in which they are set, leading to nature conservation, landscape and cultural heritage questions. Then there is the golf course management itself in terms of turfgrass culture, with the concomitant management of water, chemical fertilisers and pesticides and the handling of waste products arising. To achieve an effective, integrated environmental management of the golf course as a whole also requires a strong commitment to education (professional development of staff) and communication, both within the club and with the local community.

Such an holistic approach is being adopted by more and more golf clubs throughout Europe, and this is helping to place the golf sector in the forefront of the sustainability agenda. By demonstrating environmentally responsible management

behaviour, golf courses are showing positive, mutually beneficial solutions to environmental management situations. This is good for golf as a whole and the right thing to do.

To help golf clubs put together and implement an effective Environmental Management Programme, and to gain public recognition for doing so, an award scheme has been established under the Golf Environment Europe framework. This is golf specific. There are also other awards and systems that golf clubs can enter and these are described briefly below.

### **Golf Environment Europe (formerly Committed to Green)**

The Scottish Golf Environment Group is a national partnership initiative that participates in the pan-European Golf Environment Europe programme for golf courses. Through this scheme golf clubs are able to follow a series of structured steps leading up to the implementation of a fully integrated Environmental Management Programme.

The awards for Environmental Excellence attributed via the Scottish Golf Environment Group denote that the successful clubs have achieved high standards of environmental performance across the following categories:

- Environmental Management Planning
- Communications and public awareness
- Education and the working environment
- Nature conservation
- Landscape and cultural heritage
- Water resource management
- Turfgrass management
- Waste management
- Energy efficiency

Scottish golf clubs have been leading the way among European golf clubs in achieving Golf Environment Europe recognition.

Application of the guidelines contained in this publication will help participating clubs fulfil the Energy Efficiency criteria in the Golf Environment Europe programme.

The awards are determined and verified by the Steering Group of the Scottish Golf Environment Group, comprising golfing and environmental organisations and statutory agencies. There are no charges for participating in this scheme.

### **Green Tourism Business Scheme**

The Green Tourism Business Scheme was established by VisitScotland in 1998 and is an accredited VisitScotland Quality Assurance scheme. It is operated in Scotland by Green Business UK Ltd, a not-for-profit company on behalf of VisitScotland.

The scheme is open to all types of tourism businesses and operators. It offers a three-tiered system of awards; gold, silver and bronze, and operates via a membership programme, with subscriptions related to size of business. There is a requirement for all members to be members of their Area Tourist Board.

Key categories covered by this scheme are:

- Management
- Communication
- Energy
- Purchasing
- Waste minimising
- Water
- Transport
- Wildlife and landscape

Green Tourism Business Scheme  
Perth Business Centre  
28 Glasgow Road  
Perth PH2 0NX  
Tel: 01738 632162

**email: [gtbs@green-business.co.uk](mailto:gtbs@green-business.co.uk)  
web: [www.green-business.co.uk](http://www.green-business.co.uk)**

### **Environmental Management Systems**

Some larger golf facilities, primarily in continental Europe but also in Scotland, have achieved accreditation under the European Union's Eco-Management and Audit Scheme (EMAS) or the ISO 14001 Standard for Environmental Management. These are general Environmental Management Systems applied across sectors and operating internationally.

Properly applied, such Environmental Management Systems can be very effective tools for improving management efficiency and achieving cost-savings in an organisation, but they do require considerable work and some expense. They are not generally suitable for very small entities. Any golf clubs considering to seek EMAS or ISO accreditation should first discuss this with the Scottish Golf Environment Group.

# APPENDIX I

## GOLF COURSE ENERGY AUDIT APPLICATION FORM

This form has been designed for Golf Clubs wishing to apply for a free Energy Audit from the Scottish Energy Efficiency Office. The information here will also provide a review of energy use by golf clubs. By pooling related information from different clubs, it is hoped to define benchmarks for current golf course energy consumption, related to size, age, usage and types of facilities. In turn this will help inform recommendations for practical measures to improve energy efficiency and reduce costs.

**In all cases please specify the measuring units you are using.**

Please return the completed form to:

Scottish Golf Environment Group  
The Stables  
Dalkeith Country Park  
Midlothian EH22 2NA  
Tel: 0131 660 9480

**email: [info@sgeg.org.uk](mailto:info@sgeg.org.uk)**

**web: [www.sgeg.org.uk](http://www.sgeg.org.uk)**

N.B. Do not send this form directly to the EST. Given the limited capacity of the EST to arrange site visits, the applications will first be collated by the Scottish Golf Environment Group and sorted into regional batches.

**GOLF COURSE ENERGY AUDIT APPLICATION FORM**

| <b>I. GOLF COURSE FACT SHEET</b>   |                                 |            |                    |
|--|---------------------------------|------------|--------------------|
| Name of Golf Course  |                                 |            |                    |
| County   |                                 |            |                    |
| <b>Contact details</b>   |                                 |            |                    |
| Name   |                                 |            |                    |
| Address  |                                 |            |                    |
| Telephone:   | Fax:                            | E-mail:    |                    |
| <b>Basic golf course data</b>  |                                 |            |                    |
| Number of holes and date of opening  |                                 |            |                    |
| Total site area  |                                 |            |                    |
| Total turfgrass playing area   |                                 |            |                    |
| Do you have a powered irrigation system? (specify)   |                                 |            |                    |
| Is the golf course (and clubhouse etc) located in an exposed/windy or sheltered situation?               |                                 |            |                    |
| Number of members (playing/non-playing) (adult/junior), and/or number of rounds/year                     |                                 |            |                    |
| Total number of employees (fulltime/seasonal)  |                                 |            |                    |
| Other functions/activities held at club  |                                 |            |                    |
| <b>Golf club facilities</b>  | <b>Size (e.g. surface area)</b> | <b>Age</b> | <b>Description</b> |
| clubhouse (including changing/locker rooms, offices, bar/restaurant, kitchens, stores, meeting rooms...) |                                 |            |                    |
| Pro shop   |                                 |            |                    |
| Driving range (floodlit?)  |                                 |            |                    |
| Other buildings (specify – add lines if necessary)   |                                 |            |                    |

**GOLF COURSE ENERGY AUDIT APPLICATION FORM**

| <b>2. GOLF COURSE ENERGY CONSUMPTION DATA*</b>  |                              |                    |                 |
|---|------------------------------|--------------------|-----------------|
| <b>Type of energy</b>   | <b>Amount used per annum</b> | <b>Annual cost</b> | <b>Comments</b> |
| Electricity   | (kWh)                        |                    |                 |
| Gas   | (kWh)                        |                    |                 |
| Fuel oil  | (litres)                     |                    |                 |
| Solid fuel  | (kg)                         |                    |                 |
| Petrol  | (litres)                     |                    |                 |
| Diesel  | (litres)                     |                    |                 |
| Water and sewerage  | (m3)                         |                    |                 |
| Other (specify)   |                              |                    |                 |
| TOTAL COST  |                              |                    |                 |
| <b>Please use space below to describe any energy conservation initiatives your club has taken</b>   |                              |                    |                 |
| Is your club participating in any environmental accreditation programme (if so, please specify which scheme and what level have you reached)? |                              |                    |                 |
| Does your club have an Energy Policy (if so, when was this instigated and who is responsible)?  |                              |                    |                 |
| Please list specific energy efficiency measures you have undertaken in the last three years.  |                              |                    |                 |

\* Ideally the annual energy consumption data requested below should be averaged for a period of at least three years. If you are able to split energy consumption data into different activity centres on the golf course (e.g. clubhouse operation, golf course maintenance...) that would be most useful. Do you know the source of your electricity supply? Please include any such supplementary information in the comments column below.

# APPENDIX 2

## UNITS AND CONVERSION FACTORS

### Units

The standard SI unit used for energy is the Joule. This is quite small, so multiples are needed for everyday use.

|             |   |                  |
|-------------|---|------------------|
| 1000 Joules | = | 1 Kilojoule (kJ) |
| 1000 kJ     | = | 1 Megajoule (MJ) |
| 1000 MJ     | = | 1 Gigajoule (GJ) |
| 1000 GJ     | = | 1 Terajoule (TJ) |

The standard unit for power rating is the Watt.

|                |   |        |
|----------------|---|--------|
| 1 Joule/second | = | 1 Watt |
|----------------|---|--------|

As the Watt is also quite small, multiples are required for everyday use.

|         |   |                 |
|---------|---|-----------------|
| 1000 W  | = | 1 Kilowatt (kW) |
| 1000 kW | = | 1 Megawatt (MW) |
| 1000 MW | = | 1 Gigawatt (GW) |
| 1000 GW | = | 1 Terawatt (TW) |

If a load of 1 kW is run for one hour, then the energy used is 1 kWh. Likewise 1 kW run for 10 hours equals 10 kWh, as does 5 kW run for 2 hours.

### Conversion factors

Below are some basic conversion factors to help you. If your gas supplier quotes you in therms you can use these to convert to kWh. You can also convert from MJ to kWh. If you have old motors rate in horsepower, you can convert these to kW.

|               |   |             |   |           |
|---------------|---|-------------|---|-----------|
| 1 kWh         | = | 3.6 MJ      | = | 3412 Btu  |
| 1 therm       | = | 100,000 Btu | = | 29.31 kWh |
| 1 horse power | = | 745.7 Watts | = | 0.7457 kW |

# APPENDIX 3

## KEY CONTACTS

### **Energy Saving Trust business advice:**

**0845 458 5040**

**[www.energy-efficiency.org](http://www.energy-efficiency.org)**

### **Environment and Energy Helpline:**

**0800 585 794**

### **Golf Environment Europe**

Fenton Bams, North Berwick,

East Lothian, Scotland,

EH39 5BW

Tel: 01620 850 659

**[www.golfenvirontenteurope.org](http://www.golfenvirontenteurope.org)**

### **Scottish Golf Environment Group**

The Stables

Dalkeith Country Park

Midlothian EH22 2NA

Tel: 0131 660 9480

**email: [info@sgeg.org.uk](mailto:info@sgeg.org.uk)**

**web: [www.sgeg.org.uk](http://www.sgeg.org.uk)**

### **Energy Saving Trust**

112/2 Commercial Street

Edinburgh

EH6 6NF

Tel: 0131 555 7900

**[www.energysavingtrust.org.uk](http://www.energysavingtrust.org.uk)**

# NOTES

# NOTES

# NOTES

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