Energy Audit Report

Scarborough RUFC

The following document lists major energy issues found after a visit to the building and suggests green solutions which could be actuated to reduce energy consumption.

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Gemma Cave

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Survey Date: 17/07/13

nepes NEP ENERGY SERVICES

Supporting and Additional Services

All profit NEP makes from these additional services goes to support NEP, as a charity owned social enterprise, to save more carbon and combat fuel poverty.

Additional fundraising support:

Fundraising by 'Fund My Venture'

If you are looking to raise the money to pay for the measures in this report, you may consider financing or grant applications. NEP is working with social business 'Fund My Venture' to simplify this process. Fund R Venture take a small fee to write an application and a commission if an application is successful http://www.fundrventure.com; **NEP receive a small commission for referring organisations.**

Additional services through NEP:

Electricity Smart Metering

Where there is a working internet connection available, we can supply energy monitoring kit. **The kits most basic function allows remote detection of lights or equipment being left on** and costs less than £100. The kit is simple and safe to self-install, though NEP can do this for you, if it is ordered before a site visit. The kit can be used in identifying inefficient energy usage patterns and in monitoring impacts of energy saving measures. **As we buy this kit in bulk, we make a small profit on supplying and installing, though the kit will still cost you less than buying it in the shops!**

Energy Performance Certificate

An EPC gives a simple energy efficiency rating of a building and is required by law whenever a non-domestic property is built, sold or rented. NEP can produce and lodge an EPC for your site or any other non domestic site. **We charge about the same as commercial EPC suppliers; however we use our profit for good causes.** More information is available at:

Requirements for Energy Performance Certificates when marketing non-domestic properties for sale or let when-marketing-non-domestic-properties-for-sale-or-let

Renewable Energy Feasibility Study

An in-depth study of the potential for the generation of renewable energy from your site, identifying site specific issues associated with generating capacity, installation and operation of a range of renewable technologies. **Our fees for feasibility studies are not high and most initial assessments take no more than 1 or 2 days**

Access Audits

Through our partner organisation, a social enterprise called Nimbus, NEP is able to offer Access Audits, providing Certification of Accessibility for disabled people. Access Auditing is the process of making sure your building is accessible and that it meets the legal requirements laid out in The Equality Act. Where buildings do meet the requirements Nimbus is able to issue a Quality Mark called CredAbility. More information is available online at www.ask-nimbus.com. **We receive a small referral fee from Nimbus, if you purchase their services.**

If you are interested in any of the above services then please contact NEP for more information.

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Disclaimer

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Executive Summary

Over a 12 month period, Scarborough RUFC has used 204,000 kWh of electricity costing £27,540 and 361,500 kWh of gas costing £13,376. This equates to annual carbon emissions of 165 tonnes.

The RFU has proposed a carbon reduction target of 15% by 2015 using the above baseline figures. For your club this equates to an annual cost saving of £6,137 and carbon reduction of 24.77 tonnes per year.

NEP have identified projects which have the potential to achieve annual cost savings of £1,606 and reduce your carbon emissions by 3.5 tonnes per year. In addition we have identified several "quick win" measures which can be implemented immediately and have the potential to achieve further savings. These projects and "quick wins" are summarised in the tables below.

Projects

Table 1 contains larger more technical projects which have a higher cost but would also achieve significant energy and carbon savings. The table shows the likely capital cost of each project alongside the estimate energy savings. The column on the right hand side of the table shows the percentage of the target carbon reduction which is achieved by each project.

As you can see, there are not many technical projects as the building is only 4 years old, and therefore much of its building envelope and many of the internal services are very new and already efficient.

Table 1: Proposed Projects

Proposed Projects	Capital Cost (£)	Annual Savings[1]			Payback (years)	% of CO_2 target	Page Number
		£	$kgCO_2$	kWh			
Install 15 Dual Flush	£900	£574	0	0	1.6	0%	21
Complete Lighting Retrofit[2]	£2,737	£727	2,603	5,383	3.8	11%	17

Easy Actions & Quick Wins

Due to the nature of the options included in this table it is difficult to estimate their impact with exact certainty as this will depend upon a variety of factors including building usage and occupancy. However these are all commonly used actions with a wide evidence base of successful applications. The below table contains best practice estimates of the cost and carbon savings achievable from installing the proposed measures.

[1] Savings are not necessarily cumulative as some measures will reduce the impact of others.
[2] This assumes that the lighting is on for 50% of the clubs opening hours. See table 4 for details.

Table 2: Proposed Easy Actions and Quick Wins

No.	Action	Cost (£)	Saving (£ per year)	Information	Page No.
1	Clean Vents	0	Unknown	This will reduce the energy use of the fans and ensure that they operate more efficiently.	13
2	Clean Windows	0	Unknown	This may help to reduce the need for artificial lighting.	15
3	Ensure heating temperature is set according the season	0	Unknown	Using seasonally appropriate temperature set points minimises the temperature difference while maintaining comfort. Set to 20°C to optimise comfort and energy costs. Each degree over 20°C yields a 1% increase in heating energy cost.	11
4	Move refrigeration equipment away from heat sources	0	Unknown	This will ensure that the fridge and cooling equipment is not working harder than necessary and will reduce the running hours of the fridges' compressor.	20
5	Install Save – a – flush bag	0	£64	Savings are calculated at 1 litre per flush. These are available in limited numbers free from your water supplier or for a small cost form any DIY store.	21
6	Begin an awareness campaign	0	5-10%	See Appendix 8 for details of developing an appropriate energy awareness campaign.	22
7	Use timer plugs on free standing appliances	£5 each	10% appliances electricity consumption	Installing simple timer plugs to free standing appliances to ensure that they only operate when the club is open can save 10% of the appliances existing electricity use.	20
8	Install InnEnergy (optimise chiller operation)	60	£240	A case study carried out by the RFU highlighting the effectiveness of this equipment can be seen here.	13
9	Insulate cold and hot water pipes	£0.5/m	It depends on the size of the installation	Details of the effectiveness of this measure can be seen in Appendix 2.	11
10	Seal and Insulate doors	Dependent upon the size / age of the property	It depends on the number of measures	Savings from this measure are dependent upon the opening hours and usage of your property. While cost savings may be small the primary benefit will be to improve the thermal comfort of building occupants. More information is available here.	15

Combining Measures

While installing any of the measures listed above will result in energy savings for your property, it is possible to combine the installation of certain measures to ensure that efficiency savings are made as cost effectively as possible. For example; if considering a boiler replacement, it would first be prudent to ensure your property is suitably insulated and draft proofed followed by keeping accurate control of the internal temperature by installing TRVs to existing radiators and setting thermostats appropriately. Other measures which compliment each other well include installing motion and daylight sensors when upgrading to more efficient lighting.

It would be a good idea to install smart metering before any projects designed to directly reduce energy usage, such as those mentioned above. This will allow you to observe and validate the savings which are achieved through your actions.

Funding

There are different funding sources available, please see **Appendix 1** for more information.

1. Introduction

1.1. Using This Report

This Report is split into sections; Section 1, introduces the purpose behind an energy survey and describes the relevant details of your site. Sections 2 and 3 contain details of the buildings energy performance, a proposed savings target and advice on how to achieve the target, to put the recommendations of this report into context. Section 4 discusses in more detail the specific issues found at your site and the actions which can be taken to remedy them.

The technical appendices referred to throughout this report are contained within a separate document available online from the above link. These appendices give further information on how to achieve energy efficient results. The report will refer to an appropriate appendix when more information is required for you to take action. These are standard appendices and may contain some information that is not relevant to your property, but may be of interest to you.

It is recommended that once you have used this report to identify priorities for work that you obtain 3 quotes from suppliers and further estimations of savings based on their particular products and solutions.

1.2. What is an Energy Audit?

An energy audit is an evaluation of energy consumption from a home or business, to determine ways in which energy can be conserved. It is a process to reduce the amount of energy input into the system without negatively affecting the output.

The purpose of an energy audit is to help understand particular ways energy and fuel are used and identify areas where waste can occur and where a scope for improvement exists. This energy audit report provides an initial understanding of the way energy is used, and identifies opportunities for energy reduction through both behaviour change and investments in the right energy efficiency technologies. These suggestions aim to improve energy efficiency, reduce costs and cut CO_2 emissions.

NEP has identified scalable solutions that align with your needs, we have focussed on cost effective measures that bring immediate savings and reduce pay-back time.

1.3. Who are NEP?

NEP are an independent body driving forward the climate agenda. We work across all sectors to build partnerships and deliver programmes. With partner agencies we work to alleviate fuel poverty, cut carbon emission and educate the public about energy efficiency, ensuring that those most in need achieve affordable warmth and a better quality of life. We have 10 years experience of the challenges in turning national targets into local action. Initiating and delivering projects that achieve real results. Over the last 5 years, we have saved:

12,688 tCO_2e + £3m in 13,000 homes

4,318 tCO_2e + £2.6m in organisations

1.4. Site Description

Scarborough RUFC is situated in Scalby, just over 2.5 miles North West of Scarborough in a predominantly rural area. The building has a floor area of 2,957m^2 and was constructed in 2009. The two storey building is of filled cavity wall construction, and is heated by a natural gas fired combined underfloor and radiator system. There is a mechanical ventilation system which is mostly used to provide cooling throughout the summer months.

The site's usual opening hours are:

- Monday-Friday: 06:00 – 23:00
- Saturday and Sunday: 08:00 - 01:00

The property already has a 30kW solar photovoltaic system installed, which is about five months old.

2. Current Energy Performance

The table below shows actual annual energy usage, cost and carbon emissions taken from data supplied to NEP by the club for a 12 month period. These data have been used to calculate the carbon footprint of your site in relation to its energy usage. Using these figures in Section 3 we have been able to model the impact of setting a carbon reduction target of 15% for your site and what this would mean in terms of your annual spend on utility bills. These figures have also been used to calculate the projected energy savings from the projects proposed in Section 4.

Table 3: Current Energy Use and Carbon Emissions

Utility Type	Consumption (kWh)	CO_2e Emissions (tonnes)	Cost (£)	p/kWh
Electricity	204,000	98.6	27,540	13.5
Gas	361,500	66.5	13,375	3.7

2.1. Benchmark Energy Performance

Figure 1 below shows the energy usage per m^2 floor area for your club in comparison to the average for RFU clubs which we have visited across the Yorkshire region. It is possible to see from the graph that even though your club has longer opening hours than many we have visited you still use significantly less energy than the average Yorkshire club. This demonstrates how efficient your building already is and should be used as a benchmark against which further energy reductions can be measured.

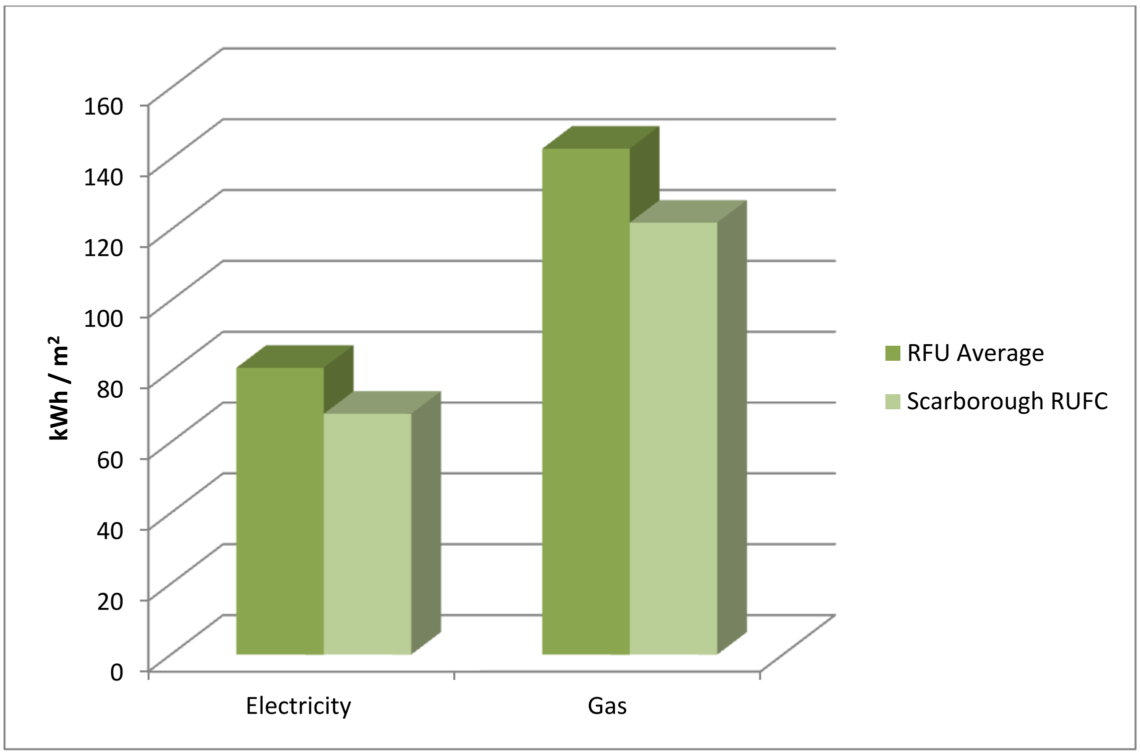

Figure 1: Comparison of Energy Performance against RFU Average

3. Cost and Carbon Reduction Target

The RFU has proposed a carbon reduction target of 15% by 2015 for all of its member clubs. Using the data provided in section 2 as a baseline NEP estimated the impact of this target on your club.

A carbon reduction target of 15% will require reducing your carbon emissions by 24.77 tonnes from current levels. This would achieve annual cost savings of £6,137.

Figure 2 shows the current carbon footprint associated with your gas and electricity use over 1 year, alongside the carbon footprint following the actions we recommend in this report, and your target reductions.

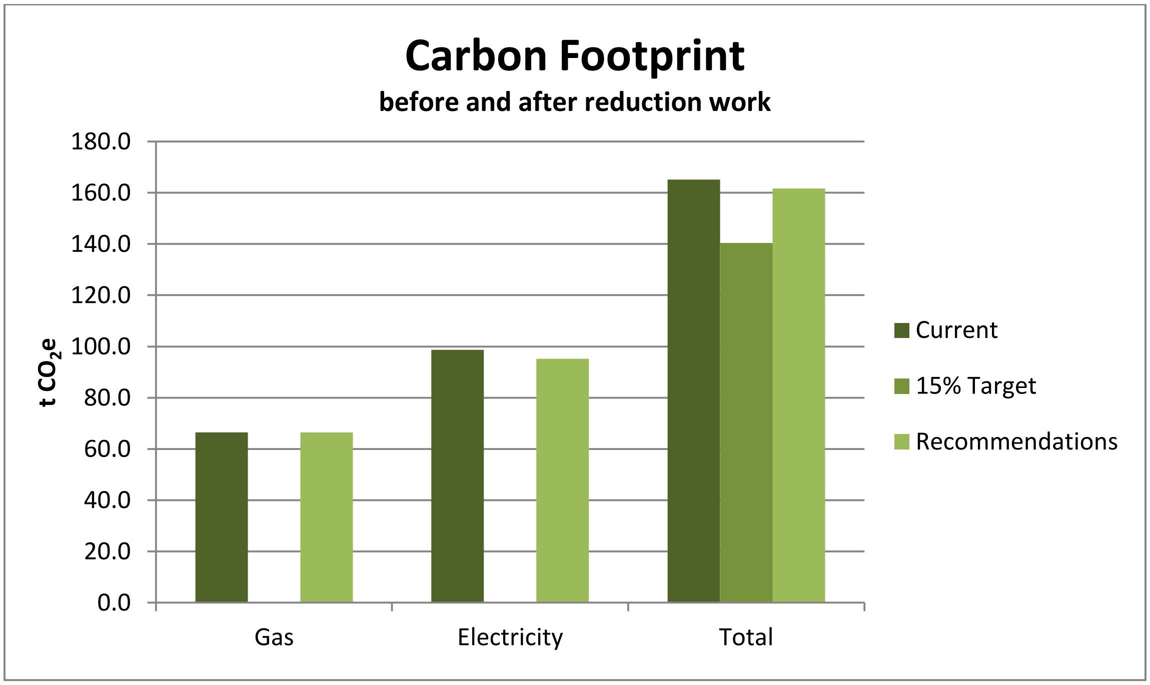

Figure 2: Graph showing target and potential savings

Setting an appropriate carbon reduction target can be an important first step in monitoring, managing and ultimately reducing your sites energy usage and carbon emissions. Setting a challenging yet achievable target can help to focus your efforts towards becoming a more energy efficient site; it can help in identifying the most effective projects and can be used in conjunction with a behaviour change campaign to encourage more sustainable behaviour amongst members and visitors.

Due to the already very efficient building envelope and services we have not been able to identify sufficient projects to reach the 15% target. This is largely due to your club already being below the RFU average (as demonstrated above), however we have been able to identify energy efficiency measures which will save you £1,600 and 3.5 tonnes of carbon per year. These savings can be further supplemented by enacting some of the "quick win" measures identified in table 2 above.

4. Recommendations

The following sections list recommendations selected by the energy assessor for improving the energy performance of the building following the onsite survey. Specific recommendations are highlighted at the end of each section.

4.1. Heating & Hot Water

4.1.1. Boiler System

There are two ACV HeatMaster 201 high performance combined boiler and water heaters installed on site (Figure 3). These are efficient boilers, which are part of a modern, well planned system where each part is linked and a system of sensors is used to optimise efficiency. These boilers provide all the hot water and heating for the site. Underfloor heating is used throughout the ground floor of the building (excluding the gym); the first floor and the gym are heated via air conditioning units.

The boilers have timers which should be set according to the opening hours of the site. To optimise this, the boilers should turn on for just a short time before opening, and can turn off again a short time before closing.

The pipes in the boiler room are very well insulated. This is shown in Figure 4. It is very important that these are insulated, as they are in an unheated room, so much of the heat would be lost if they were left bare. It is also important to treat pipes in serviced areas with the same care.

Figure 3: Boilers

Figure 4: Pipe work

It is important to ensure that the pipes that feed hot and cold water are well insulated. A hot pipe in a cooled room will make the air conditioning system work harder. Similarly, heat will be lost as hot water travels down any length of bare pipe, meaning the hot water system will have to work harder to deliver the appropriate temperature where it is needed. Pipe insulation would reduce the working time without reducing the temperature of water from the taps.

The main thermostat can only adjust the heat that comes out of the boiler, not the heat that comes out of the pipes that feed hot taps in kitchens (Figure 5) and bathrooms.

Figure 5: Exposed pipe work in kitchen, leading to hot tap

4.1.3. Thermostats and Timers

Figure 6 shows one of the thermostats on site. The central heating is controlled using thermostats on the ground floor, which are located in almost every room, and thermostats and timers linked with the air conditioning units on the first floor and the gym. The temperature set point for heating the building should be no higher than 21˚C. Setting the temperature higher than this will not make the building heat up faster, and it will waste energy. As a rule of thumb, each degree over 20°C yields a 1% increase in heating energy cost.

Figure 6: Thermostat

Using seasonally appropriate temperature set points minimizes the temperature difference while maintaining comfort.

The location of thermostats is very important. Ensure that they are far from any source of heat or cooling, such as computers, or windows.

A hot water system should be kept at between 60˚C and 65˚C.

Please see more information in Appendix 2.

RECOMMENDATIONS FOR HEATING AND HOTWATER:

INSULATE HOT WATER PIPES

4.2. Cooling and Ventilation

4.2.1. Air Conditioning Units

There are some air conditioning units in use on site. These are shown in Figure 7. Air conditioning units can be used for heating or cooling. If it is possible to ventilate and cool a room naturally, this should be looked into as an alternative.

Figure 7: Air conditioning system

It is vital that air conditioning units are not used in conflict with other systems. This includes open windows and other air conditioning units. If two units are in use at once, ensure that they are both set to the same temperature. Never have windows or doors left open if the building is being mechanically heated, cooled or ventilated.

Buildings should be heated to 21˚C in winter, and cooled to 24˚C in summer. The programmer in Figure 6 shows that the building was being cooled to 19˚C at the time of the survey (mid July). Where possible, the controls should be set and operated only by the building management team. This can be built into an effective behaviour change campaign.

This system is considerably less efficient than the main gas heating system. Extending the heating system to include rooms which are currently heated via mechanical ventilation will significantly improve the efficiency of the whole system.

4.2.2. Cellar Cooling System

The beer cellar has a chiller of around 2.5 kW, shown in Figure 8. The cellar should be kept at a temperature of around 13˚C, any colder than this is unnecessary. In order to ensure efficient operation of the chiller, it is important to ensure that the cellar is appropriately insulated from external heat sources. This includes sealing drafts through doors and walls.

Figure 8: Chiller

We recommend researching the possibility of changing the cooling system with a heat exchanger for drinks dispensing. *Brewfitt* has developed a small heat exchanger system for drinks dispensing. It is called CoolTube.

We recommend turning it off when is not needed. Also we recommend installing a simple "plug and play" device called InnEnergy. This can be used as a timer to turn the in line beer coolers on and off automatically according the opening times. Previous studies by the RFU have estimated savings on chiller electricity consumption in the region 40%.

For more information about these systems see [Appendix 3](#).

4.2.3. Ventilation System

The building is primarily naturally ventilated, apart from areas with specific requirements, such as bathrooms and kitchens. Figure 9 shows a vent which is dusty, meaning that the system will need to work harder to extract air past the dirt on the vent. It is important to keep vents and extractors clean and well maintained, to allow them to operate at optimum efficiency.

Figure 9: Vent

When ventilating a heated building, it is important to attempt to let fresh air in without letting too much heat out. To do this, open the windows that are furthest from the radiators. This will create a draught of fresh air, so the window does not need to be open too far, and the heated air that escapes will be the stuffy air that has already circulated through the building.

Appendix 4 contains more information on ventilation strategies for your property.

RECOMMENDATIONS FOR COOLING AND VENTILATION:

INSTALL INNENERGY DEVICE IN BEER CELLAR
CLEAN VENTS

4.3 Building Envelope

4.3.1. Walls

The building is quite new, and due to modern building standards is more likely to have an efficient building envelope. The walls have insulated cavities, which are suitably efficient at minimising heat loss. The wall construction is shown in Figure 10. It is clear that the walls are constructed with a cavity from the pattern of the bricks.

The building has ventilated facades on the first floor as Figure 11 shows. The ventilated air space between the two leaves serves to maintain a comfortable indoor climate. A ventilated cavity between the facade cladding and the insulation layer prevents rainwater from penetrating and diffuses water vapour from the inside to the outside. Also, ventilated facades offer a number of advantages, such as a comfortable interior climate (in winter and summer), easy to adapt to current and future energy standards, optimal moisture regulation, etc.

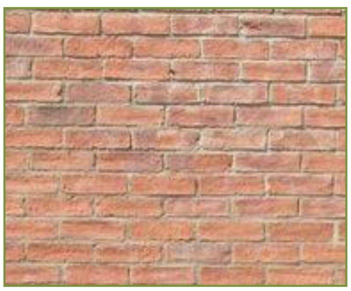

Figure 10: Wall construction

Figure 11: Ventilated facades

4.3.2. Roof Construction

The roof construction is shown in Figure 12. The roof is metal clad in most of the building, but in the left wing (offices) the roof is timber frame construction. The loft space is insulated in line with the latest recommendations (270mm). This should significantly improve the thermal comfort of the building and reduce energy bills.

Figure 12: Roof construction and insulation

4.3.3. Glazing

All windows are double glazed, clean and well maintained. This will maximise the thermal comfort of building users. An example of the glazing on site is shown in Figure 13. Another option to conserve energy while also providing a more comfortable environment would be to install Solar Control Films on the glazing. Solar control films are explained in full detail in **Appendix 5**.

Figure 13: Glazing

4.3.4. Energy Efficient Doors

Figure 14 shows an example of the type of external doors on site. Whilst the doors are modern, not all of them are well insulated and sealed, which leads to a less efficient building. The doors pictured have significant gaps, letting in draughts. These could be improved by some draught proofing, such as door brushes, which are available at very little cost from DIY stores.

The main entrance has a draught lobby. If both sets of doors are kept closed, this will stop cold draughts entering the building with the members and other building users. A lobby like this is a great advantage in keeping buildings at the right temperature. If the outer doors are often left open, it is very important that the inner doors are properly sealed.

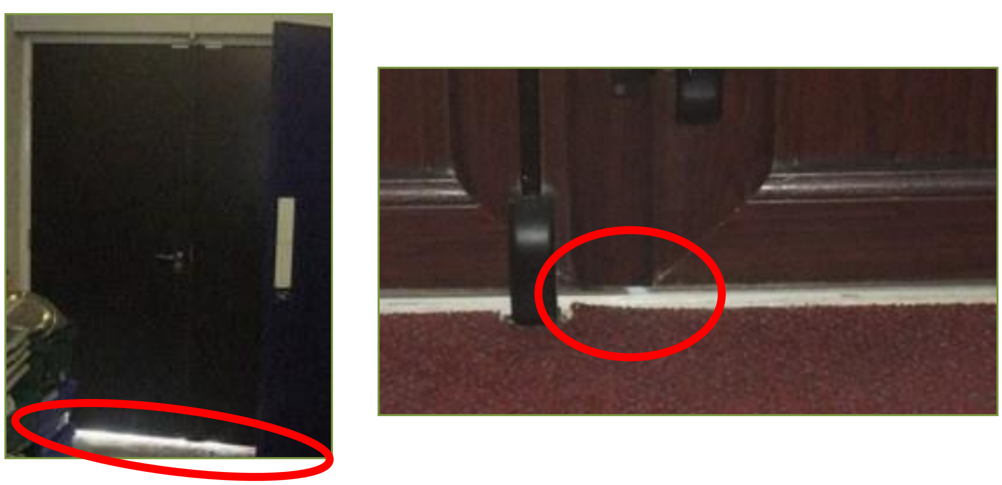

Figure 14: External doors

RECOMMENDATIONS FOR BUILDING ENVELOPE:

CONSIDER INSTALLING SOLAR CONTROL FILMS ON GLAZING TO REDUCE HEAT GAIN
SEAL AND INSULATE GAPS AND DRAUGHTS AROUND DOORS

4.4 Lighting & Floodlighting

4.4.1. Internal Lighting

There is a variety of lighting on site. Most lighting is already suitably efficient. Figure 15 shows lighting that is already efficient (2D CFL and LED technology)

Figure 15: Efficient lighting

There are also around 75 T8 strip lights; there are more efficient options available, including T5 and LED strips. We recommend upgrading the T8 strips when the bulbs reach the end of their life. The existing CFL and T5 strip lights are already quite energy efficient and do not need to be upgraded at this stage.

Replacing T8 fluorescent lamps with LEDs not only reduces the energy consumption from lighting, but also extends the lifetime of each lamp. Although it is cheaper to replace the T8 fluorescent tubes with T5 tubes, the savings on electricity will be less than if the T8s were to be replaced with LEDs. In the long term, the more expensive LED replacements will provide a greater financial saving.

In **Appendix 7**, there is a study highlighting the benefits of changing T8 and halogen lighting to the latest LEDs.

Table 4 (below) shows the savings which could be achievable by replacing the existing lighting at your club with retrofit LED alternatives. It should be noted that the purchase costs and savings achievable will vary dependent upon the make and model which you ultimately decide upon. The figures given below are for replacement of your existing lamps only i.e. the light fitting remains the same and only the “bulb” or “tube” is replaced with an LED alternative. These types or replacement can be relatively straightforward to self install and can achieve many of the benefits of LED lighting while minimising the installation cost. However if your luminaires (light fittings) are in need of replacement the cost of the upgrade to LEDs will increase. In this situation it would be beneficial to install LEDs only to those areas which have a high level of usage and thus maximise the savings which can be made.

Table 4: Upgrading Current Lighting to LED Alternatives

Proposed Projects	Capital Cost (£)	Annual Savings			Payback (years)	% of CO_2 target
		£	$kgCO_2$	kWh		
T8 58W to LED 22W	1,991	587	2,183	4,514	3.4	9%
T8 18W to LED 10W	745	92	341	705	8.1	1%

*Assuming the lighting is on 50% of the time the club is open.

4.4.2. Lighting control systems

The building has PIR in all the corridors, toilets and changing rooms (Figure 16). This makes the building very efficient and saves around 20% of the total electricity used by the lighting system, which would be wasted otherwise.

Figure 16: PIR lighting sensor

In a building such as this one, where there is constant movement of people, lighting control systems are extremely useful in reducing energy wastage. Motion sensors can reduce bills substantially as they ensure that all lights are switched off when the building is vacant, and that empty rooms and hallways are not consuming energy. At Scarborough RUFC, Passive Infra Red (PIR) sensors are present in corridors, bathroom areas and other rooms to ensure that lights are only on when the room is occupied.

For more information about this type of technology please see **Appendix 7**.

4.4.3. Floodlights

The floodlights were installed when the building was built, in 2009, so are relatively modern. There are 14 columns, each with 2 lamps (Figure 17), which are used from September to May (approximately 400 hours per year).

Figure 17: Floodlights

The first step in reducing the energy usage from floodlighting is to ensure that floodlighting is only switched on for the periods it is required. This may be achieved manually and reinforced with the development of a behaviour change campaign or through the use of automatic timers.

Table 5 shows the recommended LED replacement and the savings that are possible. Clearly it is not ideal to replace lighting which is still relatively new, so it is recommended that you look to upgrade to LEDs as the existing lights begin to fail. Lighting design for sports use is a specialist field and the RFU has a number of recommended contractors who would be able to provide accurate lighting designs and quotations[3].

Table 5: Comparison of current floodlighting with suitable LED alternatives.

Floodlight Type	Number Lamps	Use per year (Hours)	kW of Lamps	kWh Floodlight PA	Floodlight Cost PA (£)	Floodlight Carbon PA (Tonnes)
Metal Halide	28	400	2	22,400	3,024	10.8
LED Floodlights	28	400	1	11,200	1,512	5.4

LIGHTING RECOMMENDATIONS:

COMPLETE THE LIGHTING RETROFIT WHEN THE BULBS REACH THE END OF THEIR LIFE

4.5 Smart Meters

A smart meter is installed on site. Installing a smart meter is an easy way to consume less electricity. Understanding when and where energy is used is vital for reducing your overall energy consumption. Correct use of smart meter readings should in fact, support behavioural changes. Example: if smart meter readings show high electricity consumption when the building is vacated, this will mean that lights and appliances are not being switched off. Consequently behavioural changes can be encouraged to avoid this happening. Typically you would expect to save 3%[4] a year on your electricity bill from correct use of smart metering, when combined with an appropriate behaviour change campaign.

For more information about smart meters please see **Appendix 7**.

CHECK THE ELECTRICITY CONSUMPTION ONLINE AND TRY TO UNDERSTAND AND CHANGE SIMPLE THINGS TO REDUCE ENERGY USAGE

[3] http://www.rfu.com/managingrugby/clubdevelopment/facilitiesandequipment/suppliers
[4] http://www.ofgem.gov.uk/sustainability/edrp/Documents1/Energy%20Demand%20Research%20Project%20Final%20Analysis.pdf

4.6 Kitchen & Appliances

4.6.1. Kitchen

The kitchen is medium size and functional. The appliances are used once or twice a week to serve the bar. It contains refrigeration, hob, fryers, ovens and three sinks. The cooker is gas (Figure 18), which is more efficient than most alternatives, if used well. Gas rings can be lit quickly so they should never be left on. The layout of the kitchen is good, with the refrigeration far from the cooker and hot fryers.

There is an extractor, which is fitted with a variable control, which allows users to reduce the amount of extraction at times of lighter usage.

Figure 18: Kitchen

These issues are discussed in more detail in **Appendix 9**.

4.6.2. Refrigeration

There are a number of fridges and freezers on site. It is important that these are kept at the correct temperatures, in order to conserve energy. It is also important that they are kept in appropriate locations, so they do not interfere with any temperature controls in the room. In a kitchen such as this one, fridges should be kept at 4 or 5 degrees, and freezers should be no colder than -18˚C.

Figure 19 shows a fridge on site which is empty, but still turned on. This freezer could be turned off when not needed in order to conserve energy.

Figure 19: Empty freezer

4.6.3. Appliances

The following appliances were identified on your site:

- Microwave
- Televisions
- Computers

Figure 20: Appliances left on or in standby mode at the time of survey

Several of these appliances are left on, or on standby, when not in use (shown in Figure 20); this represents an unnecessary waste of energy. All of these appliances would benefit from the installation of a simple timer plug which would switch them off at designated times. Seven day timer plugs can also be purchased for clubs which have more irregular opening times. Alternatively, users could be encouraged to turn off appliances themselves when not in use, as part of a behaviour change campaign.

KITCHEN AND APPLIANCES RECOMMENDATIONS:

ENSURE THAT APPLIANCES ARE TURNED OFF WHEN NOT IN USE
USE TIMER PLUGS ON FREE STANDING APPLIANCES

4.7 Water Saving

Figure 21 shows some examples of the water usage equipment on site. Although the building is relatively new, some of the water dispensing fixtures and fittings are out of date. Single flush toilets use far more water than is necessary. Water companies offer free bags which can be placed safely in the cistern which reduce the amount of water used (by one litre per flush). Alternatively, the toilets can be upgraded to dual flush systems, which will have an associated cost, but will save more water. The details of this are given in Table 1.

Showers and taps are fairly modern, push-operated versions which are efficient and do not need upgrading.

Figure 21: Water usage equipment

Please refer to **Appendix 6** which contains information on water management and water efficiency, tips for saving water and further information about embedded water and the links between energy and water usage.

RECOMMENDATIONS FOR WATER SAVING:

INSTALL SAVE-A-FLUSH BAGS
CONSIDER DUAL FLUSH

4.8 Behavioural Change

Many studies have found that individual behaviour changes can produce highly significant energy reductions, ranging from 5% to 50%. These savings can be achieved by developing a suitable behaviour change campaign and supporting this with greater use of the smart metering data which is available to you through the npower encompass online energy monitoring system.

In section 3 we have modelled the impact for your club of the RFU's proposed 15% carbon reduction target. This information can be used to begin a behaviour change campaign and can be supplemented by smart metering information to report progress towards the target on a monthly basis. Research has shown that behaviour change actions are significantly more effective if progress can be measured and regular feedback given to building occupants.

One option to further engage the buildings users in energy efficiency projects and encourage a lasting behaviour change in the way occupants view energy usage at the club is to install an energy display screen within a public area. This could be linked to the existing or a future renewable energy installation and can demonstrate, using a variety of different graphics, information ranging from the actual energy produced by the PV array or wind turbine to progress towards a carbon reduction target and total annual energy use. Studies have shown that actions to encourage behaviour change in building occupants are significantly more effective when provided with real time information updates.

Please refer to **Appendix 8** for more information on developing an effective behaviour change campaign.

BEGIN AN AWARENESS CAMPAIGN

4.9 Renewable Technologies

The below information is a high level assessment of potential for renewable energy on your site and aims to provide an indication of the types of costs and savings achievable. Additional information on renewable energy technologies can be found in **Appendix 10** and in the renewables section of our **website**.

As the building already has a 30kW solar photovoltaic system installed on a south facing roof, an assessment for a photovoltaic system will not be needed. The club has more South facing roof space that could be used to install a solar thermal system to heat hot water, which could be of particular use for the showers. However, the changing rooms are some distance from the suitable roof space; therefore the installation is unlikely to be suitable. Nonetheless the club does have a significant amount of open land which may be suitable for a small scale wind turbine.

NEP are able to undertake a complete renewable energy feasibility study of your site on request, please get in touch to find out more.

4.9.1. Photovoltaic system

Figure 22: Existing solar PV system

The club already has a 30kW solar photovoltaic system installed on a south facing roof (see Figure 21). The installation is around five months old.

4.9.2. Solar Thermal System

Solar water heating is another free and abundant resource. As stated above, the club has a good sized south-facing roof on one side of the sports hall (see Figure 22), which could be suitable for a solar thermal installation. The hot water produced would be used in the changing rooms. However, as the panels would need to be situated a significant distance from this part of the building, the installation (including pipe work etc.) would be expensive and not very efficient. For this reason, a solar thermal system is not recommended for the site.

Figure 23: Suggested location for solar thermal system

4.9.3. Wind Turbine

The site has an estimated average annual wind speed of 5.2 m/s at a 10m height which is considered a good wind resource. There should be sufficient unobstructed space for a wind turbine within the clubs boundaries. If a turbine were installed it would have the potential to reduce your electricity bills by generating zero carbon electricity on site and can provide an additional source of income through the government's Feed in Tariff scheme. Please see below the proposed small wind turbine installation in Table 6.

Due to the high cost of the turbine and the complexity of installation and obtaining planning permission the details below have not been included in the carbon reductions and cost savings estimated for your site in section 3 (above) and in the executive summary. The below details are for reference and should give you an idea of what may be achievable on your site. Scoping for a wind turbine is an in-depth and complex process and beyond the scope of this report, therefore it is recommended that you seek further technical advice before considering this option further.

Table 6: Proposed Small Wind Turbine Installation

System	Total Cost	Total Financial Savings	Total CO_2 Savings (kg)	Total kWh Savings	Payback (years)
Wind Turbine 5.3kWp	£22,050	£3,629	5,445	9,167	7.9

* Assuming wind speed of 5 m/s. Assuming that the club consumes 50% of the generated energy.