sportscotland
Carbon Management Programme 2016

Carbon Management Plan (CMP)

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Owner: Craig Worsley

Project Sponsor: Alison Gardiner

Executive Sponsor: Stuart Ogg

Contents

Introduction

sportscotland is the national body tasked with sports training and development and in encouraging sporting activity for all. It plays a key role in promoting Scotland on the international sporting stage and in 2014, was central to the country's successful participation in the Glasgow Commonwealth Games. It has three directorates: sports development, high performance and corporate services. In order to provide the best example and service, **sport**scotland is committed to reducing its carbon emissions.

As a non-departmental public body (NDPB) **sport**scotland is required to meet the Scottish Government's commitments within the Climate Change Scotland Act 2009 in addition to the requirements of its own Environmental Policy Statement (see Section 2.1 below). To this end, like other public agencies, **sport**scotland is fully committed to sustainably reducing greenhouse gas emissions associated with business operations and produce a Carbon Management Plan every five years.

Generally, Greenhouse Gas emissions are measured in tonnes of "Carbon Dioxide equivalent". The sources of these emissions within scope of the Plan are: energy from non-renewable resources in buildings (electricity, gas, LPG and oil), fuel for transport and the emissions generated from waste, primarily from landfill.

International travel is inevitably linked with **sport**scotland's mission to promote Scottish success in the sporting arena. Athletes and their support staff have no option but to travel around the world to compete and they have no control over the location of competitions. The previous Carbon Management Plan recognised this and included only local travel for non-sporting reasons, where there would be possibilities to reduce the impact either by different forms of travel, or not travelling at all.

With the updated Plan presented here, even though for the baseline year (2015) air travel represents only 20% of the carbon emissions, this sector will not be included in this report. It is too variable as it depends on where the sports events are held year by year which is something that **sport**scotland cannot control.

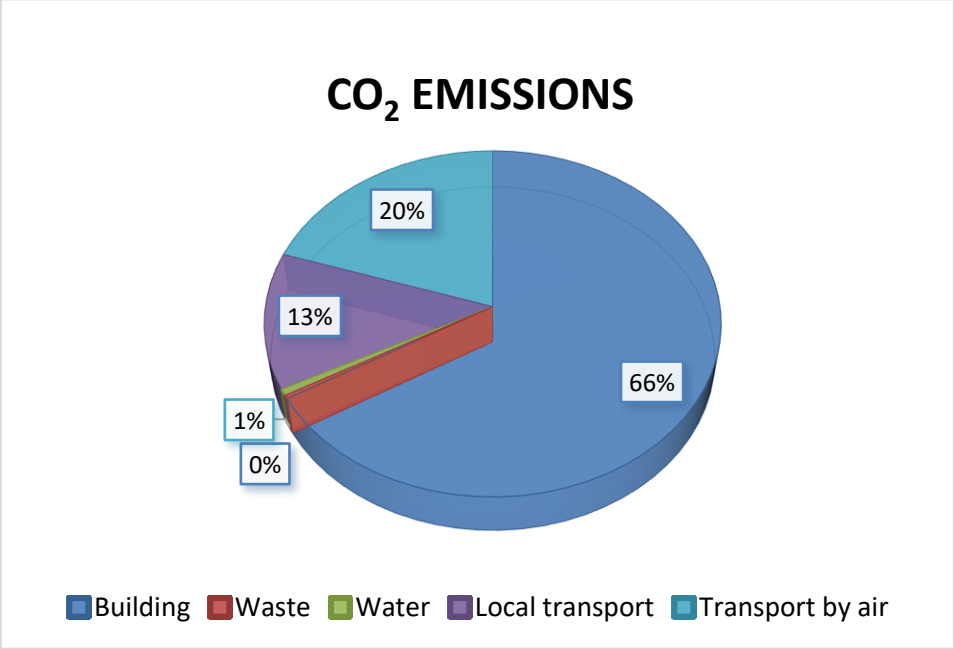

Table 1: Carbon emissions per sector

	Tot. Consumption	CO_2 factor	CO_2 (t)
Building	N/A	N/A	868.5
Water	7,494 m^3	(0.708+0.344)	7.9
Waste	126,314 kg	31.5	4
Local transport	952,643 km	N/A	166
Transport by air (from sportscotland spreadsheet)	936,653 km	N/A	260
Total			*1,306*

Considering that in 2011 the total emissions of carbon dioxide were 1,883t following the previous Carbon Management plan, not only has **sport**scotland met its objective of reducing emission by 20% in 5 years but has overtaken it by reducing carbon emissions by 31%.

This Plan supersedes the previous one which covered 2010 to 2015. In that period, amongst others, two significant, positive developments have taken place to improve **sport**scotland's carbon footprint:

1) The original Inverclyde building has been demolished and a new purpose-built centre is close to completion. This will make a major contribution to reducing carbon emissions.
2) A 200kW biomass boiler has been installed in Glenmore Lodge. This has displaced a large proportion of electrical demand and most of the previous LPG consumption.

sportscotland operates from six different sites with different activities in each one. Within them, **sport**scotland, a Trust Company operates three national training centres: Glenmore Lodge, Inverclyde and Cumbrae. This enables access to a wide range of sports. The other sites are administrative centres covering training, event organising, international competition and athlete development. The centres are as follows:

- *Inverclyde*: This site is at the moment under construction. Once the centre is complete, it will be able to host 120 para-athletes, and it will be the only one in the UK with that capacity. It will have different studios for different sports and it will include a rugby, football and a hockey pitch, two tennis courts, a café and a gymnastics hall.

- *Cumbrae*: This site is the water sports centre, situated on the isle of Cumbrae. Activities include dinghy and yacht sailing, wind surfing, kayaking and open water canoes. There is a central building with a kitchen, gym and four chalets for visitor accommodation. All are electrically-heated.

Figure 1: The Watersports Centre of Cumbrae

- *Stirling*: This site comprises an original building which has been extended with a new adjoining building. Its main purpose is administration of athlete development, concentrating in particular on high performance athletes. It is located in the grounds of Stirling University.

- *Glenmore Lodge*: Situated in the Cairngorms near Aviemore, this is the base for mountain sports, covering skiing, climbing, winter mountaineering and outdoor survival. The site is also the base for the local Mountain Rescue team. There are a number of buildings including the main centre which houses a climbing wall, a kayak training pool, gym, office space, bike workshop, two drying rooms and a restaurant. There is staff and student accommodation in the main building and in separate lodges outside in the area around the centre.

- *Templeton*: Situated in Glasgow, this is the organisation's headquarters. **sport**scotland occupies office space on two floors of the building.

- *Caledonia House*: This building is situated in Edinburgh. Its main purpose is office use, however, it does have a motion analysis room with video recording equipment which can be used for a variety of sports.

This Plan seeks to build on the above activities and to ensure future activity is planned within the strategic themes laid out in Section 2.

2. Carbon Management Strategy

2.1 Environmental Policy Statement

In parallel with sporting objectives, **sport**scotland continues to aim for excellence in every aspect of the business and are committed to minimising the environmental impacts of normal business operations.

The organisation's commitment continues as it has been over the last 5 years:

- Increase awareness of environmental responsibilities amongst staff.
- Continuously improve environmental performance and integrate recognised carbon management best practice into normal business operations.
- Reduce consumption of resources, improve the efficient use of those resources which are consumed and minimise waste.
- Implement policies and procedures that contribute to a reduction in the carbon footprint.
- Promote policies which will give preference, as far as possible, to those products and services which cause the least harm to the environment.
- Avoid the use of damaging substances, materials and processes, where possible.
- Measure and take action to reduce the carbon footprint of business activities to meet our published environmental objectives and targets.
- Manage waste generated from business operations according to the principles of reduction, re-use and recycling.
- Manage business operations to prevent pollution e.g. travel policies.
- Encourage modes of transport by staff and athletes which minimise the environmental impact.
- Include environmental issues and energy performance in the acquisition, design, refurbishment, location and use of buildings.
- Ensure environmental, including climate change, criteria are taken into account in the procurement of goods and services.

To meet these commitments **sport**scotland will:

- Provide management oversight and review of environmental policies and performance and allocate resources for their effective direction and implementation.
- Set and monitor key objectives and targets for managing our environmental performance annually.
- Communicate internally and externally our environmental policy and performance on a regular basis and encourage feedback.
- Communicate the importance of environmental issues to our staff.
- Work together with staff, service partners, suppliers, landlords, etc, to promote improved environmental performance.
- Consider sustainability and environmental issues in the services and advice provided.
- Review environmental policy every two years.

This statement represents our general position on environmental issues, and the policies and practices we will apply in conducting our business. The Environmental Policy is accessible via our website (www.sportscotland.org.uk) and on request on 0141 534 6500.

2.2 Our low carbon vision

The organisation's policies will continue aiming to deliver against the Government's carbon reduction targets. **sport**scotland will **reduce its Carbon emissions by 5% over the next 5 years** through sustainable delivery of its business operations and by having a range of policies in place to minimise the negative impact on the environment. This modest figure recognises that in 2015 which is the base year for this report, there was no permanent building at Inverclyde and therefore no significant energy consumption there. This will not be the case in 2017 when the new building is in operation. In addition, the gains achieved at Glenmore Lodge with the installation of the biomass boiler will not be repeated on that scale.

sportscotland aims to use, wherever possible, renewable energy and to have in place green fleet management and national travel planning measures. In addition, during the currency of the 2016 Carbon Management Plan, a new initiative will use land owned in Scotland by **sport**scotland to plant trees which will absorb carbon during their normal growing cycle. Raising staff awareness and active participation in our environmental are aims both at work and at home. At the end of the five-year plan, there is the possibility to install a micro-hydro scheme on land owned by sportscotland at Inverclyde.

2.3 Strategic Themes

In pursuit of our carbon vision, the following seven strategic objectives will be delivered:

- **Estate Building Emissions**

Reduce energy use in our Buildings and maximise the use of renewable / sustainable energy.

To review where and how energy is used, to maximise the efficient use of energy. To ensure that the building services are as efficient as possible, with the best technologies employed and maintained to their optimum performance. To investigate the potential use of renewable energy technologies to replace and/or supplement existing supply.

- **Sustainable Travel**

Reduce the need to travel, where it can be achieved, and to promote safe, healthy and sustainable travel patterns by people working in and visiting the organisation's buildings.

To review the current travel policy and establish a package of measures tailored to the needs of **sport**scotland and aimed at promoting travel choice through initiatives such as car sharing, cycle to work scheme and reducing car use.

- **Procurement**

Approach procurement with the aim of minimising negative environmental impact.

To devise and implement a sustainability procurement policy and establish a range of both generic and specific sustainability criteria which apply to all purchases.

- **Decision Making**

Approach all of its strategic planning, risk management and decision making with the aim of minimising negative environmental impact and maximising carbon emission reduction without adversely affecting the delivery of its core organisational sports-

related objectives.

To acknowledge that all decisions impact on the environment and associated organisational carbon footprint. To ensure that decisions at all levels aim to reduce the organisation's emissions and as such will be reviewed by Management on a "continuous improvement" basis.

- **Organisational operations**

*To ensure the carbon management plan is an integral part of **sport**scotland Corporate Plan and Business Plans which promote environmental "best practice" across all areas and locations of the organisation and encourage staff to deliver their respective roles and responsibilities with due regard to the environmental impact.*

To review all current office processes and procedures that have a direct impact on energy use, with a view to minimising future energy needs. All **sport**scotland operations and practices will be reviewed, measured, monitored and updated accordingly.

- **Operational delivery**

To acknowledge that all awards for external support have an environmental impact and ensure that advice and guidance is available to minimise the embodied carbon footprint, e.g. investment in sports facility development.

To review all current investment processes and procedures that have a direct impact on energy use, with a view to minimising future energy needs.

2.4 Targets and objectives

sportscotland will reduce its Carbon emissions by at least 5% by 2021 from the 2015 baseline level. To achieve this target, we will:

- Implement a prioritised list of carbon emissions reduction projects during the period as detailed in Section 4 of this document.
- Increase stakeholder (staff, partners, visitor public) awareness of the importance of reducing energy consumption so that energy efficiency can be incorporated into their working, home and everyday lives.
- Implement policy and procedure changes that will help reduce emissions across the operations of **sport**scotland.

3. Emissions Baseline and Projections

3.1 Scope

The emissions are categorised in the Greenhouse Gas Protocol (GHG Protocol), and are defined as follows:

- Scope 1: Direct emissions that occur from sources that are owned or controlled by the organisation, for example emissions from combustion in owned or controlled boilers, heaters, catering equipment, on-site vehicles

- Scope 2: Emissions from the generation of purchased electricity consumed by the organisation. The carbon emissions from this category generally take place at the power station and remote from the user. Exclusions would be on-site generation like a CHP unit, which would be a Scope 1 emission.

- Scope 3: All other indirect emissions which are a consequence of the activities of the organisation, but occur from sources not owned or controlled by the organisation, for example, water, waste, business travel, commuting and procurement.

International travel is fundamental to **sport**scotland's ability to compete on the world stage and without this competition, the organisation's role would be diminished. It does pose a challenge though to attempts to reduce carbon emissions, as there is no realistic alternative means of travelling to foreign competitions. Every long-haul journey is scrutinised to ensure it is necessary and arrangements are often made to share services with local specialists at destinations, but there is still a minimum level below which critical mass is lost. This is particularly the case every four years when the Commonwealth Games are on.

There is therefore a recommendation with this Plan to offset travel emissions by tree-planting. This would not normally be recommended as off-setting is usually hard to verify when plantations are in foreign lands. However, **sport**scotland owns significant areas of land at their facilities and growth of trees planted there would be easy to verify.

To cover all greenhouse gas emissions resulting from the delivery of **sport**scotland functions which can be measured with a reasonable degree of accuracy, the Carbon Management Programme addresses:

Owned & Leased Buildings Energy Use

- Electricity and Gas
- Biomass, which does have a carbon footprint, though it is orders of magnitude lower than that of fossil fuels
- Diesel and LPG
- Water (mains and borehole)
- Waste (landfill – packaging, office and catering)

Travel

- Staff: Leased/Private fuel use
- General Fleet (minibus, grounds maintenance machinery etc) fuel use
- Water sports fuel use
- International and business travel – public and commercial transport

Exclusions

- All embedded carbon in purchased goods and services

3.2 Baseline

The baseline year for the CMP is 2015/16. This baseline is used for all **sport**scotland estate buildings and transport, for which emissions data is available. All other data has been gathered from source and used to calculate the baseline position. The data relates to "real time" and the associated activity (users / staff / activity) for each of the Estates facilities in the baseline year. It is recognised that the organisation has changed significantly in structure, strategically and operationally since 2011 and as a consequence it will be necessary to acknowledge this in any future analysis of environmental performance, e.g. increase in staffing levels and number of facilities across the estate.

Table 2: Shows total of all consumption and emissions of Scope 1,2 and 3.

	Consumption	*Conversion factor**	*CO_2 [tonnes/yr]*
Grid electricity	1,506,530 kWh	0.41kgCO_2e/kWh	617
Natural gas	541,615 kWh	0.2 kgCO_2e/kWh	108
LPG	24,938 ltr	1.5 kgCO_2e/ltr	37.4
Gas (propane)	517 ltr	1.5 kgCO_2e/ltr	0.8
Oil	39,155 ltr	2.5 kgCO_2e/ltr	98
Biomass	118 t	61.98 kgCO_2/t	7.3
Solar panels	13,395 kWh	0	0
Water	7,495 m^3	1.052 kgCO_2/m^3	7.9
Waste	126,314 kg	31.5 kgCO_2/t	4
Transport	1,889,569 km	N/A	426
Total			1,306

*Factors used by sportscotland – EMS Figures all sites 2015/2016 spreadsheet.

Table 3: Energy consumption, cost and carbon emission for each site in 2015.

	Cost, ex vat (£/yr)	*Energy Consumption (kWh/yr)*	*CO_2 Emissions (Tonnes/yr)***
Templeton			
Electricity	15,450	153,681	63.3
Natural gas	6,231	17,519	3.6
Totals	*21,681*	*171,200*	*66.9*
Caledonia House			
Electricity	18,253	246,935	101.73
Natural gas	16,430	396,164	80.82
Solar PV	N/A	3,651	-1.5
Totals	*34,683*	*646,750*	*181.05*
Inverclyde			
Electricity	33,600	403,458	166.22
Natural gas	577	28,454	5.8
Gas oil (39,511 litres/yr)	11,650	401,629	117.19
Totals	*45,827*	*833,541*	*289.21*
Cumbrae			
Electricity	22,665	202,481	83.42
LPG (517 litres/yr)	787	3,440	0.78
Petrol (10,000 litres/yr)	9,850	92,690	
Diesel (1,000 litres/yr)	510	10,165	
Totals	*33,812*	*308,776*	*108.77*
Stirling			

Electricity	8,586	69,715	28.72
Natural gas	9,982	256,950	52.42
Totals	*18,568*	*326,665*	*81.14*
Glenmore Lodge			
Electricity	49,460	443,229	182.61
LPG (24,938 litres/yr)	4,140	165,937	37.53
Biomass wood pellets (119 tonnes/yr)	22,809	571,200	7.47
Solar PV	N/A	3,105	-1.28
Totals	*76,409*	*1,183,471*	*226.33*

**Conversion factors from DECC 2016

Carbon factor for UK electricity from DECC 2016: 0.412 kgCO_2e/kWh
Carbon factor for natural gas DECC 2016: 0.204 kgCO_2e/kWh
Carbon factor for Gas oil: 2.966 kgCO_2e/l
Carbon factor for LPG: 1.505 kgCO_2e/l – 0.23041kgCO_2e/kWh
Carbon factor for petrol: 2.196 kgCO_2e/l – 0.25319 kgCO_2e/kWh
Carbon factor for diesel: 2.612 kgCO_2e/l
Carbon factor for biomass wood pellets: 55.53 CO_2e/tonne - 0.01307kgCO_2e/kWh

3.3 Principle of carbon management planning

When planning carbon management to a five-year timescale, it is normal to plan projects or programmes which will deliver the carbon savings over the five years. However, the nature of some types of programme is often for all the benefit to accrue in year 1, with incremental improvements much more difficult to achieve in the later years. A good example is staff awareness training, where savings of 10 to 15% can be made in year 1, but to do the same in year 2 is much more challenging, as the easy wins have gone.

A phased approach to some of the recommendations is therefore suggested below. In particular, there are no recommendations for the new building at Inverclyde until end of year 4 and even those are caveated with a comment to monitor performance in the early years before confirming any changes.

Figure 2: Inverclyde during construction

4. Carbon Management Projects

Following visits to the sites, a number of savings opportunities were identified. They all have the potential to reduce emissions and costs. Two of the buildings, Templeton and Stirling, are leased and this may limit the extent of upgrading. There may be scope to negotiate with the landlord to share costs if a case can be made that the upgrade can be shown to protect the building fabric and increase the value of the property. The other four buildings are owned by sportscotland.

The recommended upgrades are in the following categories:

- Lighting Improvements – sports halls, offices, car parking.
- Lighting Controls – presence detection,
- Energy management system at Stirling
- Biomass heating at Glenmore Lodge and Cumbrae
- Solar panels at Caledonia House
- Water Management – boreholes, water management measures.
- Building Fabric – upgrade insulation, window, draft exclusion etc.

If all the projects that have been identified are implemented and deliver their predicted carbon savings the 5% target will be achieved. It has been assumed that some of the higher risk (complexity, cost etc) projects may not be delivered once the details are understood or they may not deliver all of the full predicted carbon savings.

Projects have been identified over a number of time frames as follows:

- Near term 2017/18
- Long term 2018/20

4.1 Scope 1-2

Templeton					
Project	Cap ex	Annual savings		Payback	Year
		£	CO_2 (t)		
Install light sensor PIR on lights next to the windows	250	92	0.4	2.7	2017
Replace lighting with LEDs	538	4,367	18	0.1	2017

Limited in what can be changed, as this is a leased building.

Caledonia House					
Project	Cap ex	Annual savings		Payback	Year
		£	CO_2 (t)		
2xVRVs in the same room-isolate to prevent simultaneous heating/cooling	0	152	0.5	Instant	2017
Timer on drinks cooler	50	8*	0.2	6	2017

Fit a PIR in server room and cupboards	200	658	2.7	0.3	2017
Increase loft insulation	4,930	559	5.4	8.8	2018
Install solar PV on south facing roof	86,000	7,190	27.5	11.9	2019

* Due to very competitive overnight price of electricity, financial savings are very small.

Inverclyde					
Project	Cap ex	Annual savings		Payback	Year
		£	CO_2 (t)		
Install electric charging points	1,500	1,400	1.5	1	2018
Grow a wood	4,125	N/A	32.4	1.3	2021
Micro-hydro	300,000	35,950	97.8	8.3	2021
Recover heat from chillers	1,500	227	1.7	6.6	2021
Upgrade roof in the gymnastic hall	3,600	4,404	10.8	0.8	2021
Upgrade meters in sub-circuits	1,500	7,181	23.6	2	2021

Cumbrae					
Project	Cap ex	Annual savings		Payback	Year
		£	CO_2 (t)		
Install biomass boiler district heating	35,000	15,968	84	2.2	2018
Upgrade lighting	185	1,442	5.3	0.1	2017
Fit a humidistat on dehumidifiers in drying room	1,000	1,430	5.3	0.7	2017

Stirling					
Project	Cap ex	Annual savings		Payback (year)	Year
		£	CO_2 (t)		
Update lighting in reception & gold zone	95	1,470	4.9	2.2	2017
Fit light sensors PIR	1,500	376	0.6	4	2017
Update windows to secondary glazing	900	175	1.6	5.1	2018
Install BMS	10,000	1,857	8	5.4	2020
Increase loft insulation	1,450	177	1.6	8.2	2018

Limited in what they can do, as this is a leased building.

Glenmore Lodge					
Project	Cap ex	Annual savings		Payback	Year
		£	CO_2 (t)		
Install BMS	20,000	11,461	8.9	1.7	2018
Increase loft insulation in the main building	2,580	1,545	2.8	1.7	2017

Install an additional biomass boiler	35,000	6,717	36	5.2	2019
Install solar PV to the south facing workshop	40,000	3,263	9.7	12.2	2020
Replace 3 mopeds with 3 electric bikes	9,000	2,190	2.5	1.4	2020

Common opportunity at all sites					
Project	Cap ex	Annual savings		Payback	Year
		£	CO_2 (t)		
Increase staff awareness of energy use	4,750	11,549	39.3	0.4	2017

Total opportunities – Scope 1 and 2					
Site	Cap ex	Annual savings		Payback (yrs)	Year
		£	CO_2 (t)		
Templeton	788	4,459	18.4	0.2	2017
Caledonia House	91,180	8,567	36.3	10.6	2017 - 2019
Inverclyde	312,225	49,162	167.8	6.4	2018 - 2021
Cumbrae					
Stirling					
Glenmore Lodge					

4.2 Scope 3

Project	Annual savings		Year
		CO_2 (t)	
Aeriated showers	1,875 m^3	1.9	2020
Displacement brick in toilet cisterns			
Cleaners awareness			
Spring loaded tap (showers and basins)			
Recycling/reduce landfill	6.3 t	0.2	2020
Share cars	142,896 km	24.9	2020
Use trains			
Conference rooms			

5. Benefit Realisation

The benefits to **sports**cotland as a non-departmental public body (NDPB) in implementing the Carbon Management Programme are two-fold.

Firstly, there will be a reduction in carbon emissions underpinning the organisation's "green" credentials and evidencing commitment to the Climate Change Scotland Act.

Secondly, there will be demonstrable cash savings which will be utilised for the purpose of investment in sport. This will assist in offsetting any negative impact of the potential public sector financial cuts and ultimately safeguard jobs.

As a result of previous environmental projects delivered over the past 5 years a number of "quick wins" can be achieved relatively soon, others are longer term in terms of justifiable financial payback. The overall success of the Plan however, can only be achieved if its objectives are embedded in all of the organisation's activities.

5.1 Benefits / savings – quantified and un-quantified on an annual basis

	2017	2018	2019	2020	2021
Annual saving [£]	**23,089**	**29,740**	**13,907**	**7,310**	**47,762**
Annual CO_2 saving	**80**	**103**	**63.5**	**47.2**	**166.3**
% of target achieved					

5.2 Unquantified benefits:

- Advice and guidance for sporting partners in the development of their services in the context of environmental impact.
- Reputation enhancement in relation to Scottish Government objectives to reduce the public sector environmental impact.
- Influential in respect to the delivery of the "environmental" message with stakeholders i.e."*practice what we preach".*
- Reduced planned maintenance and replacement requirements, i.e. minimise lifecyle costs.
- Estate: improved playing and working environment for staff and participants in the delivery of sports programmes at all levels within the sports development pathway.

6. Financing

The primary objective of the plan is to reduce consumption and therefore CO_2 emmissions, it is unrealistic that CO_2 emissions will be reduced in line with the objective without some financial investment.

The true prediction of cost savings, particularly of gas and electricity, is difficult in the current fluctuating climate, however, consideration will be given as to the cost/benefit analysis of implementation of the proposals, particularly those which have a longer > 10 years payback.

figures in £000's	2017	2018	2019	2020	2021
Annual costs:					
Total annual capital cost	**10,150**	**63,780**	**127,000**	**59,000**	**316,900**
Total annual revenue cost					
Total costs					
Committed funding:					
Committed annual capital					
Committed annual revenue					
Total funded					
Unallocated funding					

Unallocated annual capital					
Unallocated annual revenue					
Total unfunded					

Funding will be drawn from a combination of internal Capital and Revenue budgets. All efforts will be made to identify potential alternative funding sources which will be applied for on a project by project basis if/as applicable.

Photo of the original building at Stirling

7. Governance for Implementation

7.1 Embedding Carbon Management

The Corporate Plan commits **sport**scotland to being an effective and efficient public body, thus requiring resources to be used in the most effective and sustainable way in order to reduce its carbon footprint. Progress towards the carbon reduction target is a key measure of organisational efficiency within the Business Plan Performance Management system.

Progress will be reported to the Estates Strategy Group quarterly and reviewed / refreshed annually.

7.2 Data Management – measuring the difference, measuring the benefit

The Carbon Management Group will monitor progress against the Carbon Management Plan as part of its quarterly environmental performance reviews.

The Programme Manager will draw together quarterly reports on progress towards targets and implementation of the projects.

The Estates Strategy Group will receive the outputs of the quarterly reviews, in conjunction with the site-specific operational management reports.

7.3 Implementing the Initiatives

The CMP will sit within the context of the **sport**scotland Estates Strategy.

The Programme Manager will lead the delivery of the CMP and report on its progress to the Estates Strategy Group. The Estates Strategy Group is responsible for considering capital investments plans, revenue investment plans in estates and making associated recommendations to the Strategic Management Team.

Once approved, site-specific action plans and associated projects will be delivered by identified leads at each site.

The roles and responsibilities will be used for implementing and under taking the annual review of the CMP. The key groups and individuals with responsibilities are:

SMT – Strategic Management Team Chaired by Stewart Harris, CEO

- approve environmental / strategic policy of CMP

Estates Strategy Group – Chaired by Stuart Ogg Director Corporate Services

- define overall policy direction
- approve annual objectives and targets and monitor progress
- approve allocation of resources for projects

Carbon Management Group – Chaired by Alison Boyd, Head of Office Services

- monitor the delivery of the CMP

Programme Management – Undertaken by Martin Bowie, Programme Manager

- lead the delivery of the CMP

Project Management – Undertaken by Site Representatives as appropriate

- project management of individual activities / projects

7.4 Maintaining quality over time

There will be a need to maintain, monitor, evaluate and revise the plan, developing new initiatives on a regular basis, to sustain it's delivery over time. This review will be reported to the Estates Strategy Group, as part of the delivery of the Estates Strategy.

7.5 Programme Management

The Programme Manager will have responsibility for delivery of the CMP, on behalf of the Estates Strategy Group, through Programme Office utilising organisational project management process and procedures. This activity will be supported by the Carbon Management Group.

7.6 The Carbon Management Group – delivering the projects

The Carbon Management Group will provide leadership for activity related to managing, monitoring and improving the environmental impacts of **sport**scotland.

The Group will do this through:

- Ensuring that mechanisms are in place to facilitate realisation of **sport**scotland's environmental performance targets
- Ensuring that all legislatory, regulatory and other requirements are complied with
- Ensuring awareness of and commitment to the organisation's Environmental Policy Statement and Principles
- Ensuring environmental performance is monitored, reviewed, audited and reported (producing an annual performance report)
- Demonstrating compliance with environment obligations, identifying and rectifying instances of non-compliance
- Providing a lead on environmental management to Scotland's sporting community
- Ensuring that environmental best practice is identified and adopted where appropriate
- Ensuring a systematic approach to environmental management
- Facilitating continuous improvement in environmental performance

7.7 Succession planning for key roles

The Estates Strategy Group will be responsible for ensuring continuation of the Plan in the event of key individuals leaving or moving post.

7.8 Project Delivery

All projects will be delivered following Organisational standard Programme Office process and procedure. Three project portfolios have been defined these are strategic, operational and team. The portfolio within which each project sits is defined within Appendix A.

Appendix A: Definition of Projects

Templeton

Fit PIR (daylight sensing)

Installed capacity: 3 kW (only for the lights by the windows)
Assumed operating hours: 8,760x70%=6,132 h
Assumed savings: 5%
Annual saving: 0.05 x 3 kW x 6,132 h = **920 kWh**
Savings: 920 kWh x 10p/kWh: **£92/yr**
CO_2: 920 kWh x 0.00041205 tonnes CO_2/kWh= **0.4tonnes**
Payback: cap ex (£50 each)/annual saving = £250/ £92 = **2.7 year**

Upgrade lighting with LEDs

Location	*No of Fittings*	*Type*	*Exist Rating (W)*	*Proposed Rating (W)*	*hrs*	*days*	*weeks*	*Saving (kWh)*
Office area	50	Halogen	3,000	300	16	7	52	15,724
Offices	96	T8	5,760	960	16	7	52	27,955
Total								*43,679*

Saving: 43,679 kWh · 10 p/kWh* = **£4,367/yr**
CO_2: 43,679 kWh · 0.00041205 tonnes CO_2/kWh = **18 Tonnes**
Payback = cap ex /annual saving = £538/ £4,367/yr = **0.1 years**
*Average price for electricity

Caledonia house

VRVs

Estimated power per VRV: 5kW
Assumed operating hours: 9h·5d·52w= 2,340 h
Assumed saving: 30%
Actual consumption: 5kW· 2,340h= 11,700 kWh
Energy saving: 0.3 · 11,700 kWh = 3,510 kWh
Future consumption= (11,700 – 3,510) kWh= 8,190 kWh
Saving per year: (8,190 x 0.12 x 0.11312) + (8,190 x 0.5 x 0.00883) + (8,190 x 0.38 x 0.00145) = **£152/year**
CO_2: 3,510 kWh x 0. 000412 tonnes CO_2/kWh = **0.5 tonnes/yr**
Payback: cap ex /annual saving = **Immediate**

(Price of electricity from bills 2015:
Red units: 0.11312£/kWh
Amber units: 0.00883£/kWh
Green units: 0.00145£/kWh)

Timer on drinks cooler

Considering 2 drinks coolers in total.
Based on estimated 250 W refrigerated vending machine presently operating 24 hours per day.
Assumed operating hours: 8,760h x 30%=2,628 h
Assumed savings: 35%
Saving: 0.35 x 0.25 kW x 2 x 2,628 h = 460 kWh

Saving: (12%·460kWh·11.3p/kWh) + (50%·460kWh·0.8p/kWh) + (38%·460kWh·0.1p/kWh) = £6.2+£1.8+£0.2=

Savings per year:	**£8.2/yr**
CO_2: 460 kWh x 0. 000412 tonnes CO_2/kWh =	**0.2 tonnes/yr**
Payback: cap ex /annual saving= £50/£8.2 =	**6 years**

Based on HH electricity at 11.3 p/kWh red units on for 12% and 0.8p/kWh amber units based on 50% and 0.1p/kWh green units on for 38%.

Fit PIR (movement and daylight sensing)

Installed capacity: 28 kW

Assumed operating hours: 8,760x70%=6,132 h

Assumed savings: 5%

Annual saving: 0.05 x 28 kW x 6,132 h=	**6,584 kWh**
Savings: 6,584 kWh x 10p/kWh=	**£658/yr**
CO_2: 6,584 kWh x 0.000412 tonnes CO_2/kWh=	**2.7tonnes**
Payback: cap ex (£50 each)/annual saving = £200/ £658 =	**0.3 year**

Increase loft insulation

Current average heat loss through 100mm insulation with an average heat loss from internal (average annual temp: 21°C) to external (average annual temp: 10°C), given by

$E = U \times A \times \Delta T \times t$ The buildings have a total loft area of 986 m^2

t = 8,760 hours per year.

The U-value for 100mm insulation is 0.44 W/m^2K, so

E = 0.44 W/m2K · 986 m^2 · (21- 10)°C · 8,760h= 41,804 kWh/yr

With 300mm insulation (U = 0.16 W/m^2K), the heat loss becomes 15,201 kWh/yr

Energy saving: (41,804 - 15,201) kWh =	**26,603 kWh**
Cost saving: 26,603 kWh · 2.1p/kWh* =	**£559/yr**
CO_2 saving: 26,603 kWh · 0.000204 tonnes CO_2/kWh =	**5.4 tonnes**

* cost for gas

Cost to implement: A figure of £5/m^2 is suggested. This brings out a cost of £4,930, giving a payback of 8.8 years.

Note: These costs are illustrative figures only and contractor's quotes should be sought.

PV Panels

The following calculation represents a saving and additional benefit from the Feed in Tariff (FiT) as a result of implementing a 80 kWp photovoltaic array based on 80% consumption and 20% export.

Photovoltaic Array

250W/m^2 · 325m^2= (80 KWp)

*Saving = kWp · Kk · SF, where Kk is the kWh/ kWp factor and SF is the shading factor

Pitch = 45 degrees

Orientation = 0 degrees off due south

From Zone 9E irradiance data sheet, Kk = 927 kWh/KWp

*Saving = 80kWp · 927 kWh · 0.9 = 66,744 kWh

** Saving = 66,744 kWh · 7.3p/kWh · 0.8 = £3,900/yr

Feed in Tariff = 66,744 kWh · 3.95p/kWh = £2,636/yr

Export Tariff = 66,744 kWh · 4.91 p/kWh · 0.2 = £655/yr

Total Saving = £3,900 + £2,636 + £655 =	**£7,190/yr**
Payback = Cap Ex/ Annual Saving = £86,000/£7,190/yr=	**11.9 years**
CO_2 Saving = 66,744 kWh · 0.00041205 t/kWh =	**27.5 tonnes CO_2**

**Above calculation based on 80% consumption and 20% export.

Based on average electricity price at 7.3 p/kWh

* Reference :

The Microgeneration Certification scheme for further information go to :

http://www.microgenerationcertification.org/images/PV%20Book%20ELECTRONIC.pdf

The above savings are illustrative example which can be used for information, the next step is to get quotations.

Inverclyde

Charging point for an electric car

The cost of buying and installing a charging point –single phase-32A-7.2kW-high temperature- is estimated to be around £1,500.

Considering that the mileage is up to 17,000km per year and the normal diesel consumption would be 7km/litre. The volume consumption of a standard car would be:

17,000 km / 7 km/l_{diesel} =	2,430 l_{diesel}
2,430 l_{diesel} · 10.9 kWh/l_{diesel} =	26,487 kWh

Considering that in a diesel engine the efficiency is 40% and in an electric one it is 90%.

Energy saving: 26,487 kWh · (0.4/0.9) =	11,772 kWh
Cost of diesel: 2,430 l_{diesel} · p111/ l_{diesel} =	£2,700/yr
Cost of electricity: 11,772 kWh · 11p/kWh =	£1,294
Annual savings: £2,700 - £1,294 =	**£1,400/yr**
Payback = cap ex /annual saving = £1,500/£1,400/y=	**1yr**
CO_2 emissions for diesel: 2,430 l_{diesel} · 0.00261163 tonnes/ l_{diesel}	6.3t/y
CO_2 emissions for electricity: 11,772 kWh · 0.00041205 t/kWh	4.8t/y
CO_2 savings: 6.3t/y-4.8t/y=	**1.5 t/y**

Grow a wood

The area considered to grow a woodland is around the wind turbines in the east side of the building. The area is extended for 6ha.

Planting a woodland not only enrich the area scenery but also trees absorb carbon during photosynthesis and store it in the wood for the life of the tree. The average amount of carbon dioxide sequestered by trees from Forestry Commissions is 5.4tCO_2/ha*.

CO_2 savings: 5.4tCO_2/ha·6ha=	**32.4 t**

There are different funds available for growing a woodland depending on the area and the necessities of the owner of the land.

For this area, the purpose is not selling timber but reducing carbon dioxide.

The selected woodland is “Northern and Western isles native woodland” so that it can enhance the territory with natural woodland and let the wildlife thrive. The trees selected are ash and birch with a density of 3,500 trees per hectare. **

Funds for the selected woodlands corresponds to £3,640 as initial payment and £360/yr for the maintenance costs for the following 5 years.

Cap ex: cost of seeds ·ha: £275/ha ·6ha= £1,650

This initial cost does not include cost for design, site preparation, planting, fencing, labour and maintenance (this costs will inflate the cost by 2.5).

Cap ex: £1,650·2.5= **£4,125**

Payback: (Cap ex-initial inv. from gov)/funds: ((£4,125 -£3,640)/ £360/yr= **1.3 yr**

*http://www.forestry.gov.uk/pdf/6_planting_more_trees.pdf/$FILE/6_planting_more_trees.pdf

**http://www.gov.scot/Topics/farmingrural/SRDP/RuralPriorities/Options/WoodlandCreation/NandWIslesNativeWoodland

Micro-hydro

The power extracted from the stream in the area owned by sportscotland is:

$$P=\rho \cdot q \cdot g \cdot h \cdot \mu$$

ρ= density of water (1000 kg/m^3)

q= flow of the stream (estimated 50 litres)

g= gravity (9.81 m/s^2)

h= head (difference in height of the stream)

μ= efficiency of the hydropower system ($0.75<\mu<0.95$)

P=1000 kg/m^3· 0.05 m^3/s· 9.81 m/s^2· 100m· 0.85= 41.7 kW

Energy produced by hydro: E=41.7kW · 5,694h= 237,440 kWh

Feed-in tariff: 7.52p/kWh · 237,440 kWh= £17,855/yr

Saving: 237,440 kWh· 8.3p/kWh**· 0.8*= £15,766/yr

Export: 237,440 kWh· 4.91 p/kWh· 0.2*= £2,331/yr

Total saving: 17,855/yr+ £15,766/yr+ £2,331/yr= **£35,950/yr**

Cap ex: £300,000***

Payback: cap ex/ saving= £300,000/£35,950/yr= **8.3yr**

CO_2 saving: 237,440 kWh ·0. 000412 tonnes CO_2/kWh **97.8t/yr**

*average electricity of 8.3p/kWh

**Above calculations based on 80% consumption and 20% export

***http://www.renewablesfirst.co.uk/hydropower/hydropower-learning-centre/how-much-do-hydropower-systems-cost-to-build/ for a system of less than 50kW.

Recover heat from chillers

There are three fan coil units (4.5kW each) that take heat out of the air, this heated air is currently being brought outside. If this heat can be recovered by specifying the chiller with heat recovery connections, then it could be used to generate hot water for the stances as they are close to where the chiller will be located. This option would work well in the summer months when there is more heat gain from the Sun.

Energy saving: 4.5kW·0.65·8h·120days·3units= **8,424 kWh**

Considering the price of gas will increase in the next five years, at least to 2.7p/kWh.

Saving: 8,424 kWh · 2.7p/kWh= **£227/yr**

CO_2 saving: 8,424 kWh · 0.000204 t/kWh = **1.7t/yr**

Payback: cap ex/saving: £1,500/£227/yr= **6.6yr**

Upgrade roof in the gymnastic hall

Current average heat loss through a thin layer of aluminium and wool insulation with an average heat loss from internal (average annual temp: 21°C) to external (average annual temp: 10°C), given by

$E = U \cdot A \cdot \Delta T \cdot t$ The building have a total loft area of 720m²

t = 5,000 hours per year.

The U-value for the present structure insulation is 1.5 W/m²K, so

E = 1.5 W/m²K · 720m² · (21- 10) °C · 5,000h= 59,400 kWh/yr

With 300mm insulation (U = 0.16 W/m²K), the heat loss becomes 6,336 kWh/yr

Energy saving: (59,400 – 6,336) kWh = **53,064 kWh**

Cost saving: 53,064 kWh · 8.3p/kWh* = **£4,404/yr**

CO_2 saving: 53,064 kWh · 0.000204 t/kWh = **10.8 tonnes**

*Average price of electricity

Cost to implement: A figure of £5/m² is suggested. This brings out a cost of £3,600, giving a payback of 0.8 years.

Upgrade meters in sub-circuits

Upgrading sub-meters can save up to 5% of the total consumption.

Because the building is under construction a benchmark has being used.

The building has been divided into 3 main area: sports hall, internal courts and accommodation.

Sports all: 224kWh/m² per year for heating and 69kWh/m² for electricity. tot area: 2,160 m².

Internal courts: 190kWh/m² per year for heating and 86kWh/m² for electricity. tot area: 1,648 m².

Accommodation: 360kWh/m² per year for heating and 120kWh/m² for electricity. tot area: 2,560 m².

Total energy consumption: [(224+69)kWh/m²· 2,160m²] + [(190+86)kWh/m²· 1,648m²] + [(360+120) kWh/m²· 2,560 m²]= 2,316,528 kWh

Energy saving: 2,316,528 kWh · 0.05= **115,826 kWh**

Considering that heating is 2/3 of the total energy and electricity 1/3 and that the average prices are:

Electricity: 8.3 p/kWh

Natural gas: 2 p/lWh

Saving: (115,826 kWh·2/3· 8.3p/kWh)+(115,826 kWh·1/3· 2p/kWh) **£7,181/yr**

CO_2 saving: (115,826kWh·2/3·0.000204t/kWh)+(115,826kWh·1/3·0.000204t/kWh)=

15.7 t CO_2 + 7.9 t CO_2 **23.6 t CO_2**

The meters installed need to be connected to either a computer or a BMS. This would cost up to £500 per meter. Considering a minimum of 30 meters in the building.

Cap ex: (£500·30)/£7,181/yr **2yr**

Cumbrae

Biomass boiler for heating and hot water

Heating in Cumbrae is provided by electric heaters around 203,000 kWh. This would cost 203,000 kWh x 11.2 p/kWh= 22,736 £/yr. By moving to biomass heating, unless there is a change to the building fabric, there is no energy saving, as it is only the source of heat which is changing. Assuming wood pellets at 4.5p/kWh and 90% boiler efficiency, the cost would be as follows:

Cost of wood pellets: 203,000 kWh x 0.045£/kWh/0.9 = £10,150

The installation would attract RHI as follows:

Tier 1 payment = 60 kW·1,314h·1.1·0.039£/kWh = £3,382/yr

Tier 2 payment not estimated as running hours are unknown until the plant is operating.

Total cost saving therefore: £22,736 – £10,150 + £3,382 = **£15,968/yr**

CO_2: With biomass: 203,000kWh · 0.01307kgCO_2e/kWh 2.6t/yr

With electricity: 203,000kWh · 0.00041205 tonnes CO_2/kWh 83.6t/yr

CO_2 saving: (86.3 - 2.6)t/yr **84 tonnes**

The cost of implementing is estimated at £35,000. This would have a payback of 2.2 years.

Upgrade lighting

Based on upgrading double D lights and halogen bulbs to energy efficient LED equivalent lighting.

Location	*No of Fittings*	*Type*	*Exist Rating (W)*	*Proposed Rating (W)*	*hrs*	*days*	*weeks*	*Saving (kWh)*
Drying room	3	T8	180	30	16	7	52	873
Corridor	4	T5	200	28	16	7	52	1,000
Female changing room	3	T8	180	30	16	7	52	873
Bathroom	3	2D	48	NA	16	7	52	0
Male changing room	4	T8	240	40	16	7	52	1,164
Workshops	10	T8	600	100	16	7	52	2,912
Storage ropes	2	T8	120	20	16	7	52	582
Compressor room	2	T8	120	20	16	7	52	582
Chalets x4	56	2D	896	NA	16	7	52	0
Gym	8	LED	40	NA	16	7	52	0
Dining room	8	T8	480	40	16	7	52	2,562
Lounge	10	LED	50	NA	16	7	52	0
Lecture room x4	1	T8	240	40	16	7	52	1,164
Total								*11,712*

Please note the following calculations represent the estimated number of lamps multiplied by the number of lamps per fitting where appropriate, multiplied again by the difference in watts to establish the reduction in load. This figure has then been multiplied by the number of hours per week and weeks per annum, yielding a total annual saving in kWh.

Annual Saving = 11,712+10% **12,883 kWh**

Saving: 12,883 kWh · 11.2 p/kWh = **£1,442/yr**

CO_2: 12,883kWh · 0.00041205 tonnes CO_2/kWh = **5.3 Tonnes**

Payback = cap ex /annual saving = £185/ £1,442/yr = **0.1 years**

Based on day rate electricity at 11.2 p/kWh

Fit a humidistat in dehumidifier room

The dehumidifier and the heating are on in these rooms for at least 18 hours a day, especially over night or during the winter when the activities are not so frequent the dehumidifier should be turned off. A humid stat would recognise the humidity of the hair and turn it off when not needed.

The dehumidifier have a power rating of 1.5 kW each, their load factor is 0.65.

Electricity used in Cumbrae:	202,481 kWh
Energy saved: 0.65· 1.5kW · 2units· (18h·7d·52w)	**12,776 kWh**
Savings: 12,776kWh · 11.2p/kWh	**£1,430/yr**
CO_2: 12,776kWh· 0.00041205 tonnes CO_2/kWh	**5.3 tonnes**
Payback: £1,000/£1,430/yr	**0.7 yr**

Stirling

Replace spotlight in reception area and gold zone

Location	*No of Fittings*	*Type*	*Exist Rating (W)*	*Proposed Rating (W)*	*hrs*	*days*	*weeks*	*Saving (kWh)*
Reception area	16	GU10	960	96	16	7	52	5,032
Gold zone	22	GU10	1,320	132	16	7	52	6,919
Total								*11,951*

Saving: 11,951 kWh · 12.3 p/kWh =	**£1,470**
CO_2: 11,951 kWh · 0.00041205 tonnes CO_2/kWh =	**4.9 Tonnes**
Payback = cap ex /annual saving = £95/ £43/yr =	**2.2 years**

Based on day rate electricity at 12.3 p/kWh

Fit Pir for daylight only

Location	*No of Fittings*	*Type*	*Rating (W)*	*hrs*	*days*	*weeks*	*(kWh)*
Kitchen	9	CFL	99	16	6	52	494
Corridor	10	CFL	110	16	6	52	549
Gold zone	11	CFL	121	16	6	52	604
Toilets	4	CFL	44	16	6	52	220
Open plan office	48	T5	864	16	6	52	4,313
Individual offices	32	T5	576	16	6	52	2,875
Gold zone	22	GU10	1,320	16	6	52	6,585
Reception	16	GU10	960	16	6	52	4,792
Total							20,432

The installation of Pir in the described area could bring saving of up to 15%.

Energy saving: 20,432 kWh · 0.15	**3,064 kWh**
Saving: 3,064 kWh · 12.3 p/kWh	**£376/yr**
CO_2 saving: 3,064 kWh x 0.000204 tonnes CO_2/kWh	**0.6 tonnes**
Payback= cap ex /annual saving: £1,500/£376/yr	**4 yr**

Fit secondary glazing to selected windows

Before we start with the calculations there are some assumptions that need to be made.

The only room that could fit secondary glazing without disrupting look or the ventilation of the room (especially in Summer) that is not highly occupied is the back office. This room occupies 7% of the total area of the building, the heating for this room will be in part dispersed through the roof. With these

considerations, an assumption of 3% saving in energy is made. The heating in this building is supplied only by natural gas.

Cost of natural gas in Stirling: 2.27p/kWh for gas.

Energy from gas:	256,950kWh
Energy saving: 256,950 kWh · 0.03 =	**7,709kWh**
Saving: 7,709 x 2.27p/kWh=	**£175/yr**
CO_2 saving: 7,709kWh x 0.000204 tonnes CO_2/kWh =	**1.6 tonnes**

Cost to implement: A supplier of Perspex sheeting was contacted and a figure of £100/m^2 to install was estimated. The area of window (on the west wall of floor 1) to be glazed is approximately 9m^2, giving an installation cost of £900. This brings out a payback of 5.1 years.

Note: These costs are illustrative figures only and contractor's quotes should be sought.

Building Energy Management System (BEMS)

Considering that the BEMS would only be installed to control the new building, assumption is made that half of the energy goes to this building corresponding to 163,330 kWh.

Because there are three different systems and they might be fighting one another there are 20% savings by using a BEMs.

Energy Saving = 20% x 163,330 =	**32,666kWh**
Cost Saving: 0.20 x £9,284 =	**£1,857**
CO_2: 0.20 x 40=	**8 tonnes**

Estimated cap-ex is £10,000, but the first step is to obtain a contractor's quote.

Payback = £10,000 /£1,857/yr =	**5.4 years**

Increase loft insulation

Current average heat loss through 100mm insulation with an average heat loss from internal (average annual temp: 21°C) to external (average annual temp: 10°C), given by

$E = U \cdot A \cdot \Delta T \cdot t$ The buildings have a total loft area of 290 m^2

t = 8,760 hours per year.

The U-value for 100mm insulation is 0.44 W/m^2K, so

E = 0.44 W/m^2K · 290 m^2 · (21- 10)°C · 8,760h= 12,295 kWh/yr

With 300mm insulation (U = 0.16 W/m^2K), the heat loss becomes 4,470 kWh/yr

Energy saving: (12,295 - 4,470) kWh =	**7,825 kWh**
Cost saving: 7,825 kWh · 2.27p/kWh* =	**£177/yr**
CO_2 saving: 7,825 kWh · 0.000204 =	**1.6 tonnes**

*cost for gas

Cost to implement: A figure of £5/m^2 is suggested. This brings out a cost of £1,450, giving a payback of 8.2 years.

Glenmore Lodge

Building Energy Management System (BMS)

BEMS would be installed to control the whole building corresponding to 1,183,471 kWh.

Because there are three different systems and they might be fighting one another there are 15% savings by using a BEMs.

Energy Saving = 15% · 1,183,471 kWh =	**177,520kWh**
Cost Saving: 0.15 · £76,409 =	**£11,461/yr**
CO_2: 0.15 · 59t =	**8.85 tonnes**

Estimated cap-ex is £20,000, but the first step is to obtain a contractor's quote.

Payback = £20,000 /£11,461/yr = **1.7 years**

Increase loft insulation in the main building

Current average heat loss through 100mm insulation with an average heat loss from internal (average annual temp: 21°C) to external (average annual temp: 10°C), given by

$E = U \cdot A \cdot \Delta T \cdot t$ The buildings have a total loft area of 516 m^2

t = 8,760 hours per year.

The U-value for 100mm insulation is 0.44 W/m^2K, so

$E = 0.44\ W/m^2K \cdot 516\ m^2 \cdot (21- 10)°C \cdot 8{,}760h =$ 21,877 kWh/yr

With 300mm insulation (U = 0.16 W/m^2K), the heat loss becomes 7,955 kWh/yr

Energy saving: (21,877 – 7,955) kWh =	**13,922 kWh**
Cost saving: 13,922 kWh · 11.1p/kWh* =	**£1,545/yr**
CO_2 saving: 13,922 kWh · 0.000204 t/kWh =	**2.8 tonnes**

*Price of electricity

Cost to implement: A figure of £5/m^2 is suggested. This brings out a cost of £2,580, giving a payback of 1.7 years.

Biomass boiler for heating and hot water

Heating in Glenmore Lodge is provided by electric heating. The additional biomass boiler could replace the use of LPG and supply heating and hot water for staff rooms.

This costs 165,937 kWh x 6.06 p/kWh= £10,055/yr. By moving to biomass heating, unless there is a change to the building fabric, there is no energy saving, as it is only the source of heat which is changing. Assuming wood pellets at 4.5p/kWh and 90% boiler efficiency, the cost would be as follows:

Cost of wood pellets: 165,937 kWh x 0.045£/kWh/0.9 = £6,720

The installation would attract RHI as follows:

Tier 1 payment = 60 kW·1,314h·1.1·0.039£/kWh = £3,382/yr

Tier 2 payment not estimated as running hours are unknown until the plant is operating.

Total cost saving therefore: £10,055 – £6,720 + £3,382 =	**£6,717/yr**
CO_2: With biomass: 165,937kWh · 0.01307kgCO_2e/kWh	2.2t
With LPG: 165,937kWh · 0.23041kgCO_2e/kWh	38.2t
CO_2 saving: 38.2t – 2.2t	**36t**

The cost of implementing is estimated at £35,000. This would have a payback of 5.2 years.

PV Panels

The following calculation represents a saving and additional benefit from the Feed in Tariff (FiT) as a result of implementing a 37.5 kWp photovoltaic array based on 80% consumption and 20% export.

Photovoltaic Array

$250W/m^2 \cdot 150m^2 = 37.5$ KWp

*Saving = kWp · Kk · SF, where Kk is the kWh/ kWp factor and SF is the shading factor

Pitch = 45 degrees

Orientation = 0 degrees off due south
Irradiance data sheet, Kk = 700 kWh/KWp
*Saving = 37.5kWp · 700 kWh · 0.9 = 23,625 kWh
** Saving = 23,625 kWh · 11.1p/kWh · 0.8 = £2,100/yr
Feed in Tariff = 23,625 kWh · 3.95p/kWh = £933/yr
Export Tariff = 23,625 kWh · 4.91 p/kWh · 0.2 = £230/yr
Total Saving = £2,100 + £933 + £230 = **£3,263/yr**

Payback = Capital Expenditure/ Annual Saving = £40,000/£3,263/yr= **12.2years**

CO_2 Saving = 23,625 kWh · 0.00041205 t/kWh = **9.7 tonnes CO_2**
**Above calculation based on 80% consumption and 20% export.
Based on average electricity price at 11.1 p/kWh
* Reference :
The Microgeneration Certification scheme for further information go to :
http://www.microgenerationcertification.org/images/PV%20Book%20ELECTRONIC.pdf

The above savings are illustrative example which can be used for information, the next step is to get quotations.

Replace 3 moped with 3 electric bikes

Considering that a moped covers 50miles per week and petrol covers 10 miles/litre.
Another important assumption is made here: the power coming from the PV panels (new installation) is used to supply electricity to the electric bikes.
5litres·52 weeks·3moped= 780 l_{petrol}/yr
1litre=9.7kWh
780 l_{petrol}·9.7= 7,566 kWh
7,566 kWh is the output energy from a diesel/petrol engine with efficiency of 40%.
Electric vehicles have efficiency of 90%. So the input energy for the two vehicles are:
Petrol: 18,915 kWh
Electricity: 8,406 kWh
Saving: (18,915 kWh · 11.6p/kWh*) **£2,190/yr**
*price of petrol
**price of electricity
CO_2 saving: with petrol: 10,088 kWh · 0.00025319 tCO_2/kWh 2.55t/yr
With electricity: free as it comes from PV panels 0
CO_2 saving: 2.55t/yr - 0 **2.55t/yr**
Considering the price of each bike to be £3,000, it gives a simple payback of 1.4 years.

All sites

Staff energy awareness training

The potential annual savings are as follows:

Energy: 5.0% of 3,470,403 kWh= **173,520 kWh**
Saving: 5.0% of £230,980= **£11,549**
CO_2: 5.0% of 786 = **39.3 tonnes**

As an illustration assuming 250 staff who can have an effect on energy consumption, the cost of their time would be £3,750 plus trainer's time at £1,000, giving a total of £4,750. This would have a payback of 5 months.

Scope 3

Water

By fitting all the water saving devices there is an opportunity for saving up to 25% of water consumption.

The water consumption for all sites correspond to 7,500 m^3.

Water saving: 7,500m^3· 0.25= **1,875 m^3**

CO_2 saving: 1,875m^3·1.052kgCO_2/m^3*= 1,972 kgCO_2=**1.9 tCO_2**

*carbon factor for water supply+ water treatment (0.344+0.708) kgCO_2/ m^3 from DECC 2016

Waste

By staff awareness **sport**scotland can reduce waste both going to landfill and recycled by 5%.

Amount of waste: landfill+ recycled= (92,100+ 34,214) kg 126,314 kg=126.3 t

Waste saving: 126.3t· 0.05= **6.3 t**

CO_2 saving: 6.3 t· 31.5 kgCO_2/t= 198kgCO_2=**0.2tCO_2**

Transport

By introducing all the recommendation such as using a conference room when traveling is not necessary or sharing a car to go to the same place or using the public services like trains and bus instead of private transport saving up to 15% can be made.

This saving is based only on the local transport, because as stated above, air transport is not included as it varies from year to year and it is necessary for athletes and trainers to participate in international competition.

Total transport saving: 952,643 km· 0.15= **142,896km**

CO_2 saving: 166 tCO_2· 0.15= **24.9 tCO_2**