Edinburgh College

Authority Data Pack Report
for
Scottish Funding Council

[redacted]
Assistant Project Manager

Turner & Townsend
Osborne House
1 Osborne Terrace
Edinburgh
Scotland
EH12 5HG
United Kingdom

t: +44(0) 7736 117837
e: [redacted]
w: turnerandtownsend.com

Colleges Energy Efficiency Pathfinder
Scottish Funding Council

24 March 2016

Contents

Rev	Originator	Approved	Date
1.0	[redacted]	[redacted]	30/03/2016

1 Executive Summary

This report outlines the process undertaken by Turner & Townsend to establish a high level summary of key areas for investigation into the implementation of Energy Conservation Measures to save energy within the Edinburgh College Estate utilising the Scottish Government's NDEE Framework.

The process undertaken followed the following steps:

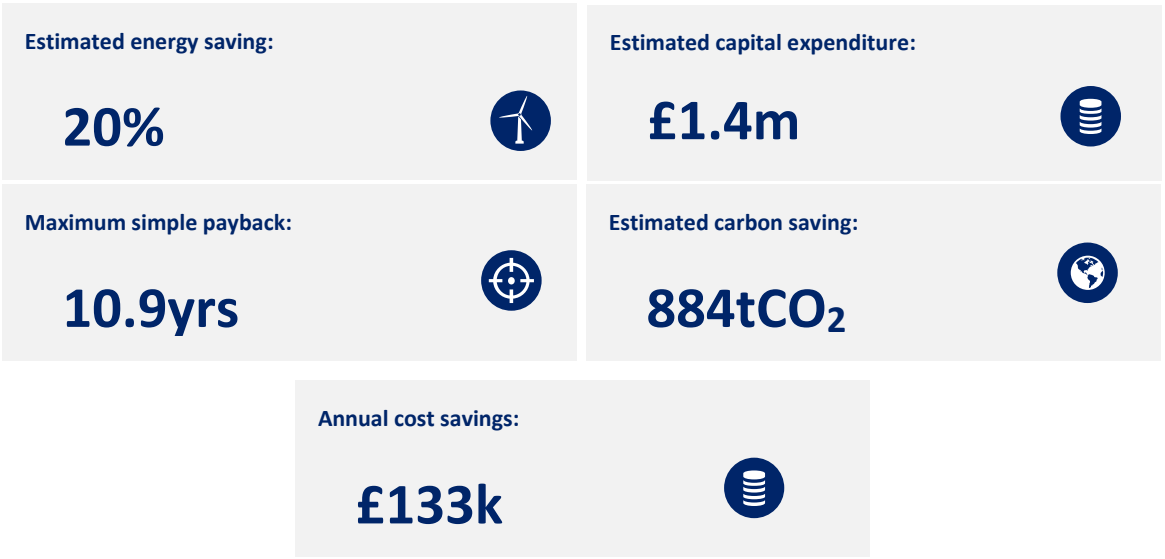
1. Data Gathering
2. Desktop Energy Assessment
3. Site Surveys
4. Project Register Development

The initial step was to gather appropriate data that could be used to investigate the energy performance of the Edinburgh College estate and the potential energy saving against the benchmark which in turn leads to the implementation of ECM. Data required to be gathered included:

- Campus Name
- Building Name
- Building Usage including number of users, usage hours etc.
- Fuel Unit Costs
- Type of Tenure
- Heritage Status
- Floor Areas
- Year of Construction
- Refurbishment Details
- Energy Usage Data
- Energy Performance Certificate
- Metering Details

Following the data gathering exercise Turner & Townsend completed a desktop energy assessment of the College, at the building level, to identify estimated capital expenditure, return on investment and energy, carbon dioxide and financial savings. The output of this analysis can be seen in Figure 1 but in summary it is estimated that an energy saving of **20%** is possible at the College, equating to a saving of **884tCO_2**, using a variety of ECMs requiring an estimated capital expenditure of **£1.4m** with a maximum payback period of **10.9 years** with an annual saving of approximately **£133k**.

Figure 1 – Benchmarking output – Edinburgh College



To ensure the robustness of the Desktop Energy Assessment site surveys were carried out at each of the sites within the Edinburgh's College Estate which have led to the identification of a number of Energy Conservation Measures that could be installed to meet the energy saving target identified. The following projects, identified by the College, are examples of potential ECMs which are being considered: lighting replacement programme, installation of a CHP boiler, cavity wall insulation and installation of a pool cover.

It should be noted that the list of ECMs identified in the Project Registers are only as a recommendation and in no way exhaustive. A final list of ECMs will need to be developed by the selected Framework Contractor in order to meet the performance standard identified in the desktop energy review.

The following categories shown Table 1 in of Energy Conservation Measure have been considered.

Table 1 - ECM Categories

ECM Cat. Ref.	ECM Cat Name	ECM Category Description
01	Automatic Meter Reading (aMR) systems	Energy consumption measurement, logging, communication & reporting systems.
02	Passive Measures (Passive)	Passive renewable energy technologies and measures, e.g. solar shading
03	Building Fabric (BF)	Building fabric thermal performance improvements, such as loft insulation.
04	Heating, Ventilation & Air Conditioning (HVAC)	Measures to improve energy efficiency of heating and cooling sources, distribution systems, heat emitters etc.
05	HVAC Controls	Building energy management systems and other HVAC controls.
06	Lighting and Lighting Controls (Light & Cntrl)	Artificial lighting systems and their control.
07	Electrical Equipment and Distribution (Electrical)	Efficient motors and other equipment; voltage management etc.
08	Low and Zero Carbon Technologies (LZC)	Biomass, solar thermal, heat pumps, photovoltaics, combined heat and power etc.
09	Specialist Systems (Specialist)	Swimming pools, lifts, catering, fume cupboards, process energy use etc.
10	Water Management (Water)	Management of water using devices, such as taps, WC cisterns, urinals etc.
11	Others (Others)	ECMs that do not fit into the above categories.

The Project Register for Edinburgh College can be identified within Appendix 7 of this report.

2 Baseline Information

Edinburgh College consists of a number of buildings across three main campuses – Sighthill, Granton, Milton Road and Midlothian.

The Sighthill campus with a total GIFA of 22,713m2 consists of three buildings:

- The main building which was built circa 1970.The building is owned and occupied by Edinburgh College.
- The creative block built in 2006 and is owned and occupied by Edinburgh College, and
- The sports hall built in 2010 which is also owned and occupied by Edinburgh College.

The Milton Road campus is made up of;

- Bolum house built in 1972– The main building which includes the main building, halls of residence, CR8 and the Library/Reception with a GIFA of 19,515m^2 and is owned and occupied by Edinburgh College,
- The Club built in 2008 - Contains a swimming pool, gym, specialist teaching areas and catering facilities of and is owned and occupied by Edinburgh College (GIFA included within Bolum House total).

Midlothian (7,500m2) campus which consists of a single four storey building solely occupied by Edinburgh College and constructed in 2008 and still has weather proofing issues with ingress of water and wind occurring regularly.

The College also operates out of the Marine Drive building (1,302m2) which is a sports changing facility constructed circa 1970 that has had several refurbishments. The building has a variety of users and new playing fields are currently under construction.

Site specific information presented within this authority data pack was gathered through site visits carried out on the 10th and 12th of February. The information is based on what was observed during site visits, discussions with the Facilities Manager and through access to various form of documentation which are included within the appendices where possible.

Below are a number of photographs to detail the current condition of the various buildings.

Figure 2 - Midlothian Cold Water Storage Tank

Figure 3 - Sighthill Creative Building Plant Room

Figure 4 - Sighthill Main Building External Cladding

The following information is available as appendices to this report:

Appendix 1 – Building Drawings

Appendix 2 – Condition Register

Appendix 3 – Carbon Management Plans

Appendix 4 – Asbestos Survey Reports (also available on site)

Appendix 5 – Building and Energy Data Sheet

Appendix 6 – Site Visit Report

Appendix 7 – Project Register

3 Authority's Minimum Requirements

Utilising the baseline data information gathered and in order to facilitate the process of identifying potential scope for energy savings across the College estate Turner & Townsend have completed a desktop energy assessment, at the building level, to identify estimated capital expenditure, return on investment and energy, carbon dioxide and financial savings.

3.1 Benchmarking approach

3.1.1 Energy and carbon savings

Turner & Townsend's benchmarking approach is a desktop based assessment which establishes current energy consumption per metre squared floor area (kWh/m2) and compares this against a blend of industry benchmarks including CIBSE's TM46, Carbon Trust Energy Benchmarks and Display Energy Certificates (DECs) as well as Turner & Townsend's own in-house data resources.

Where a building is performing above expected ranges, a proportion of the difference between actual and expected performance is calculated providing the estimated energy and carbon savings that are realistically achievable.

Where a building is performing below expected ranges, a proportion of expected energy savings is still calculated (albeit to a lesser extent) as it is recognised that energy benchmarks include old, inefficient buildings reflective of the overall building stock.

This does not involve detailed design work, which is considered at a later stage. However, if specific plant or systems are known to be inefficient/at end of life we are able to adjust the benchmarking calculations to recognise the increased availability of energy savings.

3.1.2 Capital expenditure

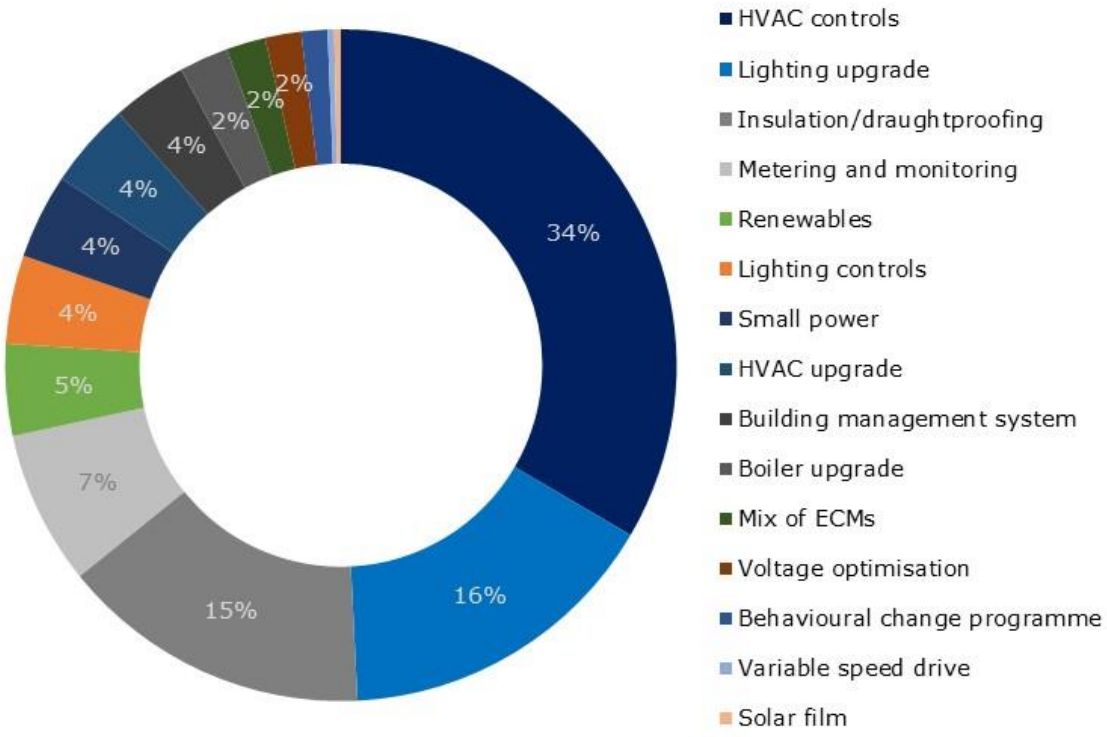
Through Turner & Townsend's experience of implementing energy conservation measures we have compiled an extensive database of project costs from the supply chain. With over 3,000 individual energy conservation measures, across a wide range of technology types, we are able to calculate the capital expenditure required to mitigate one tonne of carbon dioxide according to building type (e.g. school, office, leisure centre etc.).

Having established estimated carbon savings (Section 3.1.1); average capital expenditure costs can be applied to each building to establish the total indicative capital expenditure.

It is important to emphasise that estimated capital expenditure is based on a blend of energy efficiency measures (see Figure 5). This has the benefit of taking into account technologies with both short and long term payback periods providing flexibility during the later design stage.

Capital costs quoted in this report are at current day prices. This excludes preliminaries, VAT, client adviser fees and any specific client contingency/functional costs.

Figure 5 - Typical energy conservation measures implemented in EnPCs



3.1.3 Return on investment

Having calculated estimated energy savings and estimated capital expenditure, individual utility unit rates (£/kWh) for each building are used to calculate the maximum return on investment.

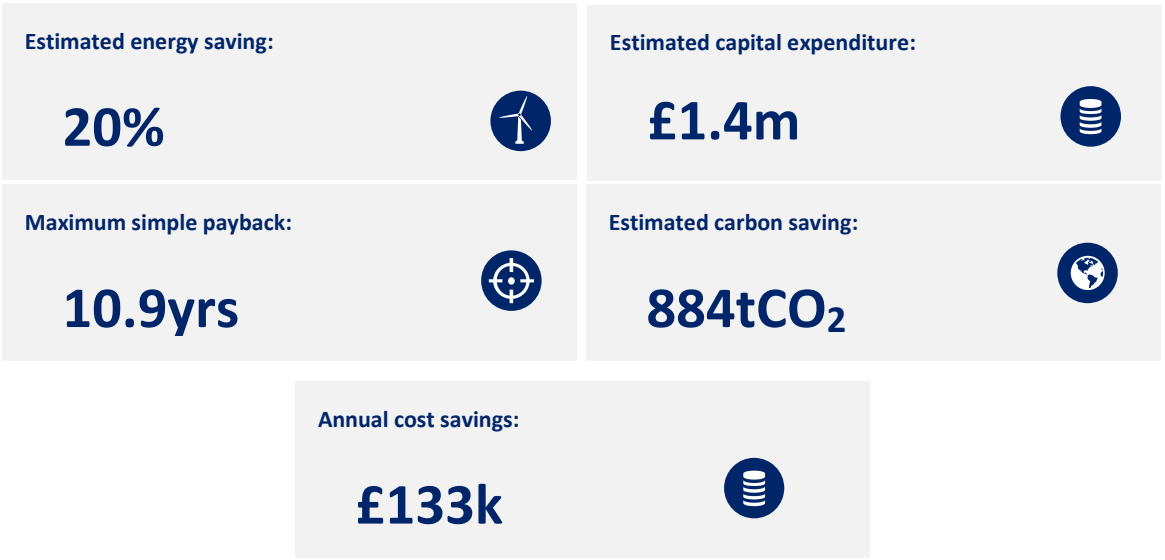
As the maximum return on investment is directly linked to utility unit rates, organisations with low energy unit rate costs tend to experience longer payback periods compared to those that pay relatively more for energy

3.2 Benchmark result

This analysis sets the business case criteria, guiding tendering framework contractors by providing minimum performance standards.

The results of this analysis are provided below.

Figure 6 - Benchmarking output – Edinburgh College



Minimum estimated energy savings are expected to be 20% when comparing current performance against 'typical' building performance benchmarks. In financial terms this equates to a minimum annual saving in the region of £133k against an estimated capital expenditure of £1.4m. This equates to a maximum payback period of 10.9 years.

Figure 7 and Figure 8 present building level benchmarking results separately by electricity and heating fuel energy consumption with actual energy consumption (kWh/m2) expressed as a percentage difference against benchmark energy rates (shown by the y-axis). Poorly performing buildings are above the 0% line and are found towards the left side of the graph. This highlights that there is greater scope to invest and make savings. Better performing buildings will be below the 0% line (i.e. they are performing under the benchmark rate) and are found towards the right-hand side of the x-axis.

The size of each bubble represents the energy spend for the given fuel type e.g. the larger the bubble, the more significant the energy spend.

Figure 7 - Edinburgh College – Electricity comparison to benchmark

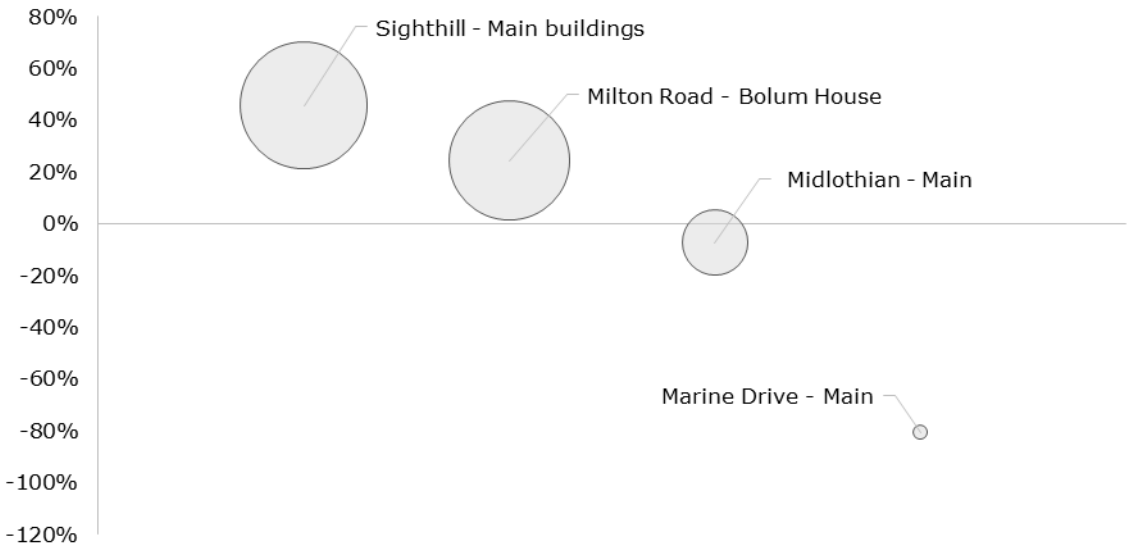
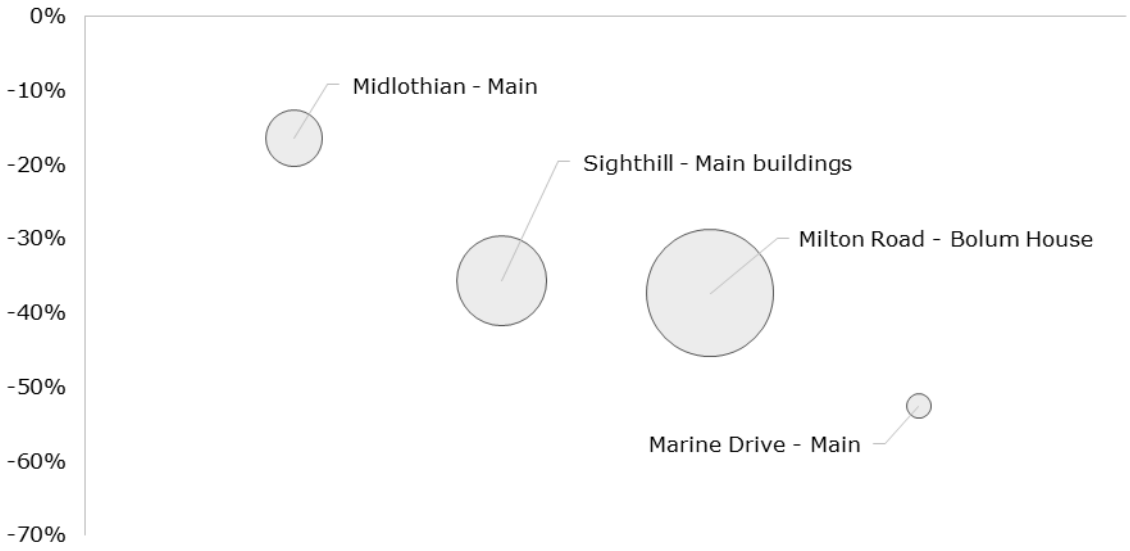


Figure 8 - Edinburgh College – Heating fuel comparison to benchmark



The savings potential at Bolum House has been increased to reflect the opportunity for energy savings given the age of boiler plant and the opportunity for a combined heat and power engine or decentralised heating system.

Table 2 shows current building energy consumption (kWh/m2) for both electricity and heating fuel and the percentage energy savings that can be expected to be achieved.

Table 2 – Edinburgh College – Current performance and estimated savings

Campus	Building	Current (kWh/m²) Electricity	Current (kWh/m²) Heating fuel	Estimated energy savings (%)	Comments
Sighthill	Main buildings	[redacted]	[redacted]	15%	Includes Creative and Sports Hall
Sighthill	Creative				
Sighthill	Sports hall				
Milton Road	Bolum House			24%	Includes Club
Milton Road	Club				
Midlothian	Main			16%	
Marine Drive	Main			11%	

4 Project Register

The Project Register is defined for each of the properties within the Edinburgh College estate and is presented in Appendix 7.

Table 3 contains a description of the key heading within the Project Register.

Table 3: Description of key headings in the Project Register

Identifier		Description
ECM Category		Numerical code identifier of the energy conservation measure (ECM) group.
Description of ECM		Identification of the potential energy conservation measure (ECM) that, based on energy data from the College and site visits, could contribute to a reduction in energy demand.
Notes		Additional notes describing the ECM and relationship to other building maintenance factors that should be considered.
Utility		Identification of which utility is principally affected by the energy saving measure (gas, electricity, oil, water, telecoms)
Savings	Cost (£)*	Energy cost savings will include variable costs only[1].
	Energy (kWh)	The estimated energy saving per year will be presented resulting from the ECM.
	Carbon (tCO2e)	The resultant carbon saving should be presented based on 2015 carbon intensity figures.
Capital Cost (£)		The capital cost of the implementation of the ECM is presented.
Payback (Years)		The simple payback is calculated based on the capital cost and cost savings identified above.
Salix Persistence Factor		This should be presented based on the most recent set of performance factors published by Salix. The SPF takes into account the expected life of the installed product and the potential loss of savings due to poor maintenance and gradual degradation.
Year of Implementation		The Project Register will include a projection of the year that measures will be implemented. This can also be used retrospectively as a register of when ECMs were implemented.

[1] A breakdown of energy costs will be appended for each ECM, showing fuel unit costs, TUoS and DUoS charges, climate change levy, CRC, feed in tariff, renewable heat incentive and VAT where this is non-reclaimable by the Colleges.

The selection of individual ECMs will depend on the capital cost and the resulting economic savings which will come from reduced energy use resulting from the installation of ECMs. There will also be a resultant Carbon emissions saving that will offer a cost saving to the building owner. The economics and the payback for the investment is calculated based on the capital cost and cost savings identified above.

The Project Register identifies a list of potential ECM that were identified as a result of the site visits. These are presented as a register of potential ECMs that can be taken forward to deliver energy savings. The list is not limited and other measures can be added.

The Project Register in Appendix 7 has identified a series of measures including installation of on-site renewable energy, fabric energy efficiency measures and draught proofing, reduction in electricity demand through low carbon fittings and voltage management and building management upgrades and improved metering.

The Project Register further identifies the potential for replacement boilers at Sighthill and Milton Road in the short term and at the Midlothian Campus at the end of the lifetime of the boilers.

It should be noted, however, that these replacements should consider the role of communal or district heating for these campuses as well as the wider community. City of Edinburgh Council have set out a vision for district heating in their strategic energy action plan[1] (SEAP). Any replacement of existing boiler plant should be safeguarded for a future connection to a forthcoming district heating network.

1 http://www.edinburgh.gov.uk/info/20220/economic_development/544/sustainable_economy/2

5 Energy Conservation Services Register

The energy conservation services (ECS) is a list of required interventions that require non-physical works to measure energy savings. Some of these services may result in direct or indirect energy savings.

The purpose of the ECSs are to ensure that energy conservation is prioritised. The list is not limited and other measures can be added.

The requirement of each Energy Conservation Service depends upon the type of Energy Conservation Measure selected and at what location it will be implemented, as such this section of the report details each of the ECS however the requirement for each of these services should be developed upon the development of the Investment Grade Proposal through the NDEE Framework process.

5.1 Measurement and Verification

Measurement and verification will involve the production of reports by the contractor will quantify the effect of ECMs against the baseline. The real measurement will be compared to the forecast of energy usage including the effect of the deployment of ECMs and ECSs. The measurement and verification is required at a building or campus level and will include the following steps:

- Establishing and agreeing the baseline
- Defining a forecast of predicted performance
- Measurement and verification of the performance of the combination of ECMs at agreed frequencies

5.2 Bureau Service

The energy performance can be enhanced with better data collection, remote monitoring and control of the system. Installation of meters and sub-meters are recommended to allow enhanced quantification of energy demand and impacts on the performance of ECMs. The Edinburgh College Campuses will benefit from an automatic meter reading system and control of energy use through a building energy management system (BEMS).

5.3 O&M Manuals and Training

The building O&M manuals will require updating with details of ECMs.

Training of the facilities management team is required from the Contractor in all building upgrades to achieve best practice application of ECMs.

5.4 Maintenance Requirements

The installation of ECMs will require commissioning to demonstrate the improved energy performance. Ongoing specialist maintenance support will be required in accordance with manufacturer's requirements and in agreement with Edinburgh College facilities management team. It is likely that photovoltaic installation and CHP, biomass or gas boiler replacements will require specialist operation and maintenance support.

5.5 Lifecycle

The lifecycle replacement of proposed ECMs should be documented in the O&M manual. This should highlight the service frequency in terms of fixed maintenance periods or preventative maintenance based on fixed run hours. It should also document the anticipated lifecycle replacement period of ECMs or critical components with shorter lifetimes.

5.6 Behaviour Change

Significant energy efficiency is achievable through a positive attitude and behaviours. This may include training of the facilities management team to deliver high standards. It will also require energy efficiency is a priority to all building occupants, both students & staff.

Publicity and promotional materials directed at staff, students and visitors may form part of the ECSs to clearly explain how basic actions could offer benefits to the College.

6 Summary of Buildings and their Services

This section provides a brief description of each building and their main services. The buildings differ in construction material which is listed below:

- Sighthill Campus - Variable typical of 70s construction with many additions.
- Milton Road – The Club - Brick/Block and Stone Walling
- Milton Road – Bolum House - Built in 1972
- Midlothian - Brick/Block and Stone Walling
- Marine Drive - Timber Construction, facing brickwork, built up felt roof, brick

Marine Drive is currently under construction at the moment so no access was permitted.

The following table details the buildings survey and some general information about each of them. Information is only shown below for the buildings surveyed.

Table 4 - General Details of the Buildings

Building	Floor Area	Orientation	EPC Rating
Sighthill Main buildings	22,713m^2	East	E (64)
Sighthill Creative Arts	included above	East	E (64)
Sighthill Sports Hall	included above	East	E (64)
Milton Road Bolum House	19,515 m^2	North	D (46)
Milton Road Club	included above	North	C (42)
Midlothian	7,500 m^2	North	C (45)

Due to the varying age of each of the buildings some of these differ in construction type. Details can be found in the Appendix 6 checklist. The following sections provide a summary the building services of the buildings on each site that were visited over the two days.

6.1 Sighthill Campus

There are 3 buildings at the Sighthill Campus two of which were constructed after 2006 so are fairly new buildings. The main building is served from a large plant room located on the ground floor of the building. The plant room provides heating and hot water for the full Main Building with boilers around 12-15 years old. The domestic hot water is served via gas fired water heaters with one of these replaced in the last few years. Replacement pumps have been installed during the last few years. There is an existing BMS system in the plant room however minimal metering was found during site visit.

There are a number of existing air handling units in the existing building however due to health and safety reasons these were not accessible. However two new AHUs installed in 2013 were surveyed on the north building roof.

There is an existing cold water storage tank in the main building roof plant room that serves the main buildings as well as potable water for the Creative Arts Building.

There is an existing chiller plant in the building however it has not been operated in the lifetime of the FM Manager we spoke with.

6.1.1 Creative Arts Building

The creative arts building was constructed in 2006 and has a separate boiler and domestic hot water plant in a ground floor plant room. Boiler and pumps are all less than 15 years old and operate within normal parameters. The Music Box that forms part of this building is served from a new boiler installed in 2008. Hot water is by calorifiers.

6.1.2 Sports Building

The sports block was constructed in 2010 and has its own boiler plant with ground floor plant room housing gas boilers and calorifiers. This building has an element of cooling using external VRF units located outside the plant room. This building has a separate cold water storage tank on the 1st floor.

6.2 Milton Road Campus (Bolum House & Club)

There are two buildings at the Milton Road Campus, one of which was built in 2008, so is a fairly new building. However Bolum House was built in 1972 (refurbished in 2008). All the buildings are served by three Cochran gas fired boilers which are between 13 and 20 years old. The domestic hot water is served via gas fired water heaters with indirect hot water generators. There is an existing BMS which controls the boilers, pumps, AHUs, DHW, Extract fans and the CW booster set. Milton Road Club also has a heat exchanger from the pool heated system. Both buildings have air conditioning.

There are a number of existing air handling units in the building which were installed in 2008. These are all located on the roof.

There is a cold water storage tank on the roof which is fed from the mains. Milton Road Club has a rainwater harvesting tank.

6.3 Midlothian (Dalhousie Road Main)

Dalhousie Road Main was built in 2008. The building is served from a large plant room which houses four ACV combi boilers which are 8 years old. The hot water is served via gas fired water heaters with a combination hot water cylinder. There are two separate BMS panels, one of which controls the pumps, UFH, rain water harvesting, boilers, pressurisation unit, workshop vent, gas protection/leak detection/CO2. The other controls the Air handling units and the domestic hot water.

There are two Samp air handling units which are located on the roof. The air handling units are 8 years old.

There is a cold water storage tank on the roof which is gravity fed with a rain water harvesting unit.

6.4 Marine Drive

As previously noted, this building is currently under construction so no access was permitted.

Detailed site visit checklists for each of the buildings at Edinburgh College can be found in Appendix 6.

Appendix 1 - Building Drawings

Appendix 2 - Condition Register

Appendix 3 - Carbon Management Plans

Appendix 4 - Asbestos Survey Reports (also available on site)

Appendix 5 - Building and Energy Data Sheet

Appendix 6 - Site Visit Report

Appendix 7 - Project Register