Borders College

Authority Data Pack Report
for
Scottish Funding Council

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Scottish Funding Council

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1 Executive Summary 2
2 Baseline Information 5
3 Authority's Minimum Requirements 7
4 Project Register 12
5 Energy Conservation Services 14
6 Summary of Buildings and their Services 16
Appendix 1 - Building Drawings and Site Plans 18
Appendix 2 - Carbon Management Plan & Carbon Trust Report 19
Appendix 3 - Asbestos Survey Reports 20
Appendix 4 - Hawick H&S File 21
Appendix 5 - SHARC System Details 22
Appendix 6 - Building and Energy Data Sheet 23
Appendix 7 - Site Visit Report 24
Appendix 8 - Project Register 25

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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 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 Borders 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 3 but in summary it is estimated that an energy saving of **17%** is possible at the College, equating to a saving of **123tCO_2**, using a variety of ECMs requiring an estimated capital expenditure of **£197k** with a maximum payback period of **8.2 years** with an annual saving of approximately **£24k**.

Estimated energy saving:

17%

Estimated capital expenditure:

£197k

Maximum simple payback:

8.2yrs

Estimated carbon saving:

123tCO_2

Annual cost savings:

£24k

To ensure the robustness of the Desktop Energy Assessment site surveys were carried out at each of the sites within the Border'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. Examples of the projects the College is considering are installation of biomass boilers, installation of sub-metering and insulation of pipework.

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 in Table 1 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 Borders College can be identified within Appendix 8 of this report.

2 Baseline Information

The Borders College currently consists of 3 campuses: Hawick, Newton St Boswells and the main campus at Galashiels.

Scottish Borders Campus in Galashiels is by far the largest Campus and is currently occupied by BC and HWU (Heriot-Watt University), there are 3 buildings on site.

- Main Building- the largest building on campus with a GIFA of 14,290 m^2. The building was constructed in the 1960s and refurbished and extended in 2008. The building is owned by BC but shared occupancy by BC (4,421 m^2 BC exclusive) and HWU (2,979 m^2 Exclusive) with the remaining 6,890 m^2 shared teaching and circulation space.

- The Technical Training Centre (TTC) is owned and solely occupied by BC, 856m2, built in 1980's with a refurbished and extended in 2007.

- The High Mill (3,877 m^2) is solely owned and occupied by HWU and for the purposes of this exercise has been omitted.

- The campus has recently installed a heat recovery system (SHARC Energy) which is in its final stages of commissioning

Newtown St Boswells Campus is solely occupied by BC, it consists of two buildings totalling 531m2.

- The reception, social space and workshop building was constructed in the 1980s and refurbished in 2012.

- The main teaching block is a two storey modular building constructed in 2006 and extended in 2012.

Hawick (1,064 m2), Campus consists of a single two storey building solely occupied by BC and constructed in 2007.

The College is currently also currently working to secure a property at Tweedbank (3,716 m2) from which to deliver engineering and land based subjects, in the long-term replacing Newtown St Boswells. The building was constructed in the mid-90s.

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

Figure 1 – Hawick main social area, air heating at Newton St Bosswells and hallway at Galashiels

Site specific information presented within this authority data pack was gathered through site visits carried out on the 16th 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.

The following information is available as appendices to this report:

Appendix 1 – Building Drawings and Site Plans

Appendix 2 – Carbon Management Plan and Carbon Trust Report

Appendix 3 – Asbestos Survey Reports

Appendix 4 – Hawick Health and Safety File

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

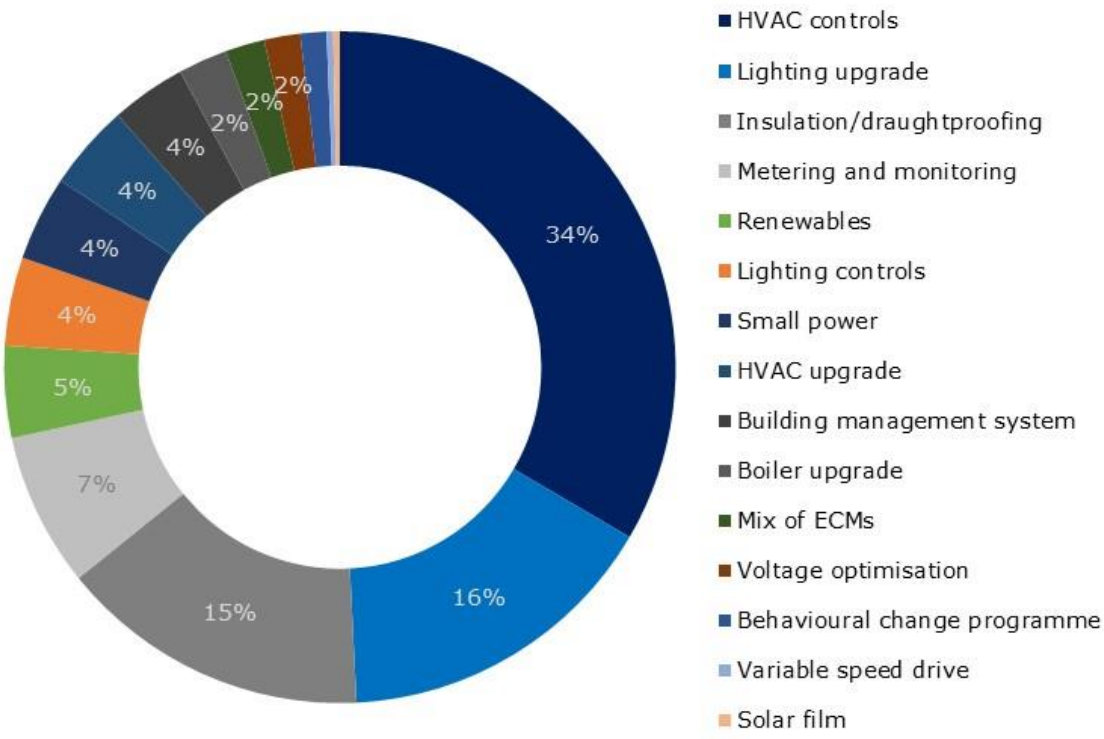
Through Turner & Townsend's experience of implementing energy conservation measures we have compiled an extensive database of project costs from the supply chain. With over 3,000 individual energy conservation measures, across a wide range of technology types, we are able to calculate the capital expenditure 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 2). 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 2 – 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.

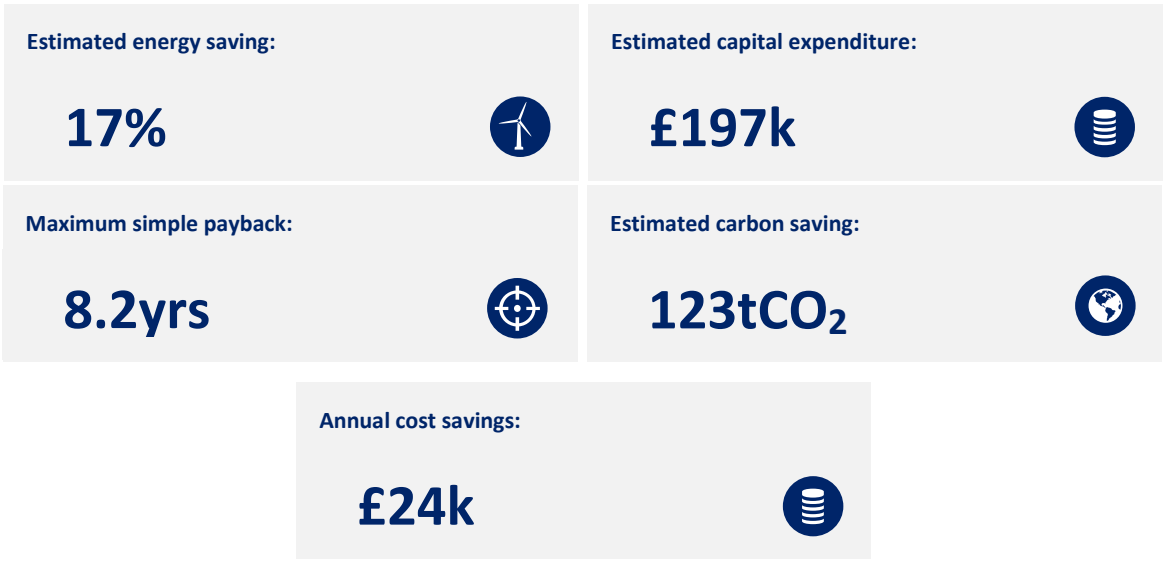
As the maximum return on investment is directly linked to utility unit rates, organisations with low energy unit rate costs tend to experience longer payback periods compared to those that pay relatively more for energy

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 3 – Benchmarking output – Borders College



Minimum estimated energy savings are expected to be 17% when comparing current performance against 'typical' building performance benchmarks. In financial terms this equates to a minimum annual saving in the region of £24k against an estimated capital expenditure of £197k. This equates to a maximum payback period of 8.2 years.

Figure 4 and Figure 5 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 4 - Borders College – Electricity comparison to benchmark

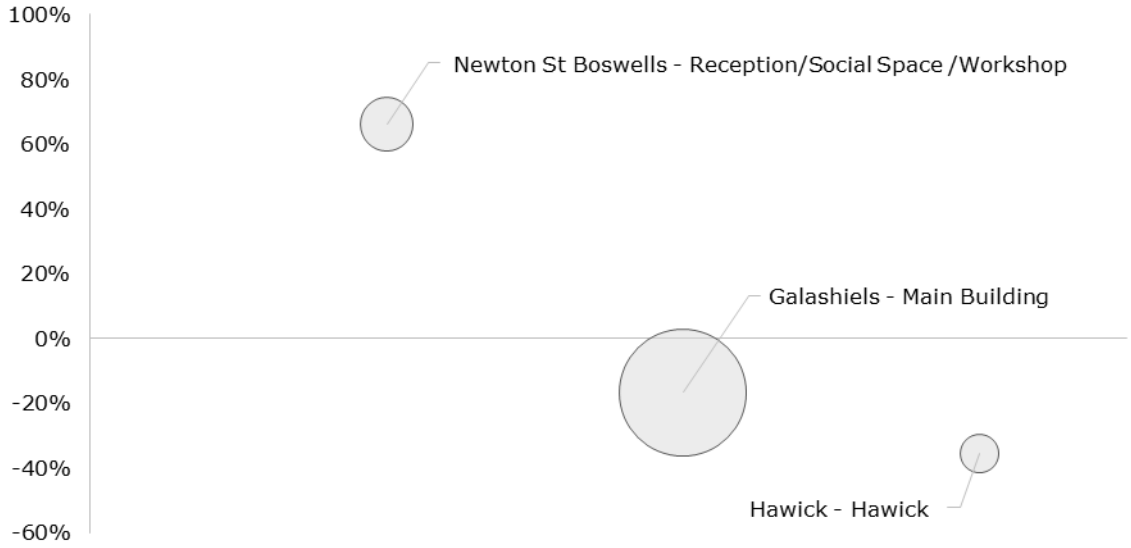


Figure 5 – Borders College – Heating fuel comparison to benchmark

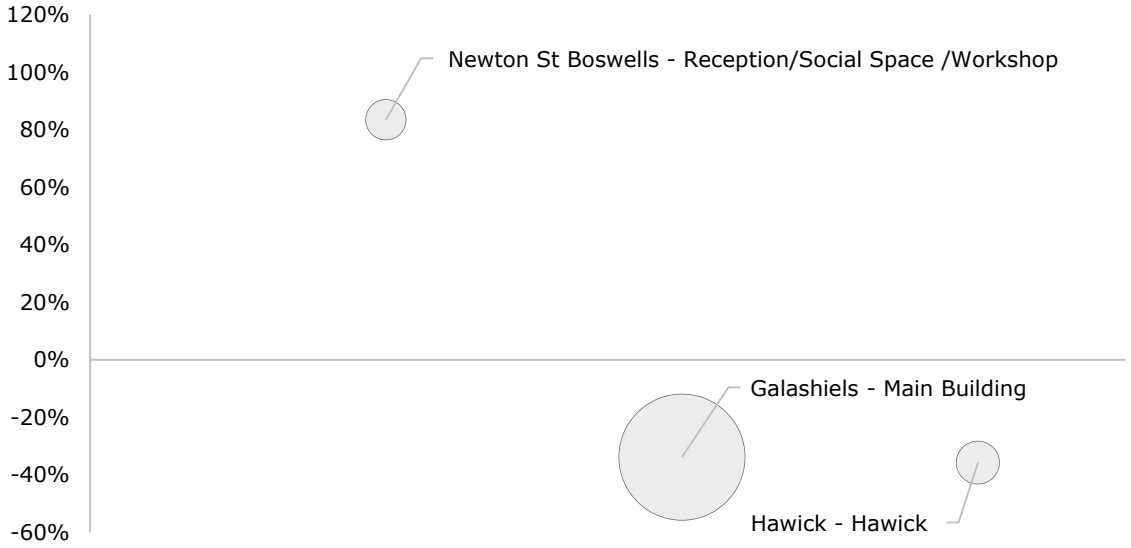


Table 2 shows current building energy consumption (kWh/m2) for both electricity and heating fuel and the percentage energy savings that can be expected to be achieved.

Table 2 – Borders College - – Current performance and estimated savings

Campus	Building	Current (kWh/m²) Electricity	Current (kWh/m²) Heating fuel	Estimated energy savings (%)	Comments
Galashiels	Main Building	[redacted]	[redacted]	15%	Includes Technical Training Centre
Galashiels	Technical Training Centre				
Newton St Boswells	Reception/ Social Space /Workshop			32%	Includes Teaching Block
Newton St Boswells	Teaching Block				
Hawick	Hawick			13%	

4 Project Register

The Project Register is defined for each of the properties within the Borders College estate and is presented in Appendix 8.

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 8 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 boiler plant at the end of the lifetime of the existing system. The Galashiels campus is currently supplied with heat from a sewer heat recovery system.

It should be noted, however, that boiler plant replacements should consider the role of communal or district heating for these campuses as well as the wider community. Consultation with Scottish Borders Council is recommended so that the heating system is safeguarded for a future connection to any forthcoming district heating network.

5 Energy Conservation Services

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 Borders 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 Borders College facilities management team. It is likely that the sewer heat pump system that is operating at Galashiels will require specialist operation and maintenance support. In

particular any replacement biomass or gas boiler installation and photovoltaic panels may require specialist O&M services.

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 and 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 Colleges.

6 Summary of Buildings and their Services

This section provides a brief description of each building and their main services.

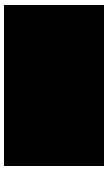
The buildings differ in construction material which is listed below:

- Galashiels Main Building – Concrete block, flat roof, extension steel portal
- Galashiels Technical Training Centre – Steel with concrete block
- Hawick Campus – Steel frame with blockwork
- Newtown St Boswells (Reception/Social Space/Workshop) - Steel portal and metal cladding
- Newtown St Boswells Teaching Block – Modular steel

All the buildings are located in a small urban area close to other buildings.

The U-values for building elements for each building are shown below:

- Construction: Walls U-value
- Construction: Windows U-value
- Construction: Roofs U-value



The table shows some general details of the buildings.

Table 4 - General Details of the Buildings

Building	Floor Area	Orientation	EPC Rating
Galashiels Main Building	14603m2	South West	D (53)
Technical Training Centre	2188m2	East	N/A
Hawick	1064m2	North West	C (32)
Newtown St Boswells Reception/Social Space/Workshop	531m2	South East	N/A
Newtown St Boswells Teaching Block	531m2	South East	N/A

All building except those at Newtown St Boswells which are heated via oil-fired boilers, are heated via gas boilers and radiators with cooling provided via split cooling systems.

The mechanical equipment such as boilers, hot water cylinders and air handling units have not been replaced since 2007/2008 making them around 8 years old. The oil-fired boilers at Newtown St Boswells are approximately 10 years old.

The buildings are a mixture of natural ventilation and mechanical ventilation where required with dedicated cooling to Comms Rooms where present. Window openings are top hung (except for Hawick where there is a mixture of top and side hung) with restrictors on lower windows.

Generally the equipment in the buildings (excluding Newtown St Boswells) was in good condition and operating within normal parameters. However the oil-fired boilers at Newton St Boswells are not in the best condition, with the FM hoping for a refurbishment in the next 1-2 years.

Detailed site visit checklists for each of the buildings at Scottish Borders College can be found in Appendix 7.

Appendix 1 - Building Drawings and Site Plans

Appendix 2 - Carbon Management Plan & Carbon Trust Report

Appendix 3 - Asbestos Survey Reports

Appendix 4 - Hawick H&S File

Appendix 5 - SHARC System Details

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