XXXXX COMMUNITY BUILDING ENERGY AUDIT AND RENEWABLE ENERGY OPTIONS APPRAISAL

Supported by the WEA North East Green Branch with funding from the Northern Powergrid Community Energy Seed Fund

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1. Introduction

1.1 This template report has been prepared on behalf of the WEA North East Green Branch (WEA). The template report has been compiled by Ewan Boyd of Green Community Buildings CIC (GCB).

1.2 The purpose of the template report is to provide an example report and to demonstrate a standard approach to assessing existing energy usage and current carbon emissions data within a community building, including how to identify relevant steps that can be taken to promote energy efficiency and (where applicable) assess renewable energy options.

1.3 The template report is based on an actual site audit, amended so as to remove references that can identify the specific site while retaining the outline of the audit and report structures. The intention is that other community groups can use the template to help specify and/or complete their own energy audits.

1.4 Further details can be provided by Green Community Buildings CIC (GCB). Please contact Ewan Boyd on 01833 640327.

1.5 Use of this template and associated audit methodology is encouraged, with the proviso that Green Community Buildings CIC is referenced in the following manner;

“This audit and report have been compiled in accordance with the community building energy audit and renewable options appraisal methodology developed by Green Community Buildings CIC.”

1.6 A site visit for the example community building was conducted on x July 2015.

2. Characterisation of the Usage Level of the Hall and Relevant Additional Factors

2.1 *Community Building X* lies within an urban setting within a suburb of x. The building is not listed¸ although the entire site lies within a Conservation Area.

2.2 The Conservation Area designation is important as this may affect the ability to explore renewable energy opportunities, such as photovoltaic (PV) panels. While x City Council planning policy SD1.4 promotes the introduction of PV panels on appropriate buildings, this may not apply in Conservation Areas.

2.3 *Community Building X* is a sports club with club house, and consists of a pitch area, with low level stands and seating areas around the playing field, with a two storey pavilion and changing rooms located on XXX Avenue at the north east corner of the pitch. The pavilion includes a bar, alongside upstairs changing rooms and showers, along with a variety of committee rooms and function suits.

2.4 The building is in regular use throughout the year, particularly the bar, but is used for sports only between April – September when the changing rooms are in regular use. For the purposes of this audit this hall has been characterised as a 'High' usage community building. *[GCB CIC have developed a usage categorisation for community buildings based on average occupancy hours. This is used as part of the GCB Community Buildings Energy Comparison Benchmark service, providing a simple method to compare energy consumption between different community buildings].*

2.5 The centre relies on a volunteer management with a paid Site Manager and ancillary staff. The structure of the management company is understood to be undergoing significant change, but this is not thought to represent a critical change in relation to energy management.

2.6 The building is understood to be owned by ……..

2.7 There are plans for some redevelopment of the building, with a range of improvements planned. The committee is keen that these take account of necessary steps to reduce energy consumption.

3 Description of Building & Construction

3.1 The building was constructed in 1963. Construction is of brick infill within a reinforced concrete structural framework, with a flat roof. Given the period of construction the walls will be of cavity design, although parts of the upper level appear to be of single course brickwork.

3.2 The building is on two floors, with the main two storey section forming a rectangular footprint, with the main façade facing the playing area to the south west. The single storey bar extends to the southeast.

3.3 The building consists of a small entrance lobby, with the Pavilion Suite function room leading off to the left and the bar and kitchens up a small flight of stairs to the right. A stair well to the upper level comes directly from the entrance lobby area, leading to the changing rooms, shower area and small committee room and office.

3.4 The approximate internal area of the building is around 500m^2.

3.5 Windows were varied in type and quality. New uPVC double glazing was present along the north eastern façade, but the windows facing the playing area are mostly original single glazed, with wood frames in the Pavilion Suite and metal frames in the bar. Due to the requirements that the playing area can be viewed from the pavilion, these windows tend to be large, with sliding doors or large opening panes present in several parts of the building.

3.6 Externally the brickwork generally appears to be in a reasonable state of repair and generally well maintained,

3.7 The site visit was conducted at 9.30pm in the morning, on a warm and still day. The building was vacant during the visit.

3.8 Internally, the ground floor has suspended panel ceilings in most areas, including the bar and the Pavilion Suite. These are also in place in the upper level where in places the roof panels are in poor repair. The condition of the flat roof is not known, but it is not thought that there is sufficient roof insulation within the original structure.

3.9 It was not possible to inspect the roof externally, but it is understood to be the original felt flat roof construction. There are some doubts regarding the structural elements of the roof and it is unknown whether the roof is sufficiently robust to tolerate solar panels.

4 Current Energy Usage, Cost & Carbon Emissions Assessment

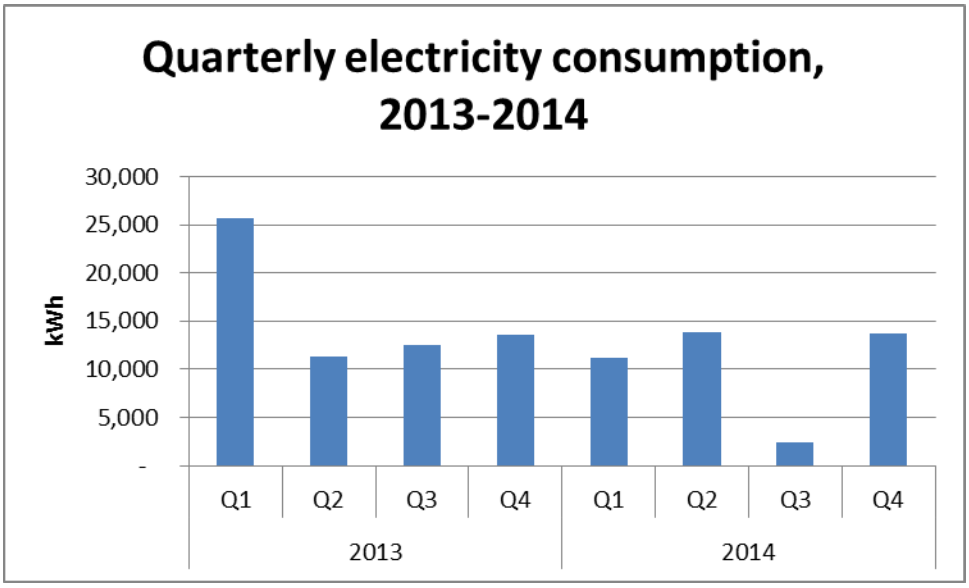
4.1 Quarterly billing data was provided for gas and electricity from December 2012 to – November 2014. Consumption data was based on meter reading schedules within billing data, so total kWh consumption for the period was available and is largely thought to be accurate at the annual scale.

4.2 The billing data, however, was often based on estimated readings, with some periodic corrections and alterations to the day of reading, which means that the detailed quarterly totals may be considered as less accurate.

4.3 It should also be noted that 'Quarter 1' operates from December – February inclusive, 'Quarter 2' from March – May etc, and so billing quarters do not represent strict calendar quarters.

4.4 The billing data indicates a high but relatively stable electricity consumption, with most quarters being within 11,000 – 13,000kWh (see Figure 4.1). Q1 2013 at 25,710kWh and Q3 2014 appear to be anomalies caused by estimated reading corrections.

Figure 4.1 Quarterly electricity consumption 2013 - 2014



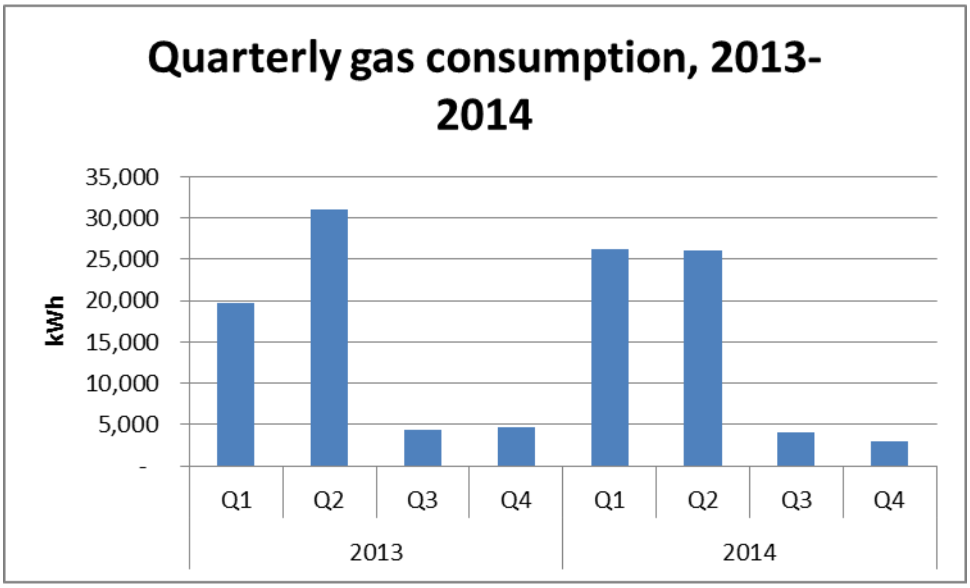
4.5 There is little discernible seasonal pattern, which may be due to the fact that parts of the building are unused outside the main sports season, possibly offsetting increased demand elsewhere in the building.

4.6 Total annual electricity use was 65,123kWh in 2013 and 43,037kWh in 2014. There is no known operational explanation for the large fall in consumption, but it is suspected that the high 2013 figure is boosted by the abnormally high Q1 reading, which is thought to be a correction of earlier underestimations.

4.7 Gas billing data suggests a somewhat unexpected pattern, with high usage in quarters 1 and 2 in both years, and significantly reduced usage in the second half of the year (see Figure 4.2).

4.8 The high usage in Q1 for both years (19,773kWh and 26,230kWh) is consistent with high heating in the Dec – Feb winter period, but the lowest quarterly total is Q4 2014 at 2,935kWh and both years have high consumption for the second quarter. This latter finding is probably related to increased use of the sports facilities in the March – May period, and other anomalies may be related to varying usage patterns or estimated readings and subsequent corrections.

Figure 4.2 Quarterly gas consumption 2013 - 2014

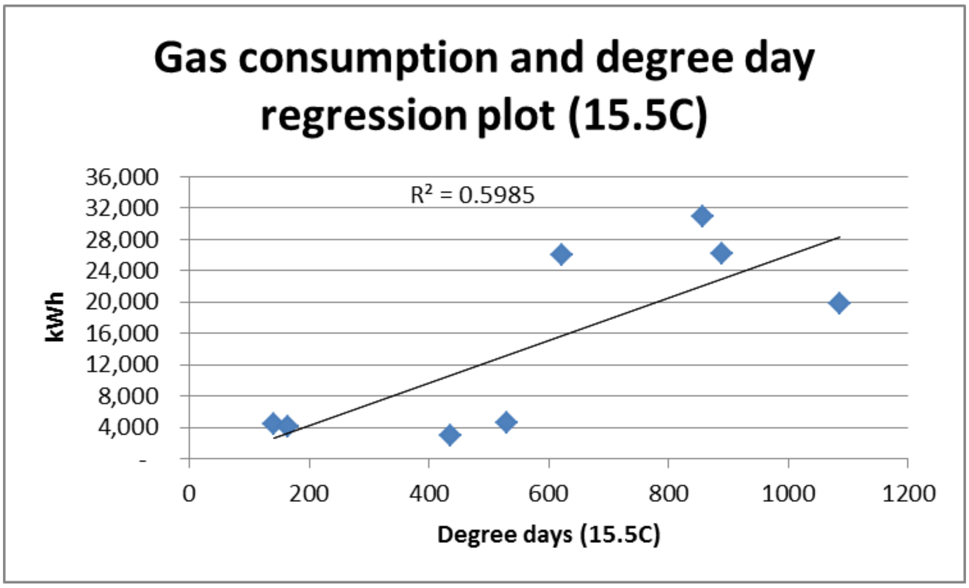


4.9 Total annual gas consumption was remarkably stable at 59,829kWh and 59,810kWh for 2013 and 2014 respectively.

4.10 An analysis of ambient temperature conditions over the period, using degree days, was conducted to test the correlation of the gas consumption to the weather. Degree Days are a standard measure of daily maximum and minimum temperatures, usually using a baseline of 15.5C above which it is assumed heating is not required. Each day's minimum and maximum temperatures are subtracted from the baseline temperature and divided by two to give a daily degree day score, with higher degree days representing colder temperatures. Daily degree days are aggregated over a given timescale.

4.11 Figure 4.3 below shows gas consumption plotted against degree days. This shows a weak relationship with energy consumption rising with cooler conditions (higher degree days).

Figure 4.3 Quarterly gas consumption against degree days 2013 - 2014



4.12 This analysis shows the relationship between ambient temperatures and heating consumption is not particularly close. Figure 4.3 is a regression plot where the R^2 value represents the level of correlation between the degree day and kWh variables. A value of 0 represents no correlation at all and 1 represents a perfect correlation. The closer the R^2 value is to 1 the greater the explanation of gas consumption by degree day levels and in this case, $R^2 = 0.5985$ suggests the correlation is weak, with weather conditions accounting for barely over half of the gas consumption variation.

4.13 This may be largely explained by the seasonal nature of the activity within the building, and care must also be taken given the possibility that readings have been distorted by periodic estimates.

4.14 The combined energy consumption data suggests a total annual consumption (gas and electricity) of 124,952kWh in 2013 and 102,847kWh in 2014,

4.15 Using a standard carbon multiplier of 0.54kgCO_2/kWh for the UK electricity supply and 0.19kgCO_2/kWh for gas the total CO_2 emissions for the hall are in the region of 35,000kg pa (35.0 tonnes) in 2013 and 23,000kg in 2014.

4.16 These energy figures suggest an energy consumption benchmark figure of between 249.9kWh/m^2/pa in 2013 and 205.6kWh/m^2/pa in 2014. Using community building energy benchmark data developed by Green Community Buildings CIC, this has been compared against regional benchmarks for community buildings.

4.17 For High usage community centres of this type, the average benchmark figure is 147kWh/m^2/pa. It therefore appears that *Community Building X* is an exceptionally high energy user.

4.18 Care should be taken, however, in interpreting this benchmark. Within the GCB database, sports clubs are underrepresented, and the daily use of the bar is likely to create a higher natural level of demand.

5 Energy Efficiency Assessment

5.1 The property displays a number of efficiency issues. In terms of the building fabric, the uninsulated walls will add standing heat losses, which could be mitigated with cavity fill insulation if this was possible.

5.2 One concern regarding cavity infill is whether the use of blown fibreglass infill material could lead to excess moisture build up within the cavity, with possible moisture transfer to the inner wall leaf.

5.3 There is increasing evidence that the blown mineral fibre method employed by most cavity wall insulation installers can lead to significant moisture retention problems, alongside limited effectiveness due to settlement, dampness and the inability to spread the infill material fully causing cold spots. If the overall result of the insulation increases internal temperatures, this causes the internal air to carry more moisture, which can then condense out onto any remaining cold spots, causing internal mould issues.

5.4 While cavity treatments are potentially possible, the relative proportion of the exterior that is cavity brick is limited, with the result that cavity treatments are likely to have little bearing on heating costs in relation to other more cost effective measures.

5.5 On the upper level, where there is single skin brick in places, a more appropriate thermal treatment would be dry lining. There are various methods available, but in this case, given the lack of cavity, there is a strong likelihood of moisture transfer through the single brick skin. While the brick is expose internally, any moisture will evaporate, enabling the wall to dry out, but if types of dry lining that fix directly to the wall are adopted, such as ‘dot and dab’ insulated plasterboard, the moisture is likely to build up and transfer into the internal layer.

5.6 The only viable approach in such circumstances is for conventional dry lining with a separation gap between the existing and new sections, with sufficient ventilation allowed in the interstitial gap to prevent a build up of moisture.

5.7 This is the most expensive and disruptive form of internal insulation, and given that the upper level is only likely to be used in the sports season, when heating is often not required, it is thought unlikely at this stage that this would constitute a cost effective investment.

5.8 In those parts of the lower level under high levels of use and with cavity wall sections, dry lining, with ‘dot and dab’ 12.5mm foam insulation backed plasterboard sheets with skim finish may be worth considering. This would give a complete insulation to a high standard with minimal internal space loss and without risk of moisture transmission. However, it is thought likely that other investments should be prioritised with greater cost effectiveness.

5.9 Probably the most serious single issue regarding fabric heat losses relates to the large expanse of glazing on the south west façade. As previously noted, this is an essential function of a sports pavilion, and so a large glazed frontage is expected, which means that the glazing should really be of optimal thermal design. As with the solid wall issues, the glazing on the upper changing room level is of less concern than the lower level that is occupied and heated throughout the year.

5.10 The two main ground floor sections on the south west façade have different glazing types. The Pavilion Suite (see Figure 5.1) has floor to ceiling single glazing in a wooden frame, with four full height sliding doors.

5.11 Single glazing is clearly a major source of heat loss, and ideally the entire glazed area should be replaced with appropriate double glazed sections.

5.12 Even with high quality modern double glazing, standing heat losses through windows remain around five times greater than through well insulated wall sections, so this would still lead to relatively high heat losses and increased chances of overheating from excessive solar gain, given the large expanse of glass. If a major refurbishment is under consideration, one possibility is therefore to reduce the total glazed area.

5.13 One option that would allow this without impeding the view of the playing areas would be to fill the lower section of the façade with conventional insulated block wall, retaining the windows from approximately 1m height only.

Figure 5.1 Exterior view of Pavilion Suite (lower level)

5.14 This option could only be applied to the fixed windows, and would need to be designed in conjunction with any replacement doors. The existing sliding doors represent a very significant issue, as in common with many sliding door designs, there is an opportunity for large draft gaps to emerge between the sliding and fixed sections. Figure 5.2 shows one of the sliding doors with an extremely large distance between the sliding and fixed sections, while Figure 5.3 shows an internal detail of the ground level glazing.

5.15 It may also be worth considering how many doors are required in the Pavilion Suite, and whether a sliding or conventional hinged opening system is appropriate.

5.16 With four sliding doors currently, around half the total length of the room can be opened up. If this could be replaced with two patio style inward opening doors, with infill wall to rail height and double glazed units elsewhere, the amount of both fabric heat loss and drafts would be severely curtailed.

5.17 Windows in the bar area are also single glazed, but within metal framed windows. These are inherently energy inefficient, but an added problem commonly found in this type of frame is distortion over time leading to a poorly fitting closure mechanism (see Figure 5.4).

<u>Figures 5.2 and 5.3 Sliding door in Pavilion Suite showing excessive air gap and ground level glazing detail</u>

Figure 5.4 Metal window frames with gaps, bar area.

5.18 In winter, a simple secondary glazing layer is fitted, but ideally these windows should be replaced with modern double glazed units with adequate draft proof fittings.

5.19 A number of external doors were noted as having visible gaps that allow drafts to enter. All external doors should have properly fitted draught strip and bottom brushes as appropriate, with these being regularly checked and replaced as required.

5.20 Hinged flap draught excluders tend to provide the best performance for the bottom of doors in regular use, with simple brushes normally adequate for fire doors, while for the sides foam or screw on rubber strips are both suitable, with the precise version depending on the extend of the gap and type of door and frame.

5.21 Even well draught proofed doors will be heat loss sources, and consideration could be given to adding internal door curtains to all fire exit doors. This is an old fashioned but highly effective means of reducing heat loss, but the building managers should check that this would not create any fire and safety issues first.

5.22 The main entrance has an existing double door system creating an effective draught lobby into the first internal corridor. Both external and internal doors are operated by an automatic PIR based opening system.

5.23 It was noted that the entrance mechanism is set so both the internal and external doors open simultaneously, with a time delay of approximately 15 seconds before both doors close.

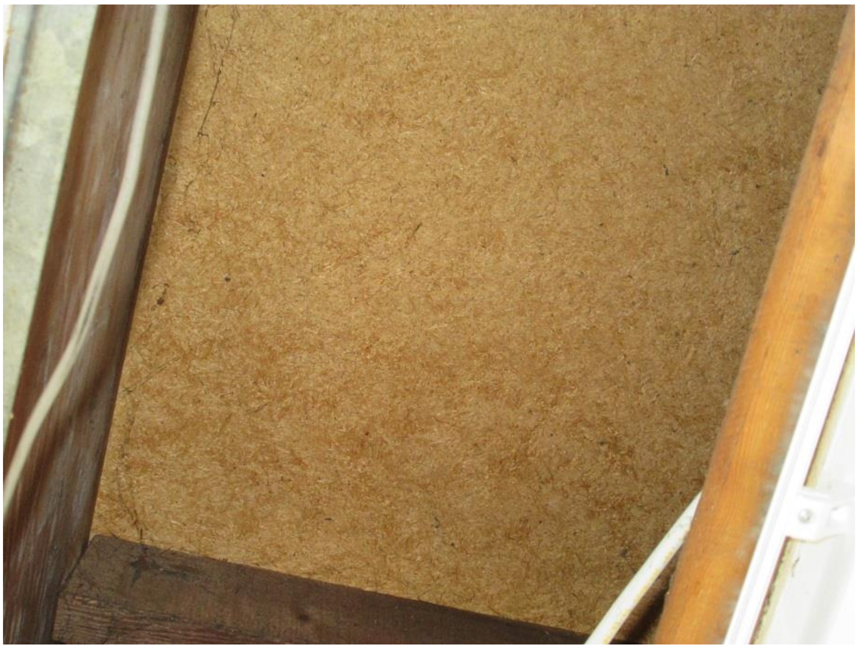
5.24 In effect, this simultaneous opening and lengthy delay before closing effectively negates the purpose of the draft lobby and allows large volumes of cold air to enter every time the entrance is operated. While a certain overlap between the external and internal door opening is unavoidable, ideally each door should be separately controlled, with a shorter delay before closing. In this way, when a person enters the building, the external door is opened while the internal door remains closed, with the internal door being opened as the person crosses the lobby, and the external door closing as soon as practicable to seal off the internal airspace.

5.25 The lobby area is also heated with a large radiator present. Ideally the temperature setting in the transit areas should be reduced to a minimal setting, with the objective that the lobby provides a transition area only from the fully heated zones to the outside.

5.26 The external rainwater goods and flashings looked to be in reasonable condition. Maintaining these in good order is of significance to energy efficiency, as leaks and drips creates wet walls that can transmit heat more effectively.

5.27 The presence and condition of roof insulation gives some cause for concern. Figure 5.5 shows an image of the main ceiling from the top of the main stairs, showing what appears to be the underside of the main roof structure through a broken internal ceiling tile. Given the construction date, it is unlikely that there is sufficient insulation incorporated into the roof structure itself, and there is no evidence of insulation within the internal ceiling layer either.

Figure 5.5 Underside of roof, top of stairs

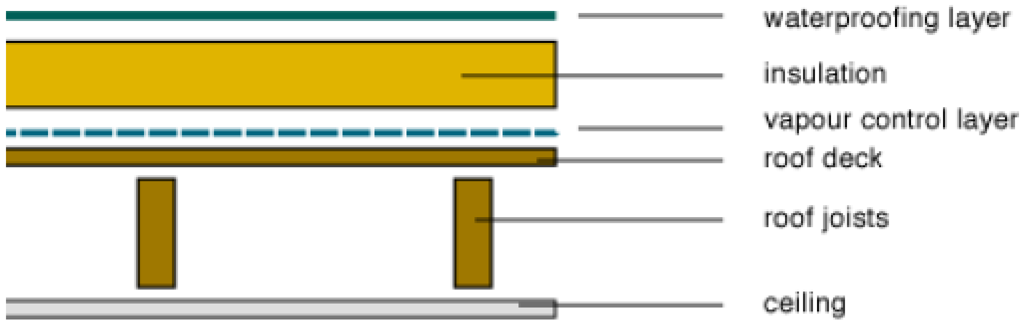


5.28 As previously noted, the upper level is not used extensively within the main heating season, so major spending on roof insulation may not be a cost effective use of resources. However, the proposed alterations will provide an opportunity to add insulation to those areas likely to be in more regular winter use, such as the meeting room and office. In these areas, some additional insulation would be helpful.

5.29 However, this may not be straightforward, as adding insulation from underneath a flat roof can lead to a cooling of the area immediately below the roof deck and therefore lead to excessive condensation. This can be reduced by applying a vapour proof membrane on the warm side of the insulation layer and allowing for ventilation between the insulation and the roof deck (known as a 'cold deck' flat roof) although the addition of extra ventilation can then lead to a loss of heat and this method is already banned under Scottish building regulations.

5.30 The alternative is to adopt a 'warm deck' approach, where insulation is added to the external roof area (see Figure 5.6).

Figure 5.6 Example 'warm deck' insulation



5.31 The difficulty with this approach is that it requires the roof to have sufficient strength to accept the load as well as the access required, and this solution is also difficult to apply in small sections, with insulation of the entire roof area more appropriate.

5.32 It may be possible to consider some internal insulation above those areas in regular winter use, but more detailed advice should be sought from an architect before making any firm decisions.

6 Heating and Hot Water Systems

6.1 The building has a generally varied occupancy regime, with the bar area having extended regular operating hours while other parts of the building are in less regular use. This creates a need for flexible heating in different parts of the building.

6.2 The objective must be to develop a heating system that can be fast acting and highly responsive to changing usage requirements, which can be managed to vary heating output in different parts of the building as occupancy changes through the day. In this building, the primary concern is seen as providing effective controls allowing efficient management of heat in different operational zones.

6.3 The heating system is understood to be a single gas fired boiler system. The boiler is a Stelrad Ideal Concord CX model, which is thought to be of 60kW capacity (although it was not possible to confirm the capacity). This boiler model is a conventional non condensing type and has a SEDBUK seasonal efficiency rating of 73% (‘F’ rating) which is considered to be poor. Replacing this with a modern ‘A’ rated appliance would be a considerable improvement in efficiency.

6.4 It is understood that the boiler is being replaced as part of the refurbishment work, and ideally this would include replacement of the heating system controls.

6.5 In terms of a replacement gas heating system, the need for a flexible system with varying heat demand requires a heating system that can provide efficiency heating at various levels of demand. In community buildings this would mean either adopting a boiler with a wide ‘turn down’ range (efficient operating range) or by a cascade system, with multiple boilers capable of operating in series. Given the size of the building, a cascade system is thought unlikely to be required, with a good sized single boiler capable of operating across a wide output range considered to be a better option.

6.6 The Broag ‘Remeha Quinta Pro’ range of wall hung gas boilers are designed to operate in a cascade system or singly, and have a high turn down range, meaning they can operate at maximum efficiency across a wide load demand ranging from 18 – 100% capacity.

6.7 This range includes models from 30kW to 115kW output capacity. Depending on detailed heat loss calculations, a single Qunita Pro 65 boiler may be possible, for the present building.

6.8 These boilers are small, and the boiler units themselves can be wall hung and take 530mm of wall space, projecting 500mm from the wall, with the Quinta range small enough to allow relocation if appropriate.

6.9 In terms of costs, the Quinta Pro range are generally recognised to be good value and generally high reliability, although as they are classed as commercial, prices are higher than for most domestic boilers, and servicing costs could also be higher. Online prices of £2,800 for the Quinta Pro 55 have been found, although clearly this is supply only.

6.10 It should be noted that while GCB CIC sometimes suggests certain types of product or provides specific models as examples, we do not give product endorsements or recommendations.

6.11 A smaller domestic boiler may be an option, although altering the boiler capacity should only be done following detailed heat loss calculations by a qualified heating engineer. This is something that could be specified with the tendering documents for the current refurbishment work.

6.12 The heating circulation system is understood to be a single circuit system, with a conventional wet radiator system operating throughout the entire building (see Figure 6.1). Radiators appear to be fitted with thermostatic radiator valves (TRV) throughout the building.

6.13 While room thermostats were noted within the Pavilion Suite and in the Bar, it is understood that these do not operate and that in effect, the system is a single circulation loop.

6.14 A significant consideration regarding the radiators is the age of the emitters, with modern radiators having much lower water volumes and improved heat dispersion capacity (usually through fins between and behind radiators). This ensures that the heating system as a whole reaches the required operating temperature much more quickly, with less energy consumed in warming up the distribution system itself.

6.15 The radiators noted were reasonably effective, but the system would be improved if these were upgraded to new heat emitter units. However, it is not felt that this is a key priority if budgets are limited.

Figure 6.1 Pavilion suite radiator with TRV control

6.16 One simple measure would be to fit reflective radiator panels behind all radiators against external walls. These work to reflect heat back into the room and insulate the walls, and can increase system efficiency by up to 14%. 'Heatkeeper' panels are one example (see http://heatkeeper.co.uk) but there are many other versions available.

6.17 Zoning the system to divide the building into appropriate functional units is seen as a key objective. The precise layout of zones should be considered with close attention paid to how the building is used, but three zones, with the bar and reception area forming one zone, the Pavilion Suite a second and the upstairs changing area a third zone may be one potential configuration.

6.18 Physically zoning the system, with separate circulation loops and zone valves with independent timer and thermostat controls would be the ideal solution. While this represents the technically best solution, depending on the layout and accessibility of the central heating pipework, this option can be disruptive and expensive.

6.19 An alternative and cheaper option that provides some level of zoning may be to replace some of the TRV valves with programmable TRV heads that enable specific timings to be set for different radiators. There are also options for wireless controlled TRV valves (see http://www.honeywelluk.com/products/Valves/Thermostatic-Radiator-Valve/Electronic-TRVs/evohome-zoning-pack/ for one specific system example) which may allow a retro fit zoning solution that would involve minimal disruption and cost in changing the TRV heads only.

6.20 Prior to undertaking any of these steps however, it is recommended that the heating service engineers are asked to identify all the relevant control aspects for the entire boiler and heating system, including the room thermostats noted during the site visit. It is assumed that these must have functioned at some point, and so it would appear likely that there remains some form of circuit connection available that could be reinstated, and checking whether these are repairable would be a good first step.

6.21 Ensuring appropriate heating controls are fitted will be important. There is generally a tendency to fit excessively complex controls to community buildings, but for such a venue a more appropriate system would be simple domestic seven day timer system, with the ability for manual override for when a short term boost is required.

6.22 It is understood that hot water for general purposes is provided by the main heating boiler, while hot water demand for the showers and changing rooms is currently provided by a large hot water cylinder heated by three immersion heater units (see Figure 6.2). This provides the high volumes of hot water required during match days and sports events.

6.23 It is understood that this is being replaced as part of the redevelopment, and it is recommended that this system is replaced with a simple feed from the new gas boiler as the most efficient and cost effective system.

<u>Figure 6.2 Existing hot water cylinder</u>

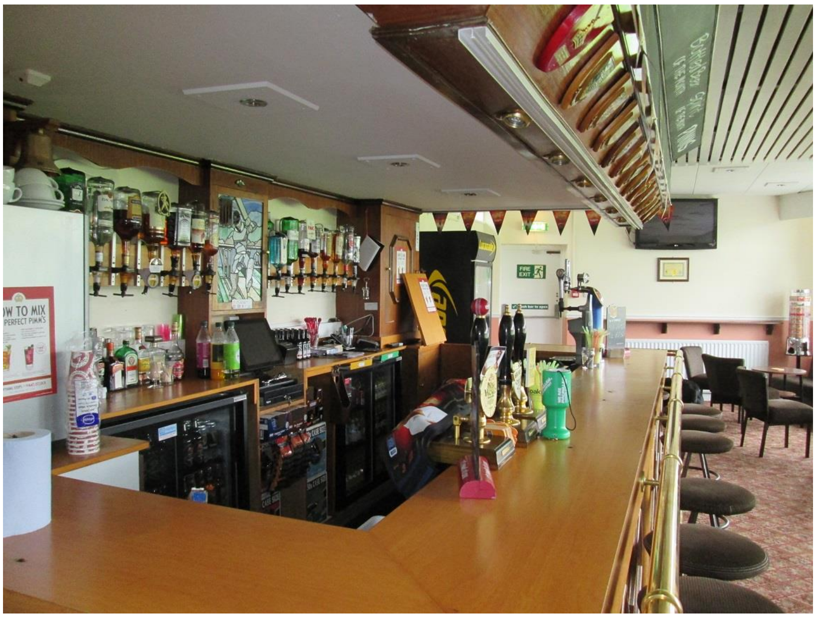
6.24 The only additional point of note is that the current insulation on the cylinder is extremely poor, with rapid heat loss making this system very inefficient. As a temporary measure before the system is replaced, it is recommended that additional insulation is fitted. This could be achieved cheaply by using old duvets or blankets tied around the tank.

7 Lighting

7.1 Lighting was provided by a mix of fittings, with T8 fluorescent strip lights, ‘double D’ fluorescent tubes and 4x 18W tubes in diffusers in various parts of the building. In general, lighting was therefore of reasonable standard of efficiency, with good management seen as the key aspect of energy efficiency.

7.2 The exception to this was the bar area. Here, the whole area was fitted with recessed spot lights (see Figure 7.1). These are not ideal for providing wide area coverage and are more suitable for restricted area task lighting, and as a result more lamps are required for the adequate lighting of large areas. There were 25 fittings within the bar room, with additional lights above the bar itself.

Figure 7.1 Bar area with recessed spotlights



7.3 The lamps at the bar itself have been replaced with LED fittings, reducing significantly the energy consumption, but the lights elsewhere in the room appear to be 50W halogen type bulbs, suggesting a standing consumption of around 13kW for the room as a whole when lit.

7.4 This is a high energy demand, and consideration should be given to replacing these with low energy LED variants, or if brighter ambient light is required, at least reducing these to 30W halogen lamps.

8 Kitchen & Bar Areas

8.1 It was not possible to inspect the kitchens during the site visit, so the following comments (excluding those relating to the bar and beer cellar) are generic comments only.

8.2 Kitchens can be high energy usage areas if appliances are misused, and care should be taken to ensure appliances are not switched on longer than necessary and are regularly maintained.

8.3 Refrigeration can consume significant quantities of electricity if not properly managed, and regular checks should be made to ensure the cooling vents and fans are free from dirt and dust build up and there is adequate ventilation around the cooling fins.

8.4 This may mean easing the unit away from the wall slightly to allow better air circulation, as fridge and freezer units are commonly placed too close to walls (see Figure 8.1).

Figure 8.1 Example of fridge placed very close to the wall (not from this building)

8.5 Regular checks on fridge and freezer doors seals should be conducted, as faulty seals are one of the most common means for excessive operating costs.

8.6 There is a general tendency in many catering establishments to turn on ovens, fryers, hot cupboards/plate-warmers and washing up machines as part of the general start-up routine, well in advance of when the appliances are actually needed and without reference to their actual warm up time requirements.

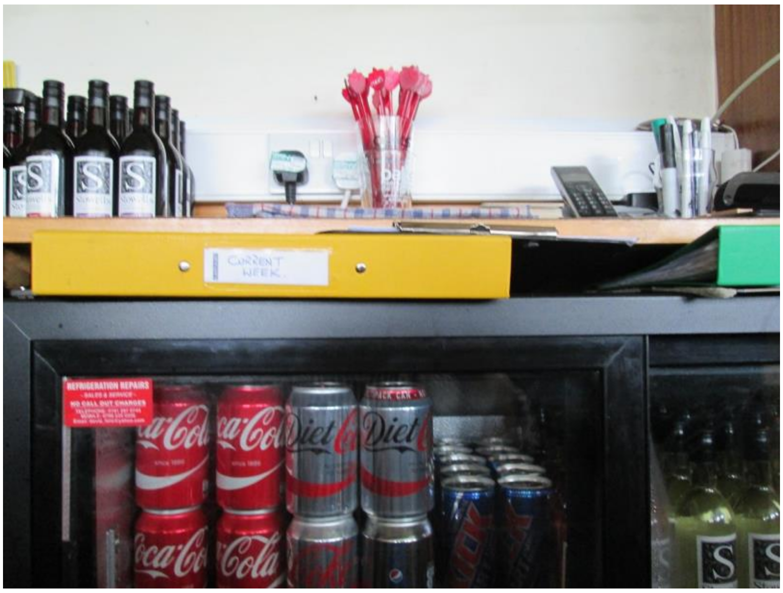
8.7 To guard against this, any heated appliances should be carefully checked to test the effective warm up time, with simple visible labels or signs being placed by each appliance instructing users on the warm up times. This should help reduce any unnecessary energy use.

8.8 The bar contained standard beer coolers and chiller units (see Figures 8.2 and 8.3). The chiller units were measured as consuming between 45W – 65W of electricity on a standing basis, with higher consumption when the compressors and pumps are required to maintain temperature.

8.9 Where possible, the chilled cabinets could be switched off over night, a measure not often seen within bar management but indicative of a good level of existing energy awareness.

8.10 In general, well stocked chillers would not gain very much warmth overnight, and for items such as carbonated drinks that will not degrade if there is a slight rise in temperature, this would be a possible energy saving option.

<u>Figures 8.2 and 8.3 Chiller units</u>



8.11 It was also noted that the temperature of the chillers was set to a very cool temperature. While certain drinks may be favoured at such temperatures, the bar management should consider whether the temperature needs to be this cool, but this will require an assessment of customer attitudes. One option would be to rearrange the chillers so that those drinks requiring very cool conditions are placed into a single chiller, with other products able to tolerate slightly warmer temperatures grouped into the remaining units. Every 1C rise in fridge temperature can save 15% of the energy used, so such a move could be highly beneficial.

8.12 Figure 8.3 also indicates a common issue with bar chillers, where there is often very limited space beneath the bar and around the unit to allow adequate air circulation. This is important for efficiency, as limited circulation leads to a build up of heat around the cooling elements, making the unit work much harder to maintain the target temperature.

8.13 While there is little that can be done in terms of the bar design, it was noted that a number of files were placed on top of the chillers between these and the bar top itself, effectively cutting out any air circulation. These should be relocated and the air gap kept open as much as possible, with the units pulled slightly forward as well if at all possible.

8.14 The building has a beer cellar with a substantial chiller unit. Steps have been taken recently to move the beer to a cooler part of the cellar, and it is understood that there are also plans to install a curtain arrangement to further separate the cool area from the remainder of the cellar. A more solid screen would be beneficial, but it is understood that access with heavy barrels is difficult, so a flexible curtain screen is a reasonable compromise.

8.15 It is also believed that deliveries are placed in the intermediate temperature zone for a period before being transferred to the chilled area, which is a further example of good energy practice.

8.16 The only possible suggestion for the beer cellar would be to consider insulating the walls, possibly with insulated plasterboard, as this would aid the retention of the required temperature with minimal chiller demand. However, given the location of the cellar, the savings from this measure would be relatively limited and so may well not merit the investment, especially where there are higher priorities elsewhere in the building.

9 Energy Management Systems and Issues

9.1 There was evidence of good levels of general energy management awareness amongst the site management, although there was limited advice for building users in terms of instructions in the use of lighting, heating and good energy management practice. These should be structured and developed, such that all building users are aware of their responsibilities. Where appropriate, building users should be able to manage the heating and lighting easily and effectively, with appropriate controls available with clear instructions as to their use.

9.2 While the management appears to have a good appreciation of the needs of managing the heating system as a whole, the lack of room by room control hampers attempts to run an efficient system.

9.3 While there does appear to be a high general level of awareness regarding energy use and costs, there does not appear to be a written Shut Down Procedure, which can be a helpful way to ensure regular attention is paid to energy matters.

9.4 The committee appear to manage energy purchasing well, regularly switching contracts to get the best deal.

10 Non Energy Issues – Water Consumption

10.1 The site understood to be on a water meter, but it is not thought that regular readings are taken by the hall management. *Community Building X* is not responsible for water bills, with these being paid for by the school under the current lease terms.

10.2 It was noted that the urinals within the washrooms appear to be left on constant flush. This can be expensive for sites on water meters, and installing a suitable flush control, or simply switching off the flush when the building is unoccupied is recommended. While this would not financially benefit *Community Building X* , it would represent good environmental practice.

10.3 The building will be subject to Surface Water Drainage charges by Northumbrian Water (NW). NW offers a scheme of reduced surface water charges for community buildings, placing them on the lowest available band regardless of the size of the site. The Band 1 charge is approximately £120, and an immediate check should be made for the community building discount, along with a claim for a refund of past charges as appropriate.

11 Renewable Options Assessment

11.1 No clearly viable renewable space heating options were identified for this site. Space for a biomass heating system is limited and the installation costs are likely to be unviable, given the availability of mains gas, while heat pump systems are unlikely to be viable on this type of building.

11.2 While it would be technically possible to install air or ground source heat pumps (if the outside perimeter of the playing area was used for the heat collection coils) this option is likely to be difficult to support on grounds of cost effectiveness, as heat pumps are not ideal for buildings in less continuous use and where cheaper gas heating is an alternative.

11.3 The flat roof would provide a technical option for a solar thermal system (hot water). This would be technically highly viable, especially given that the hot water cylinder is due to be replaced. The main issue would relate to whether the roof itself is sufficiently strong to accept the frame mounted panel arrangement. A structural survey would be required to confirm this, and such a system will require planning approval.

11.4 The most likely configuration would be to place the solar thermal panels on top of the tower section, possibly with the hot water tanks relocated to the tower section as well, depending on the detailed design following the refurbishment. [It is understood that Fenham Pool have a solar thermal system and may be able to arrange a site visit to get a clearer idea of how such a system works].

11.5 The panels would need to be mounted on ‘A’ frames for maximum efficiency, and usually with flat roofs the fixings are by ballast weighting, as this avoids puncturing the roof surface. The ballast would need to be accounted for within the structural load calculations.

11.6 With the majority of hot water demand occurring between April and October, this provides an ideal correlation of demand and supply. The normal arrangement of such systems is to have a twin coil tank, with the solar thermal coil at the bottom (providing the initial heating) with the boiler coil then only being used if the tank temperature needs to be lifted to the full operating temperature. In this way the solar system always provides heat first, maximising savings.

11.7 It should also be noted that this arrangement can require a larger volume tank, as on days when there is insufficient solar input, as the bottom of the tank is below the boiler coil, this restricts the amount of usable hot water in such circumstances.

11.8 Costs for such a system would need to be subject to competitive tender from at least three MCS accredited solar installers, but a budget of around £5,000 - £7,000 (including the new tank) are thought reasonable.

11.9 Assessing the savings from a solar thermal system can be difficult, as this depends to a large extend on how much hot water is used during the critical summer period, as the solar system will cut out once the tank reaches the maximum temperature unless water is drawn from the system.

11.10 Given the usage patterns of this site, a relatively high output of 6,000kWh pa is anticipated, which would provide savings on gas bills in the region of £200 assuming gas prices of 3p/kWh and an overall boiler system efficiency of 90%.

11.11 A solar system would also qualify for the non- domestic Renewable Heat Incentive (RHI), which would pay a further 10.16p/kWh equating to an additional £610 pa, a total income/saving of around £800. The RHI payments would increase in line with inflation annually, increasing the income over time.

11.12 Under the present usage conditions, the report finds that this option would be viable, subject to the structural survey of the roof.

11.13 There is also an opportunity to consider roof mounted solar PV systems. As with the solar thermal system, these would need to be frame mounted and would require planning approval, with the scale and location possibly creating difficulties regarding the Conservation Area status. The structural integrity of the roof would also remain a further issue, with a much wider area being required for an effective PV system than for the solar thermal option.

11.14 A second option would be to consider vertical or near vertical panels installed on the site screens at the north end of the ground. Figure 11.1 shows a detail of the structure of these screens, and it would be possible to bolt fix the panels to a frame mounted on the vertical steel supports.

Figure 11.1 Site screen detail

11.15 Two key problems would need addressing. Firstly, the panels would be highly vulnerable to damage from cricket balls, and would therefore need screening with rigid or semi rigid mesh to protect them. While this would be possible, any shading onto PV systems has a significant effect on performance, and a mesh lying close to the panels would create significant shadow. If the system is adequately protected, it could therefore mean the output is unduly impaired.

11.16 The second issue is the loss of efficiency from high angle (vertical) panels. The ideal orientation is 30 degrees from horizontal, and at 90 degrees the panels would be highly inefficient, to the point of being unviable. Even at 60 degrees, there would be a significant reduction is output, but protruding at this angle from the uprights would be sufficient to introduce difficulties in providing adequate screening as protection as additional infrastructure would be needed to support the screening material.

11.17 The financial viability of PV has also been thrown into question with the latest government consultation on the Feed in Tariffs (FITs) scheme). This was published on 27th August 2015 and can be accessed at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/456630/FIT_Review_Con_Doc.pdf

11.18 The government is proposing to reduce the FIT payments for PV systems to between 1.63p/kWh and 3.5p/kWh, depending on system size, which represents a very significant cut in potential income. The consultation also states that the possibility remains that all FITs payments for new generators could end by January 2016 if sufficient cost control measures could not be agreed.

11.19 Given the likely inefficiencies arising from the location of the PV panels on the sight screen and the significant anticipated reduction in tariffs, this suggests that on present costs, a PV system would be unlikely to be sufficiently viable. However, each time the tariffs are cut, the resulting fall in demand prompts further cuts in supply pricing, and over time such a system may therefore become viable again.

11.20 This makes providing a definitive recommendation at this time very difficult, but in light of current circumstances, it is recommended that the club invites MS registered PV installers to inspect the site and prepare designs and quotes, along with output projections, so judgements can be made once the FITs regime changes are known.

12 Funding Options

12.1 The funding position for community building projects is increasingly difficult, with few dedicated funds available for this sector. It is also worth noting that any renewable energy installations claiming either FITs of RHI payments cannot be funded from public grants, although with the reduction and possible removal of FITs payments for PV installations, this may become more economical to fund through grants.

12.2 The Urban Community Energy Fund (UCEF) is a DECC/DEFRA fund that provides grant support of up to £20,000 for community renewable energy feasibility studies and a further £130,000 of development loan finance, without affecting FITs and RHI incomes.

12.3 However, this fund is restricted to community scale projects, rather than single building installations. To secure a grant from this source the project would need to involve several buildings within the wider community.

12.4 Small scale funding of up to £10,000 in any one year is available through the BLF Awards for All funding stream. This is a relatively simple procedure, and is a potentially very good fund for relatively small, discreet projects with defined social outcomes.

12.5 Many other smaller funds are available, particularly private trust funds. A list of some of these has been attached, although it should be noted that this has been provided by a third party organisation and is a national list, and so it is likely that a number of the funding bodies would not be suitable in this case.

12.6 GCB would be able to advise further on funding applications, particularly where energy and sustainable issues are being considered.

12.7 It should be noted that lottery funding would also not be appropriate for a renewable energy systems, as this would be treated as States Aid.

13 Recommendations

1) Consider dot and dab application of 12.5mm foam backed plasterboard and skim for relevant sections of the lower level, if budgets permit. If opting for this approach, the specification should ensure each plasterboard section is fixed with a continuous ribbon of dab adhesive around each margin and any openings (light switches, sockets etc) to prevent and draught movement behind the plasterboard.
2) Replace remaining single glazed windows with double glazed units.
3) For the Pavilion Suite, consider the complete replacement of the south west façade, with reduced door openings and conventional insulated block wall to rail height.
4) If considering major alterations to the Pavilion Suite, consider conventional hinged doors rather than sliding doors that are notoriously difficult to make sufficiently draft proof.
5) Conduct a simple weekly check on all external gutters and rainwater fittings to ensure there are no leaks and blockages.
6) Check draught strip and brushes on all external doors and replace as and when required (including internal porch doors).
7) Check window seals and closure mechanisms on a regular basis.
8) Consider using door curtains on fire exits (check first with local fire officer).
9) The main entrance doors should be reprogrammed to operate independently and with a faster closing time to reduce heat loss.
10) Ensure the entrance lobby radiator is set to a low temperature setting.

11) Consult with an appropriately qualified architect regarding the possibility of roof insulation, with particular focus on those rooms and areas likely to be in use throughout the heating season.
12) Consider replacing the central heating boiler. Ideally this would be in tandem with a new heat distribution system.
13) Ideally the heat distribution system should be zoned, allowing for much greater targeting and control of heating.
14) Whether or not the system is zoned, room heating controls of some kind are essential. Ideally each room should have a thermostat control, although allowing individual radiators to be regulated via TRV's would be a lower cost option.
15) Ideally new high efficiency radiators should be fitted, although this measure is seen as a lower priority at this stage, with control and regulation of the heating system seen as a more significant objective.
16) Fit reflective panels behind all radiators fixed to external walls.
17) Ask the boiler service engineers to identify and label clearly (either on a diagram or by attaching actual labels to the physical heating system) all the control elements of the heating circuits. As part of this, they should be asked to check the apparently redundant room thermostats with a view to repairing or replacing these if a working solution remains available.
18) Failing this, consider zoning the heating system, either by the installation of physical heating zones, or by the use of programmable/remotely controllable TRV valves.
19) As a general rule, boiler and heating system controls should be kept simple, with normal domestic seven day timers adequate for a building with this type of usage.
20) The replacement HW system should ideally be fed from the new gas boiler, with a sufficiently large HW calorifier (cylinder) to enable the boiler to provide the large volumes of water required.
21) As a stop gap measure, the current tank should be properly insulated. Use of old blankets or duvets would enable this to be done without any capital spend.
22) Replace spot lights in bar with lower capacity halogen or preferably LED bulbs to significantly reduce electricity demand.
23) Check fridges and freezer compressor units and cooling fins are clean and free from dust and that there is adequate circulation space around the cooling system.
24) Provide regular checks on fridge and freezer door seals to make sure these are creating a full seal when closed.
25) Clear the tops of the chiller units in the bar and if possible, ease these forward a few centimetres to aid ventilation.
26) Maintain regular utility contract tendering to secure best value.
27) Develop a written 'Shut Down Procedure'. This should provide site staff and building users with a detailed procedure to follow as part of the regular lock up process, identifying which items require turning off or resetting.
28) This could also include visible notices in all rooms and areas for building users, identifying all powered equipment and heating appliances and detailing which of these should be switch off or turned

down on departure. GCB CIC can advise on the design of such systems if required. These procedures can be reversed to provide a systematic opening procedure.

29) Ideally, written procedures for managing heating timers and controls should be drawn up, enabling any member of staff to follow a set of clear instructions as appropriate and ensuring sufficient knowledge of the system is available for management continuity.

30) Ideally energy consumption should be reported as a standing item at all management committee meetings.

31) If the site is on a metered supply, it is recommended that steps be taken to reduce flows in toilets, cisterns etc and regular leak tests initiated to avoid liability for lost water.

32) As a priority measure, ensure that the urinal flush is switched off whenever the building is not in use. This should be included within the Shut Down Procedure (see Recommendation 27).

33) Apply to Northumbrian Water for a surface water exemption – see http://www.nwl.co.uk/_assets/documents/Surface_water_drainage_form_v2.pdf

34) Consider installing a solar thermal system as part of the new hot water system.

35) Invite MCS accredited installers to quote for fitting PV panels on the south facing sight screen.

36) Both the above options would require surveys of the relevant roof sections by suitably qualified structural engineers before any decision to proceed is taken.

14 Disclaimer

The information contained in this report is accurate at the time of writing and has been checked by GCB CIC for consistency and validity. Where assumptions have been made these have been stated, and a number of areas of uncertainty have been highlighted. The results contained in this report do not constitute guarantees of performance or cost, and GCB CIC will not be liable for any losses arising from acting on the conclusions of this report.

Ewan Boyd
Green Community Building CIC
28th August 2015

Appendix 1 Alternative Funding Sources

Please note – These funding sources have been provided by a third party organisation and may not have been checked for suitability for the current project.

Please find below a few suggestions of other organisations you may like to consider when seeking funding.

Funding Central	www.fundingcentral.org.uk
Spacehive	www.spacehive.com
GrantNet – funding directory	www.grantnet.com
Government Funding	www.governmentfunding.gov.uk
Entrust	www.entrust.org.uk/home/lcf/funders-director
Awards for All Lottery Fund	www.awardsforall.org.uk
The Big Lottery	www.biglottery.org.uk
The National Lottery	www.lotteryfunding.org.uk
Garfield Weston Foundation	www.garfieldweston.org
Henry Smith Trust	www.henrysmithcharity.org.uk
Esmee Fairburn Foundation	www.esmeefairbairn.org.uk
The Tudor Trust	www.tudortrust.org.uk
Lloyds TSB Foundation	www.lloydstsbfoundation.org.uk
Nationwide Foundation	www.nationwidefoundation.org.uk
Coalfield Regeneration Trust	www.coalfields-regen.org.uk
Ernest Cook Trust	www.ernestcooktrust.org.uk
The Lankelly Chase Foundation	www.lankellychase.org.uk
AllChurches Trust	www.allchurches.co.uk
Funds for historic buildings	www.ffhb.org.uk
War Memorials Trust	www.warmemorials.org
Sport England	www.sportengland.org
The Arts Council	www.artscouncil.org.uk
The Foyle Foundation	www.foylefoundation.org.uk
British Trust Conservation Volunteers	www.btcv.org.uk
Groundwork UK	www.groundwork.org.uk
Wildlife Trusts – RSWT	www.rswt.org
Natural England	www.naturalengland.org.uk
Energy Saving Trust	www.est.co.uk
WRAP (Waste & Resources Action Programme)	www.wrap.org.uk
The Princes Trust	www.princes-trust.org.uk
Vodafone Foundation	www.vodafonefoundation.org.uk
In Kind Direct	www.inkinddirect.org.uk
J4bgrants	www.j4bgrants.co.uk
The Mercer's Company	http://www.mercers.co.uk/
BBC Children in Need	http://www.bbc.co.uk/pudsey/grants/
The Sainsbury Family Charitable Trusts	http://www.sfct.org.uk/

The Co-operative - Community Fund	http://www.co-operative.coop/membership/local-communities/community-fund/